e-commerce 2005

15 - 17 December 2005
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Proceedings

Edited by
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IADIS INTERNATIONAL CONFERENCE

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IADIS INTERNATIONAL CONFERENCE

E-COMMERCE 2005

PROCEEDINGS OF THE
IADIS INTERNATIONAL CONFERENCE
E-COMMERCE 2005

PORTO, PORTUGAL

DECEMBER 15-17, 2005

Organised by
IADIS
International Association for Development of the Information Society

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FOREWORD

The communication and information technologies (ICTs) are playing the central role in making the continuous changes happen in the world. There are very few events in the world today that are not dominated, or at least influenced, by ICTs. E-business or e-commerce is one of the wonderful and value creating products of Internet revolution. It has created a promising market in the cyberspace providing equal opportunity to all to take part in this new business paradigm. After some initial hype and myth it is now an effective commercial hot spot.

Due to continued interest in e-commerce, we decided to run an international conference dedicated to it in 2004. This is our second international conference on *e-commerce*. We are overwhelmed with the positive responses we have received from different parts of the world this year also as in last year.

The proceedings of *e-commerce 2005* contain the papers and posters of the *IADIS International Conference on e-commerce 2005*, which has been organised by the International Association for Development of the Information Society, in Porto, Portugal, 15-17 December 2005.

The objective of this international conference is to bring together researchers, practitioners, students and anyone who works or studies in the field of e-business/e-commerce and other related disciplines. The following *thirty six areas* have been the object of paper and poster submissions:

Development of e-Business, e-Business Applications, Barriers to e-Business, Business-oriented e-Commerce, Cases in e-Commerce, Consumer-oriented e-Commerce, Cryptography for enabling e-Commerce, e-Commerce in developing countries-Commerce Software-Commerce Strategy & Implementation,e-Communities,e-Logistics, e-Government, e-Procurement,e-Services,Economics of e-Commerce,EDI and the Internet,Global e-Commerce,Infrastructure for e-Commerce,Internet payment systems, Knowledge Management, Managing Innovation, Marketing on the Web, Mobile Commerce, Multimedia and Web casting on the Web, Organisational and Managerial Issues, Other e-Commerce Models and Applications, Retailing in e-Commerce (e-Tailing),Social Issues for e-Commerce, Supply Chain Management & e-Fulfilment, Technical issues for e-Commerce, The future of e-commerce, Web advertising and Web Publishing, The future of e-Commerce technologies, The Regulatory Environment of e-Commerce and Trust & Security for e-Commerce.

The IADIS *e-Commerce 2005* Conference had about 128 submissions from more than 32 countries. Each submission has been anonymously reviewed by at least two independent reviewers, to ensure the final high standard of the accepted submissions. The final result was the approval of 38 full papers, which means that the acceptance rate was below 30%. A few more papers have been accepted as short papers and posters. Best papers will be selected for publishing as extended versions in the *IADIS International Journal on WWW/Internet* (IJWI*)*.
It is worth mentioning that the IADIS *e-Commerce 2005* is truly a global forum comprising of distinguished researchers, practitioners and industry specialists for presentations of keynotes, papers and posters.

The *Proceedings of the* IADIS *e-Commerce 2005* have been materialised as a result of the contributions from a number of individuals. We are grateful to all authors who have submitted their papers to enrich the conference proceedings.

As we all know, organising a conference requires the effort of many individuals. We would like to thank all members of the Program Committee, including the external/auxiliary reviewers, for their hard work in reviewing and selecting the papers that appear in the proceedings.

We would also like to express our gratitude to Professors Sandeep Krishnamurthy, University of Washington, USA and Petra Schubert, University of Applied Sciences Basel (UAS Basel) and Director of the Institute for Business Economics, Switzerland for accepting our invitation as keynote speakers. Professor Krishnamurthy will deliver a keynote on "*Ten Trends That Will Reshape E-Commerce in the Next Five Years*" and Professor Schubert on "*ICT Use in Companies: Promise or Hassle*?"

We wish to thank all members of our local organizing committee, sponsors, delegates, invitees and guests whose active involvements are imperative for the success of this conference.

The book of Proceedings contains a rich experience of the academic & research institutions and the industry on diverse themes related to the e-Commerce, e-Business and other areas of interest. We do hope that researchers, knowledge workers and innovators both in academia and the industry will find it an essential reference material to strengthen their research activities.

We look forward to have simulating interactions with you during the conference. Definitely you will utilise this opportunity to make new friends, new collaboration, to think about new projects and also to gain knowledge of new research in your area of interest.

We have chosen the city of Porto to hold this second international conference (*e-Commerce 2005*) is due to its historical past and present since its foundation (8th Century BC). It is the second largest city in Portugal, and is also one of the most beautiful cities in Portugal. We would love to hold future editions of this conference at different locations in Europe through proper sponsorship and support.

We cordially invite you all to participate at the third *IADIS International Conference: e-Commerce 2006* that will be held in Barcelona, Spain.

Lastly, but not the least, our sincere appreciation to our families who have supported and encouraged us thoughout the conference activities.

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Porto, Portugal
15 December 2005

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KEYNOTE LECTURES

TEN TRENDS THAT WILL RESHAPE
E-COMMERCE IN THE NEXT FIVE YEARS
by Professor Sandeep Krishnamurthy, University of Washington, USA

Abstract

Amazon.co.jp now allows Japanese consumers to walk into a store, scan a UPC code into their cell phone and access the company's page for that product. Customers can easily compare prices and if they like what they see, they can place an order with Amazon.co.jp instantly. The product is delivered to the consumer's doorstep - most likely with zero shipping cost. This simple example shows us how important E-Commerce has become in our daily lives. It seems like we do everything online nowadays. We shop. We sell. We trade. We communicate. We interact. We socialize. We consume content. Companies such as Amazon, eBay, Google, Yahoo and NTT DoCoMo are household names. Exciting new applications continue to sprout. In this talk, I will highlight ten important trends that will reshape how B2C and B2B E-Commerce works in the next five years. These trends will challenge us while enabling us to build a stronger online future at the same time.

ICT USE IN COMPANIES: PROMISE OR HASSLE?

by Professor Petra Schubert , University of Applied Sciences Basel (UAS Basel), SWITZERLAND

Abstract

The keynote speech will look into the ICT use of companies with the aim of assessing e‑commerce readiness of European players. The presentation reports on a decade of experience in research projects with industry partners. The presentation is structured into three main parts: results from a recent study on ICT use, experiences from current e-business practice, and an outlook into the future potentials of the Internet.

E-commerce applications need to be integrated with existing business software. The increasing volume of data that is being exchanged electronically forces companies to integrate their historical IT landscape – inside the company as well as with business partners. Whereas many companies are still struggling with internal integration (EAI) the use of e-commerce makes it necessary to look over the boundaries of one single company into the topic of B2B-integration. In order to gain insight into the current situation of business software, the presentation will start with a recent management survey about the importance of ICT in Swiss small and medium-sized enterprises. The results include the current use of business software modules, the assessment of the potential of ICT use, the attitude of employees and management towards ICT, as well as the current and future investments and spending.

Interviews with e-business managers showed that there are different factors that influence the way a company approaches the integration of e-commerce solutions. There are no ready-made solutions available on the market. Customer requirements are in the centre of attention. Most e-business projects aim at improving business processes by electronically linking business partners. The right

IT partner is the key to a successful project and to the long-term success of an e-business solution in general. Scalability is a basic requirement in most of the projects.

The presentation concludes with the search for the ingredients of the next Internet killer application. The presentation draws on the ideas of Moore, Metcalfe and Coase for the discussion of mobile devices and applications, digital signatures, PKI, and payment solutions.

CONFERENCE TUTORIAL

PRIVACY TECHNOLOGIES AND APPLICATIONS ON ELECTRONIC MARKETS

by Sören Preibusch, German Institute for Economic Research, Königin-Luise-Str. 5, 14191 Berlin, GERMANY

Abstract

Users' perceptions of a service provider's privacy principles constitute a major barrier on Electronic Markets. They lead to poor conversion rates in the business perspective and a loss of social welfare due to missed transactions in the economics perspective. This tutorial addresses both academia and industry and presents privacy issues in current Electronic Commerce applications along with technologies to overcome them.

In a first part, the ethical and legal bases of privacy are portrayed, with a focus on the legislation in the European Union and the recommendations of the OECD concerning electronic services. The social dimension is underlined as inappropriate data processing principles might lead to discrimination of social groups.

In a second part, current Privacy Enhancing Technologies (PETs) are summarized, facing Privacy Invasive Technologies (PITs); secure data mining techniques are confronted with data inference problems. Special attention is paid to Privacy Negotiation Techniques as they can conciliate users' and service providers' conflicting preferences in the privacypersonalization trade-off. Approaches to code (P3P, APPEL and EPAL) and to communicate (suitable site design, contextualized presentation) privacy policies are examined theoretically. They are endorsed by experimental evidence and case studies from A9.com and Amazon.com. Holistic privacy protection all along the value chain requires verifiable compliance of privacy promises towards customers and their realization in backend processes. A framework for secure integration of third parties data analysis providers will be presented. It is shown how business metrics can be calculated in a privacy compliant way.

Two emerging fields will be covered in the third part: first, Ubiquitous Computing is a forthcoming threat for privacy. Pervasive technologies such as RFID allow tracking users' actions and behaviours. Second, multichannel retailing, combining traditional stores and electronic retailing, gives rise to new potential privacy infringements, such as by linking offline and online identities. Game theoretic and information economical considerations will conclude the tutorial along with recommendations for users and practitioners.

KEYWORDS: Privacy Legislation, Privacy Ethics, PET, Privacy in Pervasive Computing, Privacy Negotiations, Multichannel Retailing

Full Papers

DIFFERENCES IN BIDDING CHARACTERISTICS ON EBAY.DE

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ABSTRACT

eBay is often regarded as one single homogeneous marketplace. This paper presents evidence gathered from 251,996 eBay auctions suggesting that the market is in fact split into segments with individual bidding characteristics. Using only bidding-related data as input for Support Vector Classification algorithms, classification rates between 55% and 69% were achieved for the distinction between items offered by high-volume sellers and items offered by low-volume sellers, and between items offered in different product categories.

KEYWORDS

Online Auctions, eBay, Bidding Characteristics, Support Vector Classification

1. INTRODUCTION

eBay.de[1] is Germany's largest B2C and C2C marketplace in terms of market participants and number of transactions. While publicly often regarded as a garage sale-like auction site, eBay's "Buy It Now" feature makes it a prime competitor for traditional online shops. eBay.de has succeeded in attracting a number of high-volume sellers who stand for a significant share of eBay Germany's sales volume and revenues.

According to eBay's principle of providing a level playing field for all market participants, these high-volume sellers are not given discounts on insertion or final value fees. With the exception of few special categories (e.g. real estate, cars, boats), these fees are also identical for all of eBay.de's categories. Selling items that traditionally yield high profit margins (like clothing) results in the same fees as selling items with low profit margins (like computer memory). Because there is no real notion of profit margin in a private garage sale, this was appropriate in eBay's origins. With a large share of eBay's revenues now coming from commercial resellers of new merchandise, the issue of profitability and profit margins needs to be taken into account to a larger extent.

Since insertion fees increase with the minimum bid amount, there is an incentive for sellers to choose a low starting bid. This carries the risk of not reaching a sufficiently high selling price (there's no reserve price option in most of eBay.de's categories).

Commercial sellers can avoid this risk by offering only items with high profit margins. This would result in an increasing heterogeneity between the product categories depending on typical profit margins, with some becoming more dominated by commercial sellers than others. By using additional eBay accounts, sellers can also cast bids in their own auctions to increase prices. This kind of shill bidding (also known as "pushing") is strictly forbidden by eBay rules.

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[1] eBay is a trademark of eBay Inc.

The above points give reason to believe that eBay might in fact be no homogeneous marketplace, but consist of a variety of segments with very different characteristics depending on the types of market participants and merchandise.

Using only data from the bidding process itself, we will apply Support Vector Classification to examine if, and to what extent, differences in bidding characteristics can be observed for items offered by high-volume sellers and for items offered by low-volume sellers. We will also analyse whether bidding characteristics differ by product categories.

2. EBAY TERMINOLOGY

eBay Inc. provides online marketplaces for C2C, B2C and B2B trade in several countries. Germany's eBay.de is - behind eBay.com - the second largest of eBay's marketplaces. All marketplaces share the same technological platform and the same database system, thus allowing every user to search local listings as well as foreign ones. Because of the various local laws and regional preferences, the marketplaces differ in some aspects. Setting a reserve price, for example, is limited to very few product categories in Germany, but universally available in the U.S.A. Items are categorised into 33 product categories and several thousand subcategories.

eBay offers, besides the traditional second-price auction format, a "Buy It Now" feature which enables the user to buy an item immediately for a fixed price. The seller can also combine "Buy It Now" with a standard auction: If the bidder chooses not to use "Buy it Now" and instead bids a lower amount, the "Buy It Now" feature disappears and the listing is auctioned normally.

The total number of transactions completed by a seller since the beginning of his eBay membership can be estimated by looking at his feedback score. A value of one is added every time a business partner leaves positive feedback about a completed transaction. Negative feedback reduces the score by one. The score does not capture every single transaction: Positive and negative feedback may cancel out each other, and if no feedback is given or if the feedback is neutral, the score remains unchanged. Furthermore, every eBay user counts only once towards the feedback score, even if several transactions have been completed with this person.

3. RELATED WORK

With eBay being the predominant B2C and C2C online marketplace, a number of theoretical and empirical studies have been conducted using either the eBay auction model or actual eBay transaction data.

Roth and Ockenfels (2002) show that early bidding can disclose information about a bidder's valuation of the offered item to competing bidders. Based on empirical data from 480 auctions and a survey amongst eBay users, they conclude that bidding at the very end of the auction is not irrational but that it reduces the price of sale sufficiently to make up for occasional late bids.

Shah et al. (2003) search for bidding strategies using data from 11,537 auctions in connection with the launch of two video game consoles. They confirm previously known strategies ("late bidding", "sniping" and "evaluator") and discover new bidding strategies ("skeptic", "unmasking") using rule-based methods.

Anderson et al. (2004) analyse data from 1,008 successful online auctions of Palm Pilot PDAs. Searching for seller strategies, they examine seller experience, sales volume, feedback rating and use of eBay features like "Buy It Now". According to their findings, retailers often use the "Buy It Now" option, yet seller strategies converge only partially with increasing sales volume. Low-volume sellers displayed a variety of strategies, which is attributed to experimentation.

Garratt et al. (2004) conducted laboratory experiments with experienced eBay users. They find that the users' bidding behaviour relates to previous experience as a seller more than to experience as a buyer. Yet even experienced users' bidding strategies are not consistent.

It is interesting to note that while not touching the general question of heterogeneity explicitly, the authors who use actual eBay auction data restrict their research to a small subset of auctions taken from specific product categories in order to provide for homogeneity of the analysed auctions.

4. DATASET AND DATA PREPROCESSING

4.1 Dataset

This paper is based on data from four of eBay.de's product categories: "Collectables", "Computers & IT", "Audio & Hi-Fi", "Clothing & Accessories". The categories were chosen because of their presumably different characteristics: In "Computers & IT" and "Audio & Hi-Fi", competition with traditional online shops is strongest. Search engines like Froogle (http://www.froogle.com) provide buyers with price comparisons, and the eBay fees of about 3-5% of the final price of sale (including V.A.T.) cut deeply into profit margins often lower than 20% (excluding V.A.T.). In the "Collectables" and "Clothing & Accessories" categories, sellers typically enjoy higher profit margins. This, in combination with lower absolute prices, allows for unsatisfactory revenues from some auctions without threatening a commercial seller's overall performance.

Our dataset contains 587,621 listings in Euro currency started on eBay.de in the four categories named above on the days of August 1-4, 2005. Listings terminated after less than 24 hours, e.g. with "Buy It Now", are not included. All eBay auctions, however, have a minimum duration of 24 hours.

From the 587,621 listings, those terminated early are removed. This includes "Buy It Now" listings, items removed by eBay (e.g. because of rule violations), and some dummy listings used by eBay staff to test new features. Multi-unit auctions are also eliminated. Finally, unsuccessful auctions that did not lead to a sale, and auctions in which the identity of the bidders is not disclosed are removed. This leaves a total of 251,996 auctions as shown in Table 1.

Table 1. Dataset.

Category (eBay category number)	Listings	Auctions	Successful auctions with disclosed bidder names
Collectables (#1)	157,946	142,229	72,211
Computers & IT (#160)	77,500	49,299	30,796
Audio & Hi-Fi (#10614)	31,271	22,324	13,662
Clothing & Accessories (#11450)	320,904	281,703	135,327
Total	587,621	495,555	251,996

The removal of more than half of all listings stems from our intention to discriminate between product categories and seller types by examining the bidding process only. The "Buy It Now" option is often a sign of commercial activity. Including these listings would offer statistical learning algorithms an opportunity to identify high-volume sellers without looking at the bidding process itself.

eBay provides information about the approximate number of listings for each product category (see Dealscart.com 2005). Using this information, we can calculate an estimate for the share of eBay.de data captured in our dataset. Between August 1-4, eBay.de contained about 5.5 million listings on average. This is in fact an upper bound for the number of listings because items can be listed in two product categories simultaneously. The product categories "Collectables", "Computers & IT", "Audio & Hi-Fi" and "Clothing & Accessories" combined for about 1.6 million (29%) of these listings. Assuming that the category distribution of new listings is similar to the distribution of existing listings, we estimate that out dataset contains about 25% of all listings added to eBay.de in the given time span.

In our dataset of 251,996 successful auctions with disclosed bidder names, we find 1,233,115 bids made by 385,965 bidders for items offered by 70,741 sellers. 173,498 bidders bought at least one item, 212,467 bidders remained unsuccessful. From the 70,741 sellers only 12,884 also acted as bidders.

To separate high-volume from low-volume sellers, we examine the empirical distribution of the sellers' feedback scores over all items contained in our sample. Using values close to the first and third quartile, we define a seller with a score of 75 or less as a low-volume seller and a seller with a score of 1,500 or more as a high-volume seller (see Table 2).

Table 2. Sellers.

Category (eBay category number)	Sellers	Sellers with feedback score < 76	Sellers with feedback score > 1,499
	(Number of items sold)	*(Number of items sold)*	*(Number of items sold)*
Collectables	18,913	5,851	1,722
(#1)	*(72,211)*	*(12,669)*	*(15,567)*
Computers & IT	14,724	7,071	572
(#160)	*(30,796)*	*(10,591)*	*(6,307)*
Audio & Hi-Fi	6,359	2,945	402
(#10614)	*(13,662)*	*(4,110)*	*(4,006)*
Clothing & Accessories	35,426	12,607	2,075
(#11450)	*(135,327)*	*(29,016)*	*(31,550)*
All four product	70,741	27,039	4,251
categories	*(251,996)*	*(56,386)*	*(57,430)*

4.2 Data Preprocessing

The ratios listed in Table 3 are calculated for each auction. The values intend to capture the characteristics of the bidding process such as number and amount of bids, number of bidders and bidding times in a form that can be used as input data for support vector classification algorithms. It is particularly desirable to use inputs with values scaled to [0;1] or to [-1;1] (see Hsu et al.), which was achieved by introducing transformations (R1, R2, R3, R9) and scaling factors (R4, R8) where necessary. Figure 1 depicts a boxplot of R1,…, R10.

Table 3. Ratios.

Identifier	Description
R1	min{number of bids / 30; 1}
R2	min{number of distinct bidders / 30; 1}
R3	min{number of distinct bid amounts / 30; 1}
R4	2 x (standard deviation of bid amounts) / (winning bid amount)
R5	(average bid amount) / (winning bid amount)
R6	timestamp of first bid relative to auction duration
R7	timestamp of winning bid relative to auction duration
R8	2 x (standard deviation of bid timestamps relative to auction duration)
R9	min{number of bids in final 120 seconds / 10; 1}
R10	(number of bids in final 120 seconds) / (total number of bids)
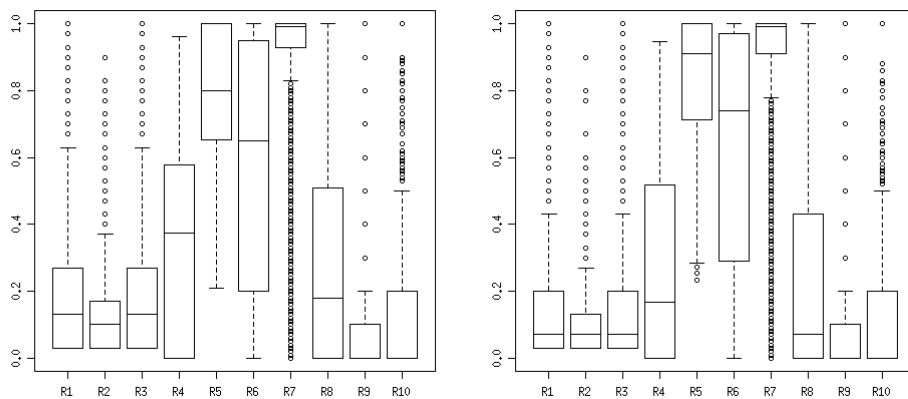
Figure 1. Boxplot of R1, …, R10 for auctions by low-volume sellers (left) and by high-volume sellers (right).

It is important to note that R1, …, R10 have been chosen to include only data from the bidding process itself. Not hints whatsoever are given towards the duration of the auction, whether the item was in used or in new condition, or towards the absolute value of the starting bid. Such hints would have been linked to properties not directly related to the bidding process. Our aim is to distinguish between bidder types and product categories from looking at the sequence of bids only.

We find that in auctions by high-volume sellers, there are slightly fewer bids (R1), the variance of bid amounts and timestamps is lower (R4, R8), the average bid amount is closer to the winning bid amount (R5) and the first bid occurs slightly later (R6). Late bidding characteristics (R7, R9, R10) are very similar.

5. SUPPORT VECTOR CLASSIFICATION

Let $X = \{x_1, \ldots, x_n\}$ be n points in the m-dimensional space R^m. A label $y_i \in \{-1; +1\}$ is assigned to each point x_i noting that point's membership in one of two classes. The two classes are to be separated by a hyperplane (w, b), $w \in R^m$, $b \in R$ such that the margin γ between the closest training points and the hyperplane

$$\gamma = \min_i y_i \{\langle w, x_i \rangle - b\} \qquad (5.1)$$

is maximal.

The maximum margin criterion is derived from statistical learning theory: From several hypotheses consistent with our empirical data, we choose the simplest hypothesis in order to increase the generalisation power of our classifier (Occam's Razor). The Vapnik-Chervonenkis dimension (VC dimension, see Vapnik and Chervonenkis 1974 and Vapnik 1995) denotes how many data points a classifier is maximally able to shatter, and is therefore a measure of the classifier's complexity. From a family of classifiers, we select the one with the smallest VC dimension and thus minimise the structural risk. In our case, the maximum margin hyperplane has the smallest VC dimension of all separating hyperplanes.

Calculating the maximum margin hyperplane is a convex optimisation problem with a unique solution which is independent from starting conditions. By switching to the problem's dual representation, the decision function

$$f(x) = \text{sgn}(\langle w, x \rangle - b) \qquad (5.2)$$

can be formulated as

$$f(x) = \text{sgn}(\sum_i \alpha_i y_i \langle x_i, x \rangle - b) \qquad (5.3)$$

α_i is non-zero only for those points that lie closest to the separating hyperplane. These points are called *support vectors* (thus the name *Support Vector Machines* or *SVM*).

To allow for overlapping classes in the training data, *soft-margin* SVM introduce slack variables. The amount of penalty attributed to slack in the objective function can be adjusted through a parameter C (*C-Support Vector Classification* or *C-SVC*). By reformulating the objective function, the parameter C can be replaced with a parameter $\nu \in (0; 1)$ (see Schölkopf et al. 2000). This, amongst others, facilitates parameter selection by grid search.

Since real-world data is usually not linearly separable, the data is mapped by a function $x \rightarrow \Phi(x)$ from the original input space I to a higher dimensional feature space F in which the data can be linearly separated. Given that the dimension of F can be very large or even infinite, it can be computationally expensive to map the entire dataset and calculate the classifier in F. This can be avoided by using the "kernel trick":

In the calculation of f, α and b, the x_i appear only in the context of dot products. With the knowledge of a function

$$k(x_1, x_2) = \langle \phi(x_1), \phi(x_2) \rangle \qquad (5.4)$$

all calculations can be done in the input space I. k is called the *kernel function*. Instead of defining Φ, usually only the kernel function is given. Often used kernel functions include linear, polynomial and radial based functions.

Classification performance of SVM has proven to be at par with or better than other classification methods. For the USPS benchmark set of handwritten characters, optimised SVM achieved a classification rate of 97%, only slightly worse than the human rate of 97.5% (see Schölkopf and Smola 2002, p. 219).

6. CALCULATIONS AND RESULTS

Our calculations were conducted with R's kernlab package (Karatzoglou et al 2004). In the absence of prior knowledge, we used the radial based kernel function with parameter σ:

$$k(x_1, x_2) = e^{-\sigma \|x_1 - x_2\|^2} \qquad (6.1)$$

Because of its bounded parameter, we preferred ν-SVC over C-SVC. For each classification problem, the classifier was calculated using 2,500 or 5,000 auctions from each category (5,000 or 10,000 in total). The testing data consisted of the remainder of auctions from the smaller category and an equal number of auctions from the larger category.

6.1. Low-Volume and High-Volume Sellers

To determine the parameters ν and σ, we performed grid searches over the ranges $\nu \in [0.3; 0.7]$ and $\log_2(\sigma) \in [-5; 5]$ with 5-fold cross validation (see Figure 2). The model with the smallest cross validation error was then retrained with the entire training data and tested on the previously unseen test data. The results are given in Table 4. Since we chose the parameters based on *average* cross validation error, we can expect to find models with good *average* classification rates. By giving up only a little on average classification rates we could have chosen models with less deviating individual classification rates, like e.g. 51.4% and 54.6% for an average classification rate of 53% instead of the 43.87% and 66.79% and the 55.33% average in the first row of Table 4 (Figure 2 (right) displays the classification rates resulting from the different grid search parameter combinations). However, this was not our concern in this analysis as we concentrate on the average classification rate only.
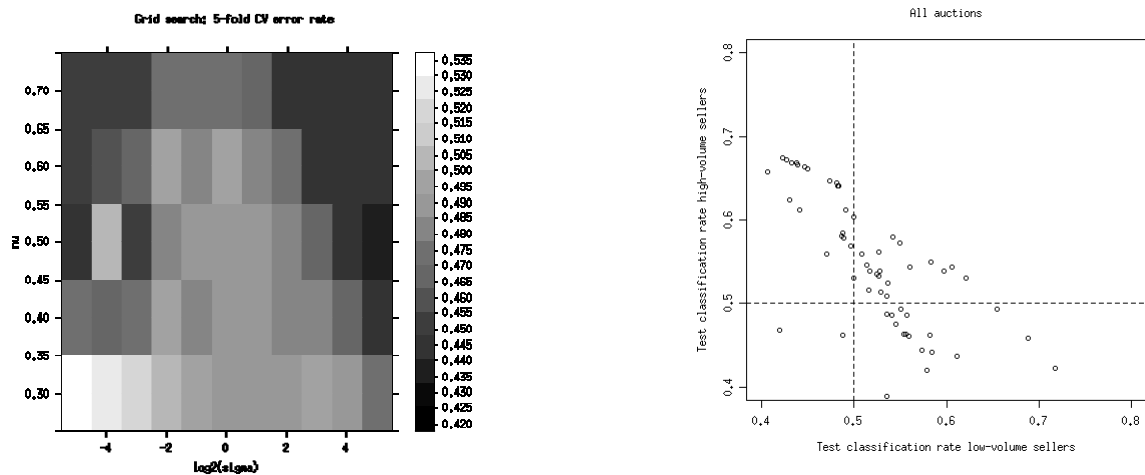
Figure 2. Grid search (left) and combinations of test classification rates (right).

Table 4. Results after retraining.

Product category	nu	sigma	Number of training auctions	Number of test auctions	Number of support vectors	Cross validation error	Classifi-cation rate low-volume sellers	Classifi-cation rate high-volume sellers	Average classifi-cation rate
All four product categories	0.5	32	10,000	102,772	7,880	43.97%	43.87%	66.79%	55.33%
Collectables	0.6	32	5,000	20,338	4,100	43.14%	41.69%	71.35%	56.52%
Computers & IT	0.7	1	5,000	7,614	3,629	36.88%	64.49%	62.17%	63.33%
Audio & Hi-Fi	0.7	0.5	5,000	3,012	3,589	32,62%	74.04%	62.68%	68.36%
Clothing & Accessories	0.7	32	5,000	53,032	4,291	43.24%	43.05%	66.61%	54.83%

We can see that bidding characteristics are difficult to discern for the full set of auctions in general and for the product categories "Collectables" and "Clothing & Accessories". We find a better average classification rate for "Computers & IT" and particularly for "Audio & Hi-Fi".

6.2 Product Categories

As in 6.2, we performed grid searches and subsequent retraining.

Table 5. Results after retraining.

Product categories	nu	sigma	Number of training auctions	Number of test auctions	Number of support vectors	Cross vali-dation error	Classifi-cation rate first category	Classifi-cation rate second category	Average classifi-cation rate
Collectables / Computers & IT	0.7	0.125	5,000	56,592	3,578	32.84%	73.97%	61.88%	67.93%
Collectables / Audio & Hi-Fi	0.7	0.0625	5,000	22,324	3,529	30.86%	82.04%	56.50%	69.27%
Collectables / Clothing & Accessories	0.7	0.03125	5,000	139,422	3,578	43.92%	58.70%	58.91%	58.81%
Computers&IT / Audio & Hi-Fi	0.6	0.03125	5,000	22,324	3,109	44.98%	58.18%	52.28%	55.23%
Computers&IT / Clothing & Accessories	0.7	8	5,000	56,592	3,976	41.62%	46.71%	71.03%	59.37%
Audio & Hi-Fi / Clothing & Accessories	0.7	1	5,000	22,324	3,751	35.26%	49.95%	78.46%	64.21%

We find bidding characteristics in "Computers & IT" and "Audio & Hi-Fi" to be most similar to each other. Bidding behaviour in the category "Collectables" is easiest to discern from bidding behaviour in "Computers & IT" and "Audio & Hi-Fi".

7. ANALYSIS

Regarding the entire set of auctions, we can not claim that there is a large general difference between high-volume and low-volume sellers. This finding comes as no surprise given the heterogeneity of the different product categories. For "Computers & IT" and "Audio & Hi-Fi", however, we can discern between the two

seller types with average classification rates of more than 63%. We can explain this by arguing that high-volume sellers in these categories either sell different merchandise (that triggers different bidding behaviour), sell similar merchandise, but in a different way (e.g. with nicer page templates). or "look after" their listings more closely than low-volume sellers.

When comparing the bidding characteristics in several product categories, we find "Computers & IT" and "Audio & Hi-Fi" similar to each other, but different from the other two categories. The reason could be a stronger competition from inside and outside of eBay and lower profit margins in these two categories.

If the absolute values of the average classification rates seem only moderate when compared to rates of more than 90% in SVM benchmark results, the type of data presented to the classification algorithm must be considered. We allowed the SVM to look only at data calculated from the sequence of bids. Given the large amount of test data and assuming a considerable level of intra-categorical heterogeneity, classification rates above 90% can not be expected for our eBay dataset.

8. CONCLUSION AND OUTLOOK

The evidence from our data suggests that the segmentation of the eBay marketplace affects bidding behaviour. Research on bidding strategies should take into account that successful strategies for a certain product category or seller type can be useless in different market segments. In the engineering of electronic markets, the heterogeneity of market participants and product types should be reflected in trading rules and fee structure.

Support Vector Classification has proven to be easy to apply and to deliver good classification results. Yet it does not offer an explicit explanation for its classification results. It would be interesting to know what exactly differentiates e.g. bidding in certain product categories from bidding in other categories. To extract such information from the sets of support vectors and non-support vectors is ongoing work.

REFERENCES

Anderson, S. et al, 2004. *Seller Strategies on eBay*. Working Paper, available at http://ideas.repec.org/p/wpa/wuwpio/-0412004.html.

Dealscart.com, 2005. *eBay Germany Category Count*. Retrieved October 1, 2005, from http://www.dealscart.com/count/-ebayGermanyCategoryCount.html

Garratt, R. et al, 2004. *Behavior in Second Price Auctions by Highly Experienced eBay Buyers and Sellers*. Working Paper, available at http://repositories.cdlib.org/cgi/viewcontent.cgi?article=1181&context=ucsbecon.

Hsu, C.-W. et al, *A Practical Guide to Support Vector Classification*. Retrieved October 1, 2005, from http://www.csie.ntu.edu.tw/~cjlin/papers/guide/guide.pdf.

Karatzoglou, A. et al, 2004. kernlab – An S4 Package for Kernel Methods in R. In *Journal of Statistical Software*, Vol. 11, No. 9, pp. 1-20.

R Development Core Team, 2004, *R: A Language and Environment for Statistical Computing*, Version 2.0.1.

Roth, A. E. and Ockenfels, A., 2002. Last Minute Bidding and the Rules for Ending Second-Price Auctions: Evidence from eBay and Amazon on the Internet. In *American Economic Review*, Vol. 92, No. 4, pp. 1093-1103.

Schölkopf, B. et al., 2000. New support Vector Algorithms. In *Neural Computation*, Vol. 12, pp. 1083-1121.

Schölkopf, B. and Smola, A., 2002. *Learning with Kernels – Support Vector Machines, Regularization, Optimization and Beyond*, The MIT Press, Cambridge, USA.

Shah, H. S. et al, 2003. Mining eBay: Bidding Strategies and Shill Detection. *WEBKDD 2002 – Mining Web Data for Discovering Usage Patterns and Profiles*, Edmonton, Canada, pp. 17-34.

Vapnik, V, 1995. *The Nature of Statistical Learning Theory*, Springer, New York, USA.

Vapnik, V. and Chervonenkis, A., 1974. Ordered risk minimization. In *Automation and Remote Control*, Vol. 35, pp. 1226-1235, 1403-1412.

INFORMATION PRESENTATION AND DESIGN FOR MULTILINGUAL GLOBAL E-COMMERCE SITES – A CULTURAL ASPECT

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ABSTRACT

This paper addresses the design of web sites for companies engaged in global e-commerce. Different language groups and different cultures prefer different styled of web pages. In this paper we performed a comparative feature analysis on airline web sites which may be targeted at specific national or regional audiences.

KEYWORDS

E-commerce, Web design and Culture

1. INTRODUCTION

With the scope of businesses spreading globally, there are increasing numbers of global e-commerce sites that provide links to different country sites, however most of the sites are in English and not all sites provide languages other than English for web users from different countries. It was found in earlier studies, that the presentation of information through different languages and web design elements such as navigation, images and color can provide diverse reactions from people in different cultures (Kang and Corbitt, 2002, Fernandes, 1995, Lerner, 1999). Usually, presentation of business information and services offered through the web is not only conveyed with developers' ideas but are also possible with web users' perception of choices. In short, information on the web relies on both groups forming a common perception. In a global context, most web interfaces do not support effective usage due to use of unsuitable tools for conveying information in a global context, as most of the information is presented on the web by icons, metaphors, shapes, colors of text and background, frame/text locations on screen, etc., which, may be relevant to the culture of origin but may be misinterpreted by the global audience.

Chen (2004) proposed an e-commerce model that contains different categories of retailers. One of the categories consists of retailers that replace their physical stores entirely with online operations (Chen et al., 2004) and so this area of research gains more relevance. This paper presents issues related to information presentation, web design, site structure and cultural aspects on the global site. Hence a particular business category of large global retailer sites, international airline companies, were selected and investigated. International airline companies are increasing their business operations on web sites, though they do not intend replacing their bricks and mortar facilities, web services provide a vehicle for improving their customer services and increase convenience for their customers. Benefits for the business are manifold, web based services can significantly cut operating costs, expand market by promoting global exposure, increase customer services, and overall deliver better product value. By examining different global airline sites, the

researchers hoped to find answers to research questions such as "what are design characteristics in different country web sites?" and "what are popular design features in West and East country sites?"

2. FEATURE CATEGORIZATIONS OF E-COMMERCE WEB SITE

The categories of design features that were investigated in this research are site links, page structure, menu frame, images and color, text density, high-tech features, and content. The categories and their characteristics are summarized in see table 1.

These issues were investigated through different country sites in two different culture groups. The purpose of this investigation was to find the design characteristics and information presentation styles that are distinct to a culture. An exploratory approach was taken to examine multi-linguistic sites. This enabled understanding of typical design styles in different language sites.

Table 1. Categories of design feature and information presentation

	Categories	Details
Design feature	Page structure	Linear, hierarchical, network or multiple access links to product info
	Menu frame	Horizontal, vertical, or both
	Image	Image map, cartoon, moving or stationary, country logo, or picture with person/people
	Density of text	Low, medium or large on the home page
	High tech feature	Number, size, location
	Content	News, search or links for promotion
	Form	Search engine, booking from
	Global Links	Country, language options,
Information presentation	Style of presentation	Introduction, tailored information in different countries

3. EC WEB SITES AND CULTURE

Around 600 million people are expected to access Internet in 2005 compared to 633 million people in 2004 (Statistics, 2000). The internet users' primary language was English (35.8%), and Non-English content was 64.2% in 2005(Statistics, 2000). Lerner (Lerner, 1999) suggested localization web sites into six languages other than English, namely, Japanese, German, Spanish, Portuguese and Swedish, e-commerce to cover up to 90% of the online population. The argument for localized information with local languages is that it is likely to increase transactions in e-commerce business. Hence it is important conceive what constitutes the quality of site for different country users as well as for e-commerce providers.

Web site structure is the organization of information on a site. Site structure is the groundwork of design, navigation and organization of documents at a site (Smart et al., 2000). Sometimes attractive design features such as animations, video clips, or graphics may attract web user's attention, but the static information on the web can be provide ease of navigation to the users (Lynch and Horton, 1999, Nielson, 2000, Norman, 1994, Shneiderman, 1980, Raskin, 2000, Preece, 1993). A combination of these features result in an effective good quality website. Aspects of web interface usability need to be considered at the design stage to make content easy to understand for global web users.

4. APPROACH

As Yin (1994) suggested, evidence of case studies may come from six sources such as documents, archival records, interviews, direct observation, participant observation and physical artifacts (Yin, 1994). In this study, observations and documents were used in process of conducting the case study. Firstly, the researchers focused on design features and information presentation differences in large global corporation web sites. Understanding how color, image presentations and facilities for data entry in different sites, and how the page included different regions. The researchers also considered complexity of a page including text density, site structure, frame and global links. This approach sought to confirm the generalizations and to test the impact of cultural differences on web design. This exploratory investigation attempted to formulate more precise objectives for further research.

Firstly, we selected airline sites, and identified information web design styles; page layout, visual design elements and language options. Secondary, this research was conducted on pre-selected global sites, which are based in Australian, UK, Korea and Japan. The research questions were "what are design characteristics in different country web sites?" and "what are popular design features in West and East country sites?". The study attempted to find out the characteristics of design features. For the second research question, observations were conducted to determine the different design categories in four different countries. Also we investigated design features, where some design effects were taking into consideration, such as color, images, menu layout, etc. Both, culture differences and design features. The data collection and research methods are similar to many studies, were exploratory research method was used to examine about the web design sites (Ives and Jarvenpaa, 1991, Huberman, 1994, Evans and Tigre, 1989). This approach was found to be beneficial to confirm generalizations made in relation to test the impact of cultural differences on web design. This research then attempted to formulate more precisely objectives for further research.

5. RESULTS AND DISCUSSION

In this section, results are presented on general views from over 23 airline sites on design. Results relate to the design categories of colors, image, text density, high-tech features, particular features and common features from four different countries.

5.1 Feature analysis on airline sites

Most of airline sites (20 out of 23) provided same page designs for different countries as the main home page. Some of the sites had same design with different color and pictures for different countries, but theme color and image were same. Though, some Asian country's sites did not follow this norm. Asian sites generally had more moving images and bigger pictures than Western country's sites. Sixty one percent of the airline sites investigated provided connections to global sites through links. Furthermore, 9 sites had different design features than home sites. 8 airline sites had different design pages for different countries compared to the home site. Rest of the sites presented cover pages with different photos or menu frames compared to the main home site, with the same information contents as the main home page. Most of airline sites presented the same type of cover pages with links to other languages/ countries as the main home site. 13 sites provided different menu frame and colors on local pages. Twenty six percent of sites had multiple access links to product information. Overall images were not a major feature of the site and mainly contained stationary images. Most of sites contained more than three images per page. Cartoons and moving images were not popular, and only one airline site had some cartoon images on the site. They also had the company logo with just one exception, and were mainly located on the top-left corner of the cover page. Some of the sites had more prominent use of images such as on Asian country sites, where images of people and big welcome signs were used to promote friendliness. The prominent color on airline sites was found to be 'blue' images on a 'white' background. The text density was also found not to be very high with 'black' text delivering information mainly through the functional form and menus. Generally, each site contained between three to five different colors for each site including text and images.

Overall hierarchical structure was most the popular information presentation structure. Twenty one out of twenty three sites provided a hierarchical structure. Generally, a flat hierarchy of information is important for

a successful web site design (Sklar, 2000, Shneiderman, 1997). Hierarchical presentation of information facilitates the user to understand information on each page easily. The user can also control navigation easily and recognize selection points readily. Most of the sites investigated provided information at the top and second levels in the hierarchic information format for a selected product group and brought up to the index or a text box for the search engine. The horizontal layout was observed on 19 out of 23 sites, and 4 sites were found to be with the vertical layout. Over 16 sites had top-down and left to right arrangement for the menu layout. Unlike other popular e-commerce sites, none of airline sites investigated used pop up windows; 8 sites contained rollover features, and 11 sites had moving images

Out of the 23 airline sites examined, 19 sites provided English sites only, and they focused on English speaking users mainly based in the USA including 7 airlines from USA. For providing global links and sites for users from other countries, almost all airline companies provided links to other country or regional sites, and only one company provided local sites for each country separately. Fourteen out of twenty three global sites provided links to multilingual sites or other country sites from the main page. Though web users including designers use their own language for day to day business activities, most of the airline sites presented information in English on the cover page, except sites in Dutch, Japanese and Chinese languages. These country sites focused only on local users rather than other country users. Apparently, 14 out of 23 sites provided links for different country users, but not all airline sites provided local language sites for different country users.

Most of airline sites required the user login to access service features. The login form was located on the top for the cover page for 8 sites and bottom of the cover page for 3 sites. All airline sites provided multiple text boxes and drop-down selections for the booking forms. These were located in the middle of the page for 39% of the sites, on the right side of the page on 2 sites and on the left side of the page on 3 sites.

Out of 23 sites, 14 sites provided global options, and only 4 sites offered links to other language options. This means that majority of the airline companies prefer to have home sites in English rather than local languages in different country site.

5.2 Feature comparison – Australia/UK vs. Korea/Japan sites

With these results in mind, a detailed study was conducted for four country sites; that of Australia, UK, Korea and Japan for each airline. No cartoon and/or moving images were found in these sites. There are many design features that are different from each country site for the same airline company such as image links, overlapped images, number of people in the picture, dominant page/text color and high tech features. Overall, table 2 shows the categories of design clustered in three selected groups.

Most of the airline home sites provided more search tools and links. Korean/Japanese sites provided more than two languages including Native English and their own language. Most of the Korean/Japanese sites provided alternative designs for local users. However Australian/UK site rarely provided different features (e.g. menu bar, links, etc), other those on their home site. From these observations, use of text, images, color and new high tech features in design for Korean/Japan and Australian/UK were found to be different. Australian/UK users were considered as equal to Native English site users on their home site. Some Korean/Japanese sites provided different design for Native English and non-Native English users, and provided different favorites for different language background users.

From the study, the Australian sites were found to be identical to a typical western global site in comparison to Korea/Japan and Home sites. The western sites usually have an introduction page which provides information about the company and their market and the product information is accessed through links. In comparison Korea/Japan sites provide no introduction and take the user directly to links for the selection of services and products. By looking at different design features, there was a clear connection between design features and pages aimed at or originating from certain cultures. Further investigations are necessary in this aspect of web design.

Table 2 Characteristics of design feature

categories	Country site		
	Home	Korea /Japan	Australia /UK
Image	Image links are popular but no cartoon images.	Company logo and images are large. Mostly, the human faces on the picture are female. More images and links for same information.	Smaller images are popular
Color	Dominant color is blue in text and image. More than three colors of text.	More multiple colored images and backgrounds	Limited colors of text and images
Density of text	More text on the page	Low text	Low text
High tech feature	More rollover features and search tools available than other country sites	Pop up windows are popular. The animations are larger and located in the middle or top. The animations are mainly for other companies' advertisements	Animation is small, and located on the right
Particular feature	High density text on the page	The black text color was traditional	The animation is small and own company's advertisement.
Common feature	Company logo was the strongest image on the cover page. Overall, blue color was commonly used. Multiple frames are in vogue.		

Most of the airline home sites provided more search tools and links. Korean/Japanese sites provided more than two languages including Native English and their own language. Most of the Korean/Japanese sites provided alternative designs for local users. However Australian/UK site rarely provided different features (e.g. menu bar, links, etc), other that those on their home site. From these observations, use of text, images, color and new high tech features in design for Korean/Japan and Australian/UK were found to be different. Australian/UK users were considered as equal to Native English site users on their home site. Some Korean/Japanese sites provided different design for Native English and non-Native English users, and provided different favorites for different language background users.

From the study, the Australian sites are more likely to be identical to a western global site in comparison to Korea/Japan and Home sites. The western sites have an introduction page which provides information about the company and their market and the product information is accessed through links, in comparison to Korea/Japan sites, which provide no introduction and take the user directly to links for the selection of services and products. By looking at different design features, there was a clear connection between design features and pages aimed at or originating from certain cultures. Further investigation is necessary and will be performed in future studies.

6. CONCLUSION AND LIMITATIONS OF THE STUDY

This study confirms Lerner's (1999) suggestions that there are certain ways to localize web sites. These suggestions are to plan ahead as all languages are not created equal and have their own nuances, to be aware of cultural differences, present a clear choice, know the target users, avoid slang, and keep information current on the site. However not many airline sites seemed to be aware of how cultural difference impact on local users' preferences. Even though a global site provided links to another country site, the site was in English and only three sites provided languages other than English for different country users.

This paper presented a framework to evaluate characteristics of web design in the main section, and identified some design features that will help improve ease of use and satisfaction for international users. It was observed in the study that global airline sites mainly focused on English web users rather than on other language users. The limitations of this research are that it did not go through with usability evaluations, usage of software, quality assurance testing and post-analysis, however further investigations are necessary and will be performed in future studies.

REFERENCES

Chen, L., Gillenson, M. L. and Sherrell, D. L. 2004. *ACM,* 5.

Evans, P. B. and Tigre, P. B. 1989. *World Development,* 17**,** pp. 1751-1768.

Fernandes, T. 1995 *Introduction to Culture: Global Interface Design,* Academic Press, UK.

Huberman, I. M. a. A. M. 1994. *An expanded Sourcebook Qualitative Data Analysis,* Sage, CA.

Ives, B. and Jarvenpaa, S. L. 1991. *MIS Quartly,* 15**,** pp. 32-49.

Kang, K. S. and Corbitt, B. 2002. *Electronic Journal of Information Systems in Developing Countries,* 7.

Lerner, M. 1999. In *available at www-128.inm.com/developerworks/library/web-localization.htm.*

Lynch, P. J. and Horton, S. 1999. *Web Style Guide,* Yale University Press, New Haven. CT,.

Nielson, J. 2000. *Designing Web Usability,* New Riders Press, USA.

Norman, D. A. 1994. *The design of everyday things,* Doubleday, New York.

Preece, J. 1993. *A Guide to Usability: Human Factors in Computing,* Addison-Wesley, Wokingham.

Raskin, J. 2000. Human interface directions for designing interactive systems**,** ACM, pp.191-204.

Shneiderman, B. 1980. *Software Psychology: Human Factors in Computer and Information Systems,* Wintrop Publishers, Cambridge. MA.

Shneiderman, G. B. 1997. *International Journal of Society,* 47**,** pp. 5-29.

Sklar, J. 2000. Thomason Learning, Cambridge, MA.

Smart, K., Rice, J. and Wood, L. 2000. *Journal of Technology & Teamwork.*

Statistics, Global Reach Online Statistics. 2000.available at http://glreach.com

Yin, R. K. (1994) *Case study research: Design and methods,* Thousand Oaks, Sage, Calif.

TOWARDS A DECENTRALIZED AND SECURE ELECTRONIC MARKETPLACE

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ABSTRACT

For commerce (electronic or traditional) to be effective, there must be a degree of trust between buyers and sellers. In traditional commerce, this kind of trust is based on such things as societal laws and customs, and on the intuition people tend to develop about each other during interpersonal interactions. The trustworthiness of these factors is based, to a large extent, on the geographical proximity between buyers and sellers. But this proximity is lost in e-commerce.

In conventional electronic marketplaces the trust among participants is supported by a central server that imposes certain rules of engagement on all transactions. But such centralized marketplaces have serious drawbacks, among them lack of scalability, and high cost.

In this paper we propose a concept of *decentralized electronic marketplace* (or DEM, for short) which would allow buyers and sellers to engage in commercial transactions, subject to an explicitly stated set of rules, called the *law* of this marketplace—which they can trust to be observed by their trading partners. This trust is due to a scalable decentralized mechanism that enforces this stated law, and to the reputation mechanism that is also supported by the law of DEM.

KEYWORDS

Electronic Commerce, Secure Electronic Marketplace, Distributed Systems, Decentralization, Decentralized Enforcement, Law Governed Interaction

1. INTRODUCTION

For commerce (electronic or traditional) to be effective, there must be a degree of trust between buyers and sellers. When buying an airline ticket, for example, the buyer needs an assurance that what he (or she) is getting is an authentic ticket, issued by the airline in question, and that it is not forged and cannot be duplicated. Also, if the payment for the ticket is done via a credit card, the buyer needs to trust the seller not to use the credit card for anything but the transaction at hand, and not to disclose it to anybody else.

In traditional commerce, the trust between buyers and sellers, as it is, is based on such things as societal laws and customs, and on the intuition people tend to develop about each other during interpersonal

interactions. The trustworthiness of these factors is based, to a large extent, on the geographical proximity between buyers and sellers. It is the physical venue of the trade that is subject to specific trading laws, which may be enforced by the local police; and it is the eye contact between the trading partners that may induce a degree of trust between them.

But no such physical venue exists for the electronic marketplace. Moreover the participants in electronic commerce might reside in different countries, and may be subject to different laws and different customs. The trading partners are also invisible to each other, and are often immune from traditional kind of law enforcement. We need therefore some other, non-traditional, means for inducing trust in such a marketplace. The conventional approach to electronic marketplace is to use a *centralized server* to mediate all transactions between buyers and server, subject to some rules of engagement built into this server—which can, thus be trusted by the trading partners. Examples of such marketplaces include EBay (http://www.ebay.com), the Ford marketplace for automotive parts (http://www.pricingcentral.com/ford/), Open Market [9], and AuctionBot [14].

But although these particular marketplaces operate effectively, the general concept of centralized electronic marketplace has several serious drawbacks. First, a centralized mediator of electronic transactions is a single point of failure, and could become a bottleneck, with sufficiently large number of participants. These weaknesses of centralization can be alleviated, in particular, by massive replication—but only at a great cost, as is evident from a system like EBay. (And even EBay, with its enormous resources, crumbled under a denial of service attack.) This means that it is hard and expensive to start a new electronic marketplace of this kind. Another problem with this approach is that the rules that govern a given centralized marketplace are usually implicit in the code of its server, and may not be fully available to the buyers and sellers that use it.

In this paper we propose a concept of *decentralized electronic marketplace* (or, DEM, for short) which would allow buyers and sellers to engage in commercial transactions, subject to an explicitly stated set of rules of engagement, called the *law* of this marketplace—which they can trust each other to observe. This trust is due to a decentralized, and thus scalable, mechanism that enforces the stated law of the DEM.

A DEM is characterized not by any physical server that manages it—as there is none—but by the law that governs all transactions made through it. Such a marketplace can be launched by essentially defining its law. This act that has no real cost because it does not involve the creation of any central mediator. Once launched, a DEM can grow, in a scalable manner, simply by sellers and buyers joining it. (In practice, such growth is likely to require some advertising, which is not discussed in this paper.)

The architecture of such decentralized marketplaces is based on the concept of Law Governed Interaction (*LGI*) [7,8], which provides means for the specification of the law of a given DEM, and for its decentralized enforcement. The LGI concept has been implemented as a middleware, available for public access at http://www.moses.rutgers.edu/ , and it can, in principle, support our concept of DEM. But for a DEM to be usable by buyers and sellers throughout the Internet, this middleware needs to be commercially, and widely, deployed. Such deployment is beyond the scope of our work, and of this paper.

The rest of the paper is organized as follows: Section 2 introduces a motivating example of a DEM used for the trading of airline tickets. Section 3 is the outline of LGI, which provide the computational basis for our concept of marketplace. Section 4 describes the implementation of the example marketplace introduced in Section 2. Section 5 discusses some related work. And we conclude in Section 6.

2. AIRLINE TICKET TRADING – A MOTIVATING EXAMPLE

We introduce here an example of a decentralized marketplace, called AT, for trading airline-tickets. We focus on the law that is to govern this marketplace, we express it here informally, calling it a "policy", and we later discuss its formalization as an LGI law. But we must first introduce the various participants in this marketplace, and explain broadly the role that they are to play.

The participants in this marketplace include the following: (1) The *airlines*, which provide sellers with their tickets, and have no other involvement in the marketplace. (2) The *banks*, which provide credit card authorization and money transfer services for buyers and sellers (we assume here that all payments are to be done via credit cards). (3) The *sellers* are required to be authenticated. (4) An *auditor*, which receives copies of messages that were exchanged during the trading. And (5) two *certification authorities: ca_1* is employed

to authorize airlines, banks, and the auditor; ca_2 is employed for authenticating the identity of buyers and sellers.

Note that the only other agent involved in the trade beside the buyer and the seller is the bank. A bank needs to be involved here, as it is in traditional commerce, because we have chosen payments via credit cards. Would we have chosen payment via digital cash [10], which is easy to do under LGI (as we have done in [2]), we would have no direct central involvement in an individual purchase.

This marketplace is to be governed by the following seven-point policy, stated here informally:

1. *Authenticity of the tickets:* Tickets sold by sellers are required to be authentic, i.e. issued by the specified airline. The sellers should not be able to forge or copy tickets: every such ticket can be sold only once.

2. *Security and privacy of credit card payment:* Payments under this marketplace are to be made via credit cards, with the following guarantee to buyers: (a) the credit card would be charged only for the cost of the purchased airline ticket, and only once; and (b) no information about the credit card being used would be leaked to the seller itself.

3. *Ticket reservation:* If a seller agrees to reserve a ticket for a specified period of time, it is not allowed to sell it to anybody else.

4. *Money back guarantee:* A buyer can cancel a transaction, by returning the ticket within a certain time period following the purchase. The buyer is guaranteed to receive its money back (minus a service fee, perhaps).

5. *Monitoring:* A copy of all message exchange between buyers and sellers is sent to an *auditor*.

6. *Authentication of Identity:* The sellers are required to identify themselves via certificates issued by the certifying authority ca_2.

7. *Reputation services:* The tracking and reporting of reputation will be provided for, in a decentralized manner. This will be done along the lines discussed in [14], and explained briefly in Section 4.

3. AN OVERVIEW OF LGI

LGI is a mode of interaction that allows an open group of distributed heterogeneous agents[1] to interact with each other with confidence that the explicitly specified policies, called the *law* of the open group, is complied with by everyone in the group [7][8]. The messages exchanged under a given law *L* are called *L*-messages, and the group of agents interacting via *L*-messages is called a *community* C, or more specifically, an L-community C_L.

By the phrase "open group" we mean (a) that the membership of this group can be very large, and can change dynamically; and (b) that the members of a given community can be heterogeneous. LGI does not assume any knowledge about the structure and behavior of the members of a given L-community. All such members are treated as black boxes by LGI, which only deals with the interaction between them. Members of a certain LGI community are allowed to participate in other LGI communities or in normal communication not regulated by LGI.

For each agent *x* in a given L-community, LGI maintains the *control-state* CS_x of this agent. These control-states, which can change dynamically, subject to law *L*, enable the law to make distinctions between agents, and to be sensitive to dynamic changes in their states. The semantics of control-states for a given community is defined by its law, and could represent such things as the role of an agent in this community, privileges, and reputations.

We continue this section to further discuss the concept of law, emphasizing its local nature, and with a description of the decentralized LGI mechanism for law enforcement. The concept of *obligation* is elaborated briefly. We do not discuss here several important aspects of LGI, including the *interoperability* between communities, the treatment of *certificates* and *exceptions*, the deployment of L-communities, and the performance of its current implementation. For a complete understanding of these issues, the reader is referred to [8][12]. An explanation of LGI, with examples, can also be found at www.moses.rutgers.edu.

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[1] Given the popular usages of the term "agent", it is important to point out that we do not imply by it either "intelligence" nor mobility, although neither of these is being ruled out by this model.

The concept of law and its enforcement: Generally speaking, the law of a community C is defined over a certain types of events occurring at members of C, mandating the effect that any such event should have – this mandate is called the *ruling* of the law for a given event. The events subject to laws, called *regulated events* include (among others): the *sending* and the *arrival* of an L-message; the *coming due* of an *obligation* previously imposed on a given object; and the submission of a *digital certificate*. The operations that can be included in the ruling of the law for a given regulated event are called *primitive operations*. They include, operations on the control-state of the agent where the event occurred (called, the "home agent"); operations on messages, such as *forward* and *deliver*; and the imposition of an obligation on the home agent.

Thus, a law L can regulate the exchange of messages between members of an L-community, based on the control-state of the participants; and it can mandate various side effects of the message-exchange, such as modification of the control states of the sender and/or receiver of a message, and emission of extra messages.

Figure 4 displays a section of the Java implemented *LAT* law that deals with ticket authenticity issues. A Prolog formulation of the law is also available. The law implements the following event methods: sent and arrived; it accesses the control state through the CS variable; and it calls the following primitive operations: doForward, doDeliver, doRemove, and doAdd.

The arrived event deals with the situation when a message sent by an airline agent arrives at a seller; the sent event deals with the situation when a seller sends a ticket confirmation to a buyer agent. A more detailed description of the ticket authenticity rules in the *LAT* law is offered in Section 4.

Enforced obligation: Informally speaking, an obligation under LGI is a kind of *motive force*. Once an obligation is imposed on an agent – generally, as part of the ruling of the law for some event at it – it ensures that a certain action (called *sanction*) is carried out at this agent, at a specified time in the future, when the obligation is said to come due, and provided that certain conditions on the control-state of the agent are satisfied at that time. Note that a pending obligation incurred by agent x can be *repealed* before its due time. The circumstances under which an agent may incur an obligation, the treatment of pending obligations, and the nature of the sanctions, are all governed by the law of the community.

The local nature of laws: Although the law L of a community C is *global* in that it governs the interaction between all members of C, it is enforced locally at each member of C. This is possible due to the following locality properties of LGI laws:

- L only regulates local events at individual agents.
- The ruling of L for an event e at agent x depends only on e and the local control-state CS_x of x.
- The ruling of L at x can mandate only local operations to be carried out at x, such as an update of CS_x, the forwarding of a message from x to some other agent y, and the imposition of an obligation on x.

The fact that the same law is enforced at all agents of a community gives LGI its necessary global scope, establishing a *common* set of ground rules for the members of C and providing them with the ability to trust each other, in spite of the heterogeneity of the community. And the locality of law enforcement enables LGI to scale with community size.

Distributed law-enforcement: Broadly speaking, the law L of community C_L is enforced by a set of trusted agents called *controllers*, that mediate the exchange of L-messages between members of C_L. Every member x of C has a controller T_x assigned to it (T here stands for trusted agent) which maintains the control-state CS_x of its client x. And all these controllers, which are *logically* placed between the members of C and the communication medium as illustrated in Figure 1 carry the *same law L*. Every exchange between a pair of agents x and y is thus mediated by *their* controllers T_x and T_y, so that this enforcement is inherently decentralized. However, several agents can share a single controller, if such sharing is desired. The efficiency of this mechanism, and its scalability, are discussed in [8]. Secure transmission between controllers is carried out via traditional cryptographic techniques, and we assume that these controllers are correctly implemented. Furthermore a community can choose to only use controllers certified by a certain certification authority(*CA*), which is specified by the law L.

Controllers are generic, and can interpret and enforce any well- formed law. A controller operates as an independent process, and it may be placed on any machine, anywhere in the network. We have implemented a *controller-service*, which maintains a set of active controllers. To be effective in a widely distributed enterprise, this set of controllers need to be well dispersed geographically, so that it would be possible to find controllers that are reasonably close to their prospective clients. We postulate the existence of a "public

utility" of trusted controllers which we call a controller-service. It is an organization that maintains a set of trusted hosts that function as controllers. The controllers, the controller-service and the related utility are currently implemented by a middleware called Moses. Moses is released in September and it is available for public use.
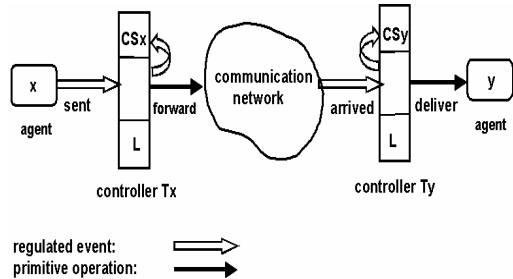
Figure 1. Enforcement of LGI through controllers
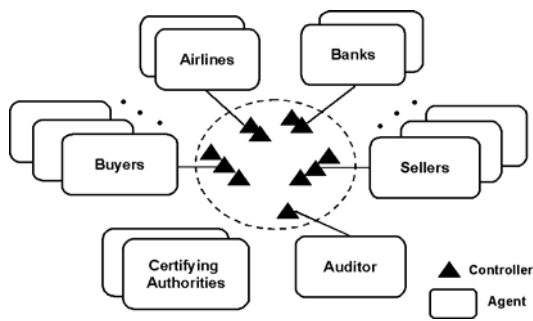
Figure 2. Architecture of LGI-based airline ticket trading marketplace
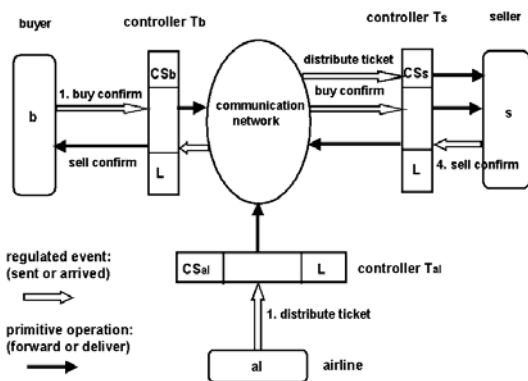
Figure 3. Flow of ticket authentication

Ticket Authenticity – Fragment of the *LAT* Law

```
law(LAT,language(java))

/* The body of the law*/
import java.util.*;
public class LAT extends Law {

public static final String ctrl= "controller";
/* Event methods*/

/* When a ticket is confirmed, its hash is compared against a
hash previously stored in CS. Upon success, send the ticket
and remove the hash from the CS. Otherwise send a denial
message*/

public void sent(String source,String message,
                       String destination, String destlaw) {
    String serial_num = getMsgContentFirst(message);
    String order_num = getMsgContentLast(message);

    /* Ticket authentication is checked*/
    if (CS.has("ticket("+hash(message)+")")){
       String c_name = getCustomerName(order_num);
       if (c_name != null){
          /* Prevents double selling of the ticket */
          doRemove("ticket("+serial_num+")");
          Term t = Cs.find("customer_order("+order_num+
                          ",%NM,%OI,%PS)");
          doRemove(t);
          doForward(Self, message, c_name);
       } return;
    }
    doDeliver(ctrl,"ticket_not_authentic ",Self);
}

/* Term ticket(hash(tk)) is added into CS for every ticket tk
sent by an airline al that arrives at the seller s.*/

 public void arrived(String source, String sourcelaw,
                       String message, String dest){
   if (message.startsWith("distribute_tkt")){
       String serial_num = getMsgContentFirst(message);
       doAdd("ticket(" +hash( message)+")");
       doDeliver();
   }
 }

 /* Helper methods*/
 public String getMsgContentFirst(String message){ … }
```

Figure 4. Ticket Authenticity–Fragment of the *LAT*

4. IMPLEMENTATION OF THE AIRLINE TICKET MARKETPLACE

A marketplace is represented by a dynamic set of buyers, sellers and other actors that are involved in a trading activity as introduced in Section 2. The marketplace is defined practically by the set of rules (policy) governing the common interaction between all the actors involved in the trading. Formally, in LGI this set of rules represents the law of airline ticket trading for the marketplace community. This law, called *LAT* represents and defines the AT marketplace. It can be observed that by changing the trading law, LGI could be easily used to apply to other trading applications in the electronic marketplace.

Figure 2 shows the interaction within the marketplace defined by the law *LAT*. A set of controllers represents the decentralized trusted infrastructure that mediates all the interaction between the actors, thus enforcing the trading policy. First buyers, sellers and other actors examine *LAT*. If they agree with it, they can decide to participate in the marketplace by adopting the controllers under law *LAT*.

The following explains the implementation of various rules from the trading policy in Section 2. A short fragment of the corresponding *LAT* law is presented in Figure 4, and the entire law is available at: http://www.moses.rutgers.edu/examples/marketplace/trade.java1 - for the Java implementation of the law and http://www.moses.rutgers.edu/examples/marketplace/trade.law for its Prolog counterpart.

Ticket authenticity and reservation: Every ticket *tk* sold by a seller is required to be authentic, i.e. issued by the specified airline. The sellers should not be able to forge or copy tickets: every such ticket can be sold only once.

Such forgery is prevented in a straightforward manner if the marketplace involves a central entity: for every bought ticket, the buyer can verify with the (central) airline that the ticket is authentic and it has not been previously sold. This solution, however, introduces the airline in the direct trading path, impeding the decentralized nature of the marketplace. Another centralized solution is to employ a trusted third party holding the ticket to verify and enforce its validity.

DEM achieves this property by putting the trust on the controller. Whenever a seller receives a ticket from an airline, the seller's controller maintains the hash of the ticket in its control state. Whenever a ticket is sold, its hash is compared against the hash stored in the control state.

Usually an airline ticket *tk* contains crucial data such as serial number *SN*, date and time *DT*, source *SO* and destination *DE*, class *CL*, and etc. During the ticket distribution from airlines *al*, the one-way hash $h_{tk}(SN, DT, DE, CL)$ can be computed for each ticket and stored in the control-state of the seller *s* . In the case of *s* altering some of the information in *tk* the controller T_s will detect the fraud and prevent the selling message of *s* from reaching the buyer *b*. One possible fraud is to change the class level *CL* of a ticket in order to make more profit, and then to send a fraudulent selling response *tk'* to a buyer *b*. Once *tk* is sold, the hash value of *tk* will be removed from T_s. This method prevents the ticket to be sold more than once by a dishonest seller as follows. When the selling message from *s* arrives at T_s, if T_s could not find the hash value of *tk*, it infers that the ticket has already been sold, and thus it denies the fraudulent selling message originating in *s*. The complete interaction involving the airline, the seller and the buyer is depicted in Figure 3, and a fragment of LAT dealing with the implementation of these rules can be observed in the code in Figure 4.

To ensure that a buyer *b* obtains the ticket it asked for, we have implemented a ticket reservation scheme. Following a ticket request from a buyer *b*, a seller *s* will put *tk* into a "reserved" state on behalf of *b*. The reservation state is in effect for a certain time period and it is implemented using the *obligation* mechanism at the controller of *s* (mechanism discussed in more detail in Section 3). If the buying confirmation of *b* arrives at T_s before the obligation is *due*, *tk* is sold to *b* and the obligation is *repealed*. Otherwise, *tk* will be released from the reservation state when the obligation comes *due* and it will be free to new queries from other buyers.

Security and privacy of credit card payment: As discussed in the trading policy of Section 2, when shopping for airline tickets, the following guarantee will be made to a buyer *b*: (a) the credit card would be charged only for the cost of the purchased airline ticket, and only once; and (b) no information about the credit card being used would leak to the seller itself.

The local controller T_s of the seller *s* protects the buyer's confidentiality by maintaining the credit card information without disclosing it to the seller itself. T_s will perform the credit card authorization check for a buyer *b* by sending a credit card checking request to bank *bk*. Meanwhile, the controller maintains a repository *R* for active buyers at *s*, by saving a customer_order in the local *CS* of *s*. This information is

transient and it will be removed once the order is completed either successfully or by failure. If the credit card check is successful, T_s will deliver the purchasing order to s in order to take an appropriate action. Otherwise, if the credit card authorization fails, T_s will send a denial message back to b.

It is worth mentioning that in certain electronic marketplaces a buyer may not want a seller to know its identity due to the sensitivity of the type of products to be purchased; this kind of identity privacy protection could be easily achieved by LGI using the approach discussed here.

Monitoring: *LAT* provides monitoring of the trading activities for the purpose of auditing. If an auditor exists, an agent can request copies of the messages exchanged during the trading and use this information to study the behavior of the agents involved in the marketplace. The trading activities are monitored to ensure that a copy of every transaction is sent to an auditor. More than one auditor can exist and *LAT* is flexible to specify what transaction messages are sent to which of them. Even though *LAT* specifies what messages are sent to what auditors, it imposes no restrictions on the way the auditors handle the messages they receive.

Authentication of Identity: There are situations when a buyer b would like to securely identify a seller s, and obtain assurance that it is legitimately established and accredited. *LAT* provides authentication of identity in the following manner. When joining the L-community, each airline al, bank bk, or auditor a has to present a *digital certificate* to its controller. This certificate, signed by the certifying authority ca_1, serves for authentication of identity and in order to assess the role as airline, bank, or auditor. Prior to selling airline tickets, each seller s has to present a *digital certificate* signed by ca_2 to its local controller for authentication of identity. This prevents s from impersonating other sellers. After the certificate has been presented at the controller, and it has been verified to be valid, a *certified* event will be triggered in the *LAT* law. As a result the identity of the seller is added into the *CS* of the respective agent.

Reputation Tracking: Reputation tracking of the sellers is a service necessary to a marketplace. Unlike in traditional e-marketplaces where reputation management requires an online central server, *LAT* implements a decentralized reputation tracking mechanism to store and update the reputation information for each active seller. The reputation information of each seller s is maintained and updated in its controller T_s. For each successful trade, a buyer can rate s by updating its *rating*, while its associated *seniority* grows automatically.

5. RELATED WORK

We have already pointed out that the conventional approach to electronic marketplaces is based on a central mediator. We have explained the limitations of this approach, despite some very successful system, such as EBay. Others have observed these limitations as well. We will mention here two such cases.

First, Schmees [10] in his 2003 paper "Distributed digital commerce," discussed the benefits of decentralized market for digital goods, and studied the processes involved in digital trading and their implementation using P2P communication. Although Schmees admitted the importance of trust and security in the marketplace, he did not propose any mechanism for achieving them. The DEM model proposed in this paper addresses exactly these issues.

Second, the European SEMPER [6][13] project attempted to examine systematically the security requirements of electronic marketplaces, and proposed a framework for addressing them. The resulting open security architecture of SEMPER offers users the ability to select components of choice from the SEMPER libraries, and to associate a certain level of trust with these components. Before trading, SEMPER proposes a series of agreements that establish a set of rules for each role: buyer, seller, bank, certification authority, and etc. Users playing these roles can commit to abide by these rules. The agreement is signed on paper with a third party. It establishes in advance the liability of the parties regarding the future transactions to conduct. The basic trust assumption of SEMPER has been that each user trusts his or her own machine, but not the machine of the partner. The SEMPER project proposed no practical implementation, and had no continuation after the project has been completed in 2000.

Finally, in a project closely related to the present one, which also employs LGI, a Decentralized Peer-to-Peer Auctions had been proposed [4].

6. CONCLUSION

The concept of *decentralized electronic marketplace* (DEM) proposed in this paper has no physical place in which the market takes place, and not even a virtual place, in a form of central manager, and mediator for all transactions. Yet, it deserves the name "marketplace" in that it provides a single, unifying, law that govern all the transactions made through it—in some analogy to the laws that govern traditional marketplaces.

The law of a given DEM is explicitly defined, and visible to all its participants. Moreover, the law is strictly enforced, via the LGI mechanism, in a completely decentralized manner. This makes such a marketplace easy to launch, essentially by writing its law; easy for a buyer or a seller to engage in, simply by locating an authenticated controller (using some controller-service), and adopting it with the law of the DEM; and easy to scale, due to the freedom from any central mediator.

We provide supporting evidence to the efficacy of this concept by presenting a study of a DEM devoted to trading in airline tickets, governed by law (*LAT*). Although this law has been only partially described here, due to space limitation, it has been fully defined and experimented with, and it is available on our web site.

It should be pointed out, however, that although the LGI mechanism, on which our concept of DEM is based, has been fully implemented (and has been released for public use), for a DEM to be usable by buyers and sellers dispersed throughout the Internet, the LGI middleware needs to be commercially, and widely, deployed. Such deployment is beyond our capacity, and we can do here no more than advocate that this would be done by some financial or governmental institutions.

REFERENCES

[1]Abad-Peiro, J., Asokan, N., Waidner, M., 1998. Designing a generic payment service. *IBM Systems Journal, Internet Computing,* volume 37, number 1, page 72,.

[2]Ao, X., and Minsky, N., 2003. Flexible regulations of distributed coalitions. In *Proceedings of the Eighth European Symposium on Research in Computer Security (ESORICS).* Norway.

[3]Ellison, C., 1999. The nature of a usable pki. *Computer Networks*, (31): 823-830,.

[4]Fontoura, M., Ionescu, M., and Minsky, N., 2005. Decentralized Peer-to-Peer Auctions. In *the Journal of Electronic Commerce Research (JECR).*

[5]Ionescu M., Minsky N., and Nguyen T., 2004. Enforcement of Communal Policies for Peer-to-Peer Systems. In *Proc. of the Sixth International Conference on Coordination Models and Languages*. Pisa Italy.

[6]Lacoste, G., 1997. SEMPER A security framework for the global electronic marketplace. *Comtec – the magazine for telecommunications technology.*

[7]Minsky, N., 1991. The imposition of protocols over open distributed systems. *IEEE Transactions on Software Engineering*.

[8]Minsky, N., and Ungureanu, V., 2000.Law-governed interaction:a coordination and control mechanism for heterogeneous distributed systems. *TOSEM, ACM Transactions on Software Engineering and Methodology*, 9(3): 273-305.

[9]Open Market, 1998. *Internet Commerce: The Open Market Transact Solution.* Technical white paper, Open Market, Inc.Available from www.openmarket.com.

[10]Schmees, M., 2003. Distributed digital commerce. In *Proceedings of the 5th International Conference on Electronic Commerce*. ACM, S.131-137. Pittsburgh, PA, USA,.

[11]Schneier, B., 1996. *Applied Cryptography*. John Wiley and Sons.

[12]Ungureanu, V. and Minsky, N.,2000. Establishing business rules for inter-enterprise electronic commerce. In *Proceedings of the Fourteenth International Symposium on Distributed Computing (DISC 2000)*. LNCS 1914, pages 179-193, Toledo, Spain.

[13]Wainder, M., 1996. Development of a secure electronic marketplace for Europe. In *Fourth European Symposium on Research in Computer Security (ESORICS)*. Rome, Italy.

[14]Wurman, P., Wellman, M., and Walsh, W., 1998. The Michigan Internet AuctionBot: A configurable auction server for human and software agents. In Katia P. Sycara and Michael Wooldridge, editors, *Proceedings of the 2nd International Conference on Autonomous Agents (Agents'98),* pages 301-308, ACM Press. New York.

PRIVACY-PRESERVING PHYSICAL DELIVERY IN ELECTRONIC COMMERCE

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ABSTRACT

Privacy in Electronic Commerce transactions is the subject of ever increasing research. However, many challenges remain to be overcome. For example, let us consider a customer, Sir Bob, who buys *anonymously* a product over the Internet. Since he must receive delivery, how could his anonymity be maintained? When dealing with digital products, several solutions have been proposed. But if Sir Bob has bought a physical product, then it might seem that he must give an address for delivery. This would obviously threaten his privacy. Until now, while dealing with privacy in e-commerce, the privacy of physical product delivery has not been considered seriously. Instead, the conventional wisdom (which sometimes even appears in print) is that nothing can be done. In this paper, we introduce Anonymous Delivery Centres (ADCs) to complete the anonymity of the buying process on the Internet that we had initiated in our earlier work on Blind Electronic Commerce. These centres enable Sir Bob to pick up the physical product he has bought online without revealing his identity to the merchant.

1. INTRODUCTION

In the context of Electronic Commerce, the merchant may gather a lot of information about the customer who is purchasing a product. Such information includes the selection of the product, the delivery address, the amount of money spent, etc. Unfortunately, this data gathering could result in a violation of the customer's privacy.

We believe that privacy is a *fundamental* right for all humans, and every means to protect it should be given serious consideration. In particular, no individual should ever have to justify a wish for privacy, and such wish should never be considered suspect *a priori*. Article 12 in the *Universal Declaration of Human Rights* states that "No one shall be subjected to arbitrary interference with his privacy". Should our idealistic position be considered extreme by some, and should it even go against the law in some countries, at least it can serve to shift the middle ground in the right direction!

This work is greatly inspired from Chaum's seminal technique of *mix-nets* [Chaum, 1981] and his legendary fight against Big Brother [Chaum, 1985]. Chaum is the precursor of the notion of transactions without identification. More precisely, he proposed an approach to protect information about individuals that private and public organizations usually exchange for many purposes such as statistics, data mining, creating individual's profile, etc. His approach also protects organizations against possible abuses from individuals.

In 1981, Chaum proposed the technique of *mix-nets* to implement "untraceable electronic mail, return addresses and digital pseudonyms". His approach enables an electronic mail system to hide the identity of email senders (as well as the content of the communication), yet provides the receiver with the possibility of sending back his response to the right person through an untraceable return address. This approach remains computationally secure even if the underlying telecommunication system is insecure. The advantage of Chaum's technique is that it does not require a *common* Trusted Authority. In fact, each participant has to be

considered an Authority, so that Chaum's solution can be compromised only by subversion or conspiracy of a significant subset of the users.

In general, the Electronic Commerce process is defined through six stages known as the *Customer Buying Behaviour* (CBB) model of Guttman, Moukas and Maes [1998]. These stages go from *Need identification* to *Service and evaluation*, while passing by *Product brokering*, *Merchant brokering*, *Negotiation* and *Payment and delivery*. The CBB model does not address privacy issues. Assume for instance that Sir Bob is a showbiz celebrity and he wishes to offer an engagement ring to Claudia. The ring costs one million dollars and Sir Bob would not like to see his name making the front page of tabloids! In fact, despite being a star, he wants to preserve as much of his privacy as possible: he thinks that his relation with Claudia is nobody else's business. In this paper, we use this example throughout under the name of *Showbiz*.

If Sir Bob uses the standard CBB model, then unfortunately, the merchant, Alice, gathers information on him whether or not he so desires. Moreover, there are several potential abuses from an unscrupulous Alice. For example, she could pool her information with other merchants and/or governments. She could also sell this information. This could result in a serious violation of Sir Bob's privacy. Such violations are prohibited by many governments but these entities do not have effective methods to enforce the law. This problem is exacerbated when information is used about individuals without their knowledge of it. Should Sir Bob have the proof that his privacy has been violated by Alice, he could complain to the proper authorities, so that justice might be served. However, the complaint alone is not sufficient to restore his privacy.

From our perspective, the most important task is to help Sir Bob buy products from Alice without revealing his profile over the Internet. A long way towards this goal has already been achieved in our earlier work on Blind Electronic Commerce [Aïmeur *et al.*, 2004, 2005], in which we have introduced the *Blind* Customer Buying Behaviour (BCBB) model. According to this model, Sir Bob can (1) blindly browse Alice's catalogue, (2) blindly negotiate with Alice a fair price and sales conditions, (3) pay untraceably and be supplied anonymously, and (4) blindly access the maintenance services. In addition to defining the BCBB model, we have developed various protocols to achieve most of the above goals. These protocols add confidentiality to the standard CBB model and help fight against the violation of customer privacy over the Internet, as well protect the merchants' sensitive information.

Even though the problem of anonymous delivery of digital goods was addressed in [Aïmeur *et al.*, 2004], we left open the question of anonymous delivery for *physical* items. This is the question we tackle in this paper, thus completing the full anonymity of the Internet buying process that we had initiated in our earlier work. For this purpose, we introduce the notion of *Anonymous Delivery Centres* (ADCs).

An ADC consists of three main parts: the Deposit Unit, in which the merchant or its Delivery Agent deposits the item to be delivered, the Mix-delivery System, which is the item's *anonymizer*, and the Retrieval Unit, from which the customer or his representative (another Delivery Agent for instance) picks up the item. These three main parts are described in detail in Section 3, with an illustration given in Figure 2.

Using the Showbiz example, suppose that Sir Bob has anonymously bought a ring from Alice's shop over the Internet. In order to deliver the ring to Sir Bob, it would seem that Alice needs information on Sir Bob, such as address, e-mail, phone number, etc. But Sir Bob does not want to reveal any information that could threaten his privacy. In our solution to this Anonymous Delivery conundrum, the use of an ADC enables Sir Bob to protect his privacy. More detail about this example is given in Section 3.5.

After this Introduction, we review in Section 2 the notions of delivery in electronic commerce and public key infrastructure. In Section 3, we present our proposed solution for delivering anonymously the physical items. We wrap up in Section 4 with a discussion in which we conclude with perspectives for future work.

2. PRELIMINARIES

2.1 Delivery in e-Commerce

In general, delivery is the process of transferring an item from one party, the *Sender*, to another, the *Receiver*, through one or several Delivery Agents, as shown in Figure 1. A Delivery Agent is a company or individual that takes the item to be delivered from the Sender or from another Delivery Agent to the Receiver or to another Delivery Agent. For example, if Alice wishes to send physical mail to Sir Bob, she may do so

through a delivery company such as FedEx, DHL, UPS, etc. In the case of electronic mail, one or more entities on the Internet (Internet Service Provider (ISP), Proxy Servers, etc.) can be used to convey the e-mail from Alice to Sir Bob; each entity forwards the e-mail to the next one until the final recipient is reached. According to the traditional paradigm, the delivery process requires identification information about the Receiver and sometimes also about the Sender, such as their names and addresses. This information allows the Delivery Agent to find either the next Delivery Agent to which the item must be forwarded or the final Receiver.
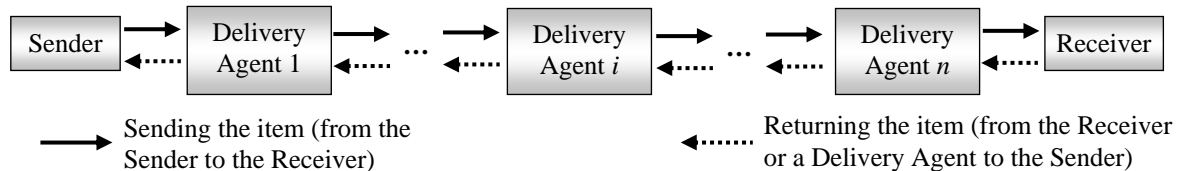
Figure 1. The delivery entities

To protect the privacy of customers in electronic commerce, *Anonymous Delivery* becomes an essential commodity. This consists in the delivery of an item from a *Sender* to a *Receiver*, without revealing the Receiver's personal information or identity to the Sender. The item could be a piece of mail, a gift, money, a product bought by means of electronic commerce, etc. We define an *Anonymous Delivery System* as a system that supports the practice of anonymous delivery, meaning that the Sender and the Receiver both use the system in order to complete the delivery process. An Anonymous Delivery System aims at guaranteeing the privacy of the Receiver all along the delivery process.

The anonymous delivery of *digital* items has been well studied in the past. It requires that the customer must be able to surf the web anonymously, which allows him to send requests and receive responses from the merchant (including the digital good to be delivered) without been traced [Aiello *et al.*, 2001]. This is usually achieved by the use of *trusted identity proxies* [URL1, URL3, etc.]. If no single third party can be trusted, Chaum's mix-nets [Chaum, 1981] can be used, in which case an untraceable return address can serve to deliver the digital good.

Possible solutions to the anonymous delivery of *physical* items also depend on whether or not the customer is willing to trust a third party. Thus, we define two main types of Anonymous Delivery Systems.

2.1.1 Trust-based Anonymous Delivery

Here, The Receiver trusts a third party. Therefore, he authorizes the trusted party to pick up the item from the Sender and convey it to him. There are companies dedicated exclusively to protecting the Receivers' privacy such as *ContinentalRelay* [URL2]. These companies specialize in offering anonymous maildrop and forwarding services to their customers, concerning mail, packages, postcards, voice-mail, fax and anonymous e-mail. To ensure the privacy of their customers, they provide them with such services as a private street and PO Box anonymous mail drop address, or an anonymous e-mail address. Items they receive are re-addressed and forwarded to the appropriate customers.

2.1.2 Secure Anonymous Delivery

Until now, the Anonymous Delivery of physical items has been limited to Trust-based Anonymous Delivery Systems, based on the concepts of anonymous maildrop and forwarding services. In other words, customers have to trust a third party to receive delivery. If that third party and the merchant are in collusion, all privacy is lost for the customer. It has even been claimed as self-evident that the increased security possible in the world of digital delivery could not be extended to the case of physical items. Nevertheless, we introduce in Section 3 a *Secure Anonymous Delivery System* in which the customer's privacy can be violated only by the collusion of a significant number of *Delivery Agents*, so that no single entity need be trusted.

2.2 Public Key Cryptosystems and Infrastructures

Public Key Cryptosystems (PKCs) were introduced by Diffie and Hellman [1976]. (The related notion of Public Key Distribution had previously been invented by Merkle [1978], despite its later publication date, but it was unknown to Diffie and Hellman at the time.) Formally, a PKC consists of three efficient algorithms: a *Key-Generation Algorithm* that generates pairs of Secret Key (SK) and Public Key (PK); an *Encryption Algorithm* that computes the ciphertext for a message, given the public key; and a *Decryption Algorithm* that computes the cleartext message back from the ciphertext, given the secret key.

Public Key Infrastructures (PKIs) have been introduced to make it possible to provide security services on the basis of PKCs. A PKI enables a security environment through a set of policies used to integrate and manage all the security parameters suitable for a great number of services, such as authentication of entities, digital signature, secure communication between entities (customers, partners, suppliers, etc.). A PKI aims at managing certificates and pairs of secret and public keys, including the ability to issue, maintain, recover and revoke public key certificates. PKIs make use of Certification Authorities (CAs), which are trusted entities whose central responsibility is certifying the authenticity of users and their public keys. More precisely, a user certificate issued and signed by a CA acts as proof that the legitimate public key is associated with the user.

In our solution to the Secure Anonymous Delivery problem, the customer uses the Public Keys of various Delivery Agents, whom he does not necessarily know, to create a mix-message (see Section 3.1) that can only be deciphered by the successive collaboration of those Agents.

3. PRIVACY-PRESERVING DELIVERY OF PHYSICAL ITEMS

We propose below a Delivery System for physical items in which the Receiver's privacy is guaranteed unless several Agents collude against him. We start this section by giving some definitions and notation that will be useful to understand our system.

3.1 Definition and Notation

A *Delivery Point* is a place where the item to be delivered undergoes some transformations, for instance packaging and labelling. The Sender and Receiver are considered to be delivery points.

A *Delivery Agent*, *A*, is a delivery entity or an individual that carries the item to be delivered from one delivery point to another. In particular, each Delivery Agent constitutes a delivery point.

A *Mix-delivery System* is a network made of several Delivery Agents.

An *Anonymous Delivery Centre* (ADC) is a physical space dedicated to anonymous delivery. The ADC is composed of several compartments communicating through a horizontal rotary surface, called *H*, on which the items are placed. Each compartment belongs to a given Delivery Agent. The Delivery Agent has access to the contents of *H* for retrieval or deposit, meaning that it can pick an item from *H*, make some transformations and put it back.

A *mix-message*, *c*, is a message addressed to a Mix-delivery System, such that each Delivery Agent has access to at most one piece m_i of the whole message. The message m_i tells the Delivery Agent how to manage the item *p* being delivered. It is composed of two main parts: the action to apply on *p* (relabelling for example) and the remaining mix-message to associate with the item for the subsequent Delivery Agents, if any. At any moment, only the first part of the mix-message can be in the *clear*, meaning that only the Delivery Agent that possesses the item and that has been chosen by the Receiver (see Section 3.2) is able to decipher this part.

The *Weight List*, *W*, is a list of weights acceptable in the ADC. When a merchant comes with an item for delivery, the Deposit Unit (see Section 3.3) chooses at random a type of packaging that can contain the item. The Deposit Unit fills empty spots in the package with some futile objects as necessary to obtain some weight that belongs to list *W*. We call that process *Weight-based Packing*.

Formal description of a mix-message: A mix-message c is a ciphertext formed from t cleartext messages $m_1, m_2,\ldots, m_t$ to be addressed to t Delivery Agents $R_1, R_2,\ldots, R_t \in \{A_1, A_2,\ldots, A_n\}$ selected by the Receiver. Message m_i is addressed to Delivery Agent R_i. In particular, R_t is the Target Delivery Agent from which the Receiver will finally pick up the item being delivered. These messages are enciphered as follows:

- After choosing an ADC, the Receiver picks in secret t Delivery Agents from that ADC. He obtains their respective public keys $P_1, P_2,\ldots, P_t$ from the ADC's public-key infrastructure.
- The Receiver enciphers the Target Delivery Agent's message m_t with public key P_t: $c_t = E_{P_t}(m_t, \mathit{Stop} = d)$, where Stop means that the Target Delivery Agent R_t is reached, d is a code that will be used to recover the item, and m_t could give R_t additional instructions.
- For $i = t–1$ downto 1, the Receiver computes: $c_i = E_{P_i}(m_i, c_{i+1})$, where m_i gives optional instructions to R_i about the package. The final mix-message is $c = c_1$.

The opening procedure of a mix-message proceeds in the reverse order:

- For $i = 1$ to t, Delivery Agent R_i computes: $D_{K_i}(c_i) = D_{K_i}(E_{P_i}(m_i, c_{i+1})) = (m_i, c_{i+1})$ and thus gets cleartext m_i and ciphertext c_{i+1}. Cleartext m_i indicates some actions (such as relabelling) to be performed by R_i while c_{i+1} is the leftover mix-message that R_i sticks on the item for the benefit of R_{i+1} when $i < t$. Note that R_i performs this task without any need to know who R_{i+1} is. At the end, the Target Delivery Agent R_t gets message $(m_t, \mathit{Stop} = d)$, keeps the item, remembers d, and waits for the retrieval process.

Delivery Agents $R_1, R_2,\ldots, R_t$ are chosen by the Receiver from the set of all Delivery Agents $\{A_1, A_2,\ldots, A_n\}$ in the ADC, with $t \le n$. Between R_i and R_{i+1}, there can be some other agents $A_{i_1}, A_{i_2},\ldots, A_{i_s}$ such that A_{i_1} receives the item from R_i, A_{i_2} receives it from $A_{i_1},\ldots$, and R_{i+1} receives it from A_{i_s}. But nothing in the mix-message says explicitly who is the next agent for which it is destined. Therefore, all intervening agents $A_{i_1}, A_{i_2},\ldots, A_{i_s}$ use their secret key to attempt deciphering the mix-message. After finding the first part to be gibberish, they let the item go undisturbed to the next Delivery Agent. Notice this essential difference between our mix-messages and the Mix-net anonymous mail delivery system of Chaum [1981] in which each email relay gets to learn the identity of the next relay.

3.2 Anonymous Delivery Centre Overview

Secure Anonymous Delivery is a mechanism to facilitate the anonymous delivery of *physical* items by way of several trusted third parties, called Delivery Agents (see Section 3.1).

After having paid Alice for an item p, Sir Bob chooses an ADC as well as a set of t Delivery Agents from the ADC, he decides on optional instructions m_i for each Agent R_i, and he computes the corresponding mix-message c, as explained in Section 3.1. Then, Sir Bob tells Alice his choice of ADC and he gives her c. Alice (or her Delivery Agent) brings the item at the Deposit Unit U of the ADC (see Figure 2) and gives it Sir Bob's mix-message c. The main role of U is to apply the Weight-based Packing process (see Section 3.1) and issue a receipt to Alice (or her Delivery Agent) as a proof of deposit.

The Mix-delivery System then takes control of the item. Recall that each Delivery Agent of a mix-delivery is associated with a delivery point. Let the set of all Delivery Agents in the ADC be $S = \{A_1, A_2,\ldots, A_n\}$. We assume that each Delivery Agent A_i takes exactly the same amount of time to act on any given item. Without loss of generality, we consider that H rotates through the delivery points according to their ordering in S. So A_1 is first to receive the item from Deposit Unit U. Now, A_1 tries to decipher Sir Bob's mix-message using his secret key. If it succeeds, it applies the action required by the message, if any, and it relabels the item with the leftover mix-message, as explained in Section 3.1. If deciphering of the mix-message fails (because A_1 was *not* the first Delivery Agent selected by Sir Bob), then A_1 simply puts the item back on H, undisturbed. The process continues, one Delivery Agent after another, until the item reaches Sir Bob's chosen Target Delivery Agent R_t, which also applies any action prescribed by Sir Bob in the corresponding message m_t. At this point, the item is kept at R_t's delivery point and replaced on H by a fake item indistinguishable from the real one, so that no one else can notice that this package has reached its Target Agent. Fake packages can be identified after a while because their labels have not been modified during an

entire turn, but this does not compromise the identity of the Target Agent. They are removed at regular interval by a garbage collector.

To retrieve item p, Sir Bob knows his chosen Target Delivery Agent A_t and the code he had inserted in $Stop = d$. In fact, $d = f(x)$ for a public one-way function f and a secret input x known only of Sir Bob. In order to convince A_t that p belongs to him, he must prove his knowledge of x. Depending on the level of trust he has in A_t, he may wish to use a zero-knowledge protocol for this last step, before collecting the item. Instead of picking p by himself, he could use some new delivery agent A' to transfer p to another Anonymous Delivery Centre where the whole process (from a new U to a new A_t) would take place all over again. For this, he must help A' convince A_t about his knowledge of x.

3.3 Architecture of Anonymous Delivery Centres
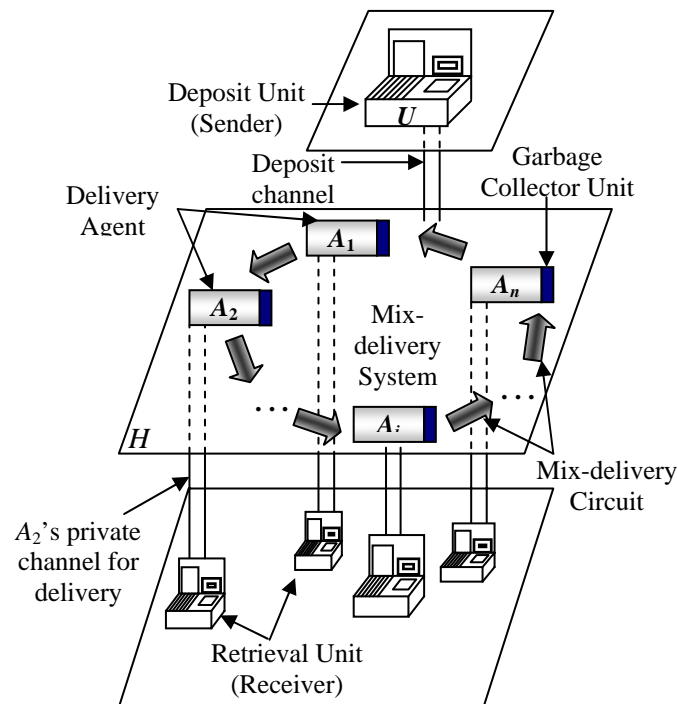
Figure 2. Anonymous Delivery Centre

The architecture of an Anonymous Delivery Centre (ADC) is given in Figure 2. An ADC consists of three components: the Deposit Unit, the Mix-delivery System and the Retrieval Unit.

The Deposit Unit is used by the Merchant or her representative to introduce the item into the ADC. There is only one Deposit Unit for any given ADC. The Mix-delivery System is defined in Section 3.1. The retrieval Unit is used by the Customer to pick up the item. In an ADC, Retrieval Units are physically separated and each Delivery Agent has its own. For increased security, Retrieval Units can (and should) be manufactured by different companies.

3.4 Formal Description of Anonymous Delivery Centres

Each ADC component (Deposit Unit, Mix-delivery System or Retrieval Unit) operates using an algorithm. We give the pseudo-code of these algorithms below.

DepositAlgorithm(c)
1.   Ask the merchant to enter the mix-message c.
2.   Open the Deposit Unit door and initialize the *timeout*.

3. Ask the merchant to put the item inside the door.
4. Close the Deposit Unit door when item is deposited or if timeout expires.
    (a) If an item has been deposited, Weight-based package it and label it with the mix-message. Transfer the labelled item to the mix-delivery system. Issue a receipt for the merchant.
    (b) If timeout has expired, cancel the operation and ask the merchant to try again later.

MixAlgorithm(*c*)
1. The item *p*, labelled *c*, goes from one Delivery Agent to another. As long as *p* circulates in the Mix-delivery System, each Delivery Agent *A* picks it up and tries to decipher its label *c* using secret key *K*. If unsuccessful, item *p* proceeds to the next Agent. If successful, $D_K(c) = (m, c')$. Agent *A* performs task *m* if any.
    (a) if *c'* is of the form *Stop* = *d*, the Target Agent R_t has been reached; it keeps the item, remembers *d*, and forwards an indistinguishable fake item to the next agent;
    (b) otherwise Agent *A* relabels item *p* with label *c'* and lets it proceed to the next agent.
2. Target Agent R_t waits for the retrieval connection from the customer—Execution of *RetrievalAlgorithm*(*d*).

RetrievalAlgorithm(*d*)
1. The customer (or his Agent) enters the Retrieval Unit of his previously chosen Target Delivery Agent R_t.
2. R_t asks the customer to prove knowledge of *x* such that $f(x) = d$.
    (a) If the verification is unsuccessful, cancel the operation and ask the customer to try again later.
    (b) If the verification is successful, then R_t transfers the item to the Retrieval Unit, opens the Retrieval Unit door and initializes a *timeout*.
    (c) R_t asks the user to pick up the item.
    (d) R_t closes the Retrieval Unit door once the item has been picked up or if timeout expires.
    (e) If timeout has expired, cancel the operation and ask the customer to try again later.

3.5 Example to illustrate Anonymous Delivery

Coming back to our Showbiz example, Sir Bob chooses an ADC for the delivery of his engagement ring. Let us say the ADC is composed of five Delivery Agents A_1, A_2, A_3, A_4, A_5. Sir Bob selects three of these Agents, say $R_1 = A_2$, $R_2 = A_3$ and $R_3 = A_4$. He accesses their public keys P_2, P_3, P_4, respectively, and uses them to create the mix-message: $c = E_{P_2}(m_1, E_{P_3}(m_2, E_{P_4}(m_3, Stop = d)))$ from the cleartext $m = (m_1, m_2, m_3)$, where m_1 = "Please, forward the item", m_2 = "Please, keep the item for one day", m_3 = "Please cover the item in a brown bag", and $d = f(x)$ for some *x* that he has secretly selected.

Next, Sir Bob tells Alice which ADC he has decided to use, and gives her the mix-message *c*. Alice packages the ring. She uses *DepositAlgorithm*(*c*) to introduce the ring into the ADC, through the Deposit Unit.

The ring is Weight-based package by the Deposit Unit, which forwards it to A_1's delivery point. Delivery Agent A_1 does not alter the package since Sir Bob did not select it in the mix-message. More precisely, A_1 tries to decipher *c*, finds gibberish, and forwards the item to A_2.

The next Delivery Agent, A_2, computes: $D_{K_2}(c) = D_{K_2}(E_{P_2}(m_1, E_{P_3}(m_2, E_{P_4}(m_3, Stop = d))))$ and gets message m_1 and ciphertext $c_1 = E_{P_3}(m_2, E_{P_4}(m_3, Stop = d))$. Since m_1 is meaningful, A_2 relabels the packaged ring with new mix-message c_1 and forwards it to the next Agent (as requested in m_1) by putting it back on *H*.

Then, A_3 deciphers c_1, gets m_2 and c_2, and keeps the ring for one day before reinserting it on *H*. To hide this fact, A_3 inserts a fake item now.

On the next day, A_4 receives the ring, deciphers c_2, and discovers it had been selected to be the Target Agent. Agent A_4 puts the ring in a brown bag (not knowing it is a ring, of course, since the original packing from the Delivery Unit is still strong). Later, Sir Bob walks in the Delivery Unit of A_4 and picks up the ring using *RetrievalAlgorithm*(*d*), thanks to his knowledge of *x*. Sir Bob could also ask a new Delivery Agent, *A'*, to pick up the ring and transfer it to another ADC, where the whole process would take place all over again. In this case, Sir Bob discloses *x* to *A'*.

3.6 Managing Post-delivery

Sometimes, it is desirable that the customer could be reached after the delivery. For example if there is a product recall stating that the item the customer had received for delivery is found to be defective or even dangerous, then the ADC should have a way to reach the customer. One solution to this problem consists in using untraceable return e-mail addresses, as proposed by Chaum [1981]. The customer could also blindly query the merchant's maintenance database on a regular basis, using our blind maintenance protocol [Aïmeur *et al.*, 2004]. Moreover, if the customer is not satisfied with the item he received anonymously, he must be able to send it back to the merchant by use of possibly another Anonymous Delivery System, which must now be able to hide the identity of the Sender.

4. DISCUSSION AND CONCLUSION

We start with discussion about the ADC. First of all, in Chaum's original technique of mix-nets, the content of a given e-mail is both unknown and unalterable by the intermediaries. This translates in a potential weakness when applying this technique directly to the physical world in which packages can be opened, examined and sealed again. Thus, the merchant could collude with the Target Delivery Agent and get for instance a picture of the customer or his representative. This attack threatens the customer's privacy. Nevertheless, this would happen with small probability because the use of a mix-delivery message does not reveal the Target Delivery Agent to the merchant. In fact, no Delivery Agent could even predict ahead of time that it has been chosen as Target!

For a more subtle threat, the merchant could collude with one or more Delivery Agents that open some packages as they circulate in the mix-delivery system. To overcome this threat, we need to study the technological feasibility of tamper-proof packages that cannot be opened without detection, but the issue is complicated by the fact that none of the packaging is under the control of the customer! Therefore, each Agent would have to check that the previous agents have not tampered with the package. Details on this issue are beyond the scope of this paper, and we leave them for further research. We also leave for further research the procedure for detecting if a Delivery Agent keeps the package for itself. One solution to this problem could be the introduction of a trust environment in which customers express their trust, through global votes, in Delivery Agents of the ADC.

Another problem is the use of tracking devices such as Radio Frequency IDentification (RFID) tags [URL4]. The RFID technology could help track items and spy on people at a distance. According to our solution, one may imagine that each Delivery Agent in the ADC has some means to perform tag-killing. In this case, our solution is considered as being technology-based in the sense that the association tag/tag-killing is comparable to that of virus/anti-virus, spam/anti-spam, cryptography/cryptanalysis, etc.

Last but not least, the delivery process in some cases can be time consuming. However, this can be considered as a price to pay for privacy, as it is already the case for several other schemes (privacy-preserving data mining, oblivious transfer, etc.) that protect all or part of the customer's sensitive data.

In this paper, we have introduced the notion of an Anonymous Delivery Centre (ADC) for physical items. An ADC consists of three main components: a Deposit Unit to put items into the ADC, a Mix-delivery System to anonymize the items and a Retrieval Unit to pick up items from the ADC. We have left for future work the implementation of the first prototype of an ADC as well as a way to make sure that some Delivery Agents did not open the packages during the delivery process and that tracking devices cannot be used without detection.

We are aware that not everybody will embrace our wish for privacy. Some people may approve of the constitution of dossiers on their buying habits because that might increase the probability that they receive occasional relevant spams. As for us, we consider privacy to be a fundamental human right. Of course, the final choice belongs to each individual, up to possible legal constraints that vary from country to country.

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REFERENCES

Aiello, B., Ishai, Y. and Reingold, O., 2001. Priced Oblivious Transfer: How to Sell Digital Goods. *Advances in Cryptology: Proceedings of Eurocrypt 01*. Innsbruck, Austria, pp. 119–135.

Aïmeur, E., Brassard, G. and Mani Onana, F. S., 2004. Blind Sales in Electronic Commerce, *Proceedings of the 6th International Conference on Electronic Commerce (ICEC'04)*. Delft, The Netherlands, pp. 148–157.

Aïmeur, E., Brassard, G. and Mani Onana, F. S., 2005. Blind Negotiation in Electronic Commerce, *Proceedings of Montreal Conference on eTechnologies 2005*. Montréal, Canada, pp. 35–43.

Chaum, D., 1981. Untraceable Electronic Mail, Return Addresses and Digital Pseudonyms. *Communications of the ACM*, Vol. 24, No. 2, pp. 84–88.

Chaum, D., 1985. Security Without Identification: Transaction Systems to Make Big Brother Obsolete. *Communications of the ACM*, Vol. 28, No. 10, pp. 1030–1044.

Diffie, W. and Hellman, M. E., 1976. New Directions in Cryptography. *IEEE Transactions on Information Theory*, Vol. IT-22, No. 6, pp. 644–654.

Guttman, R. H., Moukas A. G. and Maes, P., 1998. Agent-Mediated Electronic Commerce: A Survey. *Knowledge Engineering Review Journal*, Vol. 13, No. 3, pp. 985–1003.

Merkle, R. C., 1978. Secure Communications over Insecure Channels. *Communications of the ACM*, Vol. 21, pp. 294–299.

[URL1] www.anonymizer.com, accessed 9 October 2005. Online Privacy and Security.

[URL2] www.continentalrelay.com, accessed 9 October 2005. Anonymous Mail Drop & Mail Forwarding Service.

[URL3] www.proxify.com, accessed 9 October 2005. Protect Your Online Privacy.

[URL4] en.wikipedia.org/wiki/RFID, accessed 9 October 2005. Radio Frequency Identification.

COLLABORATIVE CLICK FRAUD DETECTION AND PREVENTION SYSTEM (CCFDP) IMPROVES MONITORING OF SOFTWARE-BASED CLICK FRAUD

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ABSTRACT

Click fraud had been identified as biggest threat to Pay-Per-Click advertising business model. We analyzed different types of click fraud activities and proposed a new classification of click frauds into four categories. While traditional commercial approached detect only some specific types of a click fraud, we developed a new system to detect and prevent all four major click fraud categories. CCFDP system is based on the collaboration between server side log and client side log. Our approach assumes that: a) user detail activities inside a web page differentiate a normal user from human click fraud while b) server side log can reveal robotic software click fraud by analyzing the difference between those two logs. Proposed architecture of the CCFDP system and click fraud identification algorithms are present in the paper. Preliminary experimental results are also included.

KEYWORDS

Click Fraud, Detection, Prevention, Software Click

1. INTRODUCTION

Pay-per-click (PPC) is an online advertising payment model, used by search engine companies, in which payment is based solely on qualified click-troughs. This pay-per-click model is now the fastest-growing form of internet advertising, according to the Interactive Advertising Bureau. However, the cost for pay-per-click becomes very high, varying by keywords and list position. Some businesses pay Google or Yahoo's Overture $90 per a click to appear as the No. 1 or 2 ads, while at the same time companies report that their fraudulent traffic is higher than 50% and the losses are in the range of $5,000 to $300,000 (Lycos, Inc.).

Click Fraud is a scam involving setting up a website affiliated with a major search engine, displaying pay-per-click advertising from the search engine and then using various methods to fraudulently increase the number of clicks to the advertiser from the affiliate website (Metwally, A. et al., 2005). The affiliate website receives a portion of the money generated by the click through even though the clicks were not generated by genuine customers. It was identified to be one of the biggest threats to the internet economy. Fig 1 shows two click fraud examples. Figure 1(a) is the human click fraud. People click on an advertiser's PPC links from client computer to navigate to advertiser's web site multiple times without view the contents of the site. Fig. 1(b) shows some software can click the advertiser's link instead.

The approach to click fraud analysis and detection has some similarity to web log user behavior pattern research. Many researches had been carried out for user's activity based on web logs (Banerjee 2001, Berendt 2000, Shahabi 1997, Gehrke 2001). However, the user activity pattern and page link analysis based on web

logs are not sufficient to find out all characteristics and all types of the click fraud. For example, if an attacker just repeats clicking a pay-per-click site without viewing any of the content, web logs will not be able to reveal such behaviors. Besides those web log approaches which are more research and experiments oriented, many companies provide some commercial solutions based on client side javascript or iframe (Click Defense Co., Click Risk, Clicklab, Direct Response Tech., Track ROI Co., Web Traffic Intelligence, WhosclickWho.com). Those commercial approaches discover only some specific, mostly simple type of a click fraud, and they can not detect some kind of advanced, usually software-based click fraud. All of fraudulent click will cost a lot for advertiser, however, can't be caught by existing commercial method alone.

a. A single client clicks PPC links multiple times without viewing the contents.

b. Click software clicks PPC links multiple times.
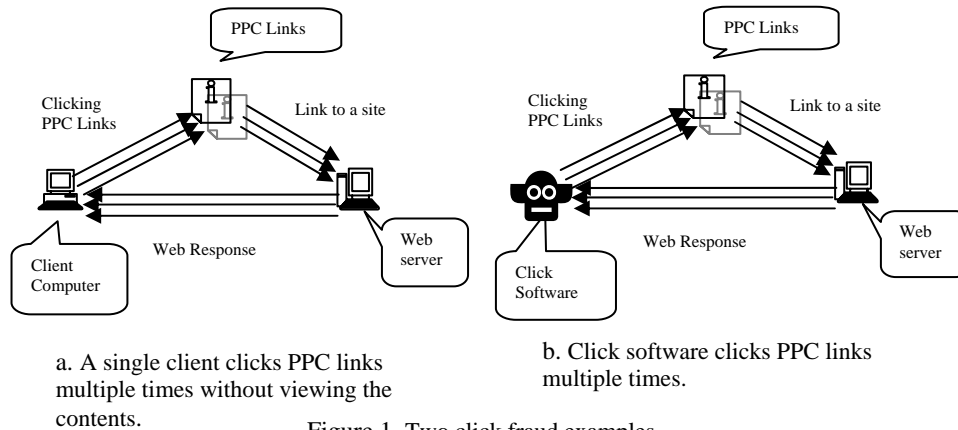
Figure 1. Two click fraud examples

In this paper, we describe a new method for click fraud detection and prevention called CCFDP. The method will utilize more data from different sources collaborating to help in better fraud discovery. To establish the architecture of the CCFDP system and to define basic algorithms for fraud detection, we introduce a new categorization of click frauds in section 2. Potentials of research and commercial solutions with all advantages and disadvantages are given in section 3, while the architecture of the proposed CCFDP system is explained in section 4. The click fraud identification algorithms and experimental results are presented in section 5.

2. CLICK FRAUD CATEGORIES

We categorize click fraud activities into four categories for the sake of detection. They are: (1) Affiliate or Competitor click fraud; (2) People in developing countries or university kids produce the click fraud; (3) Software click fraud; (4) Adware, Spyware, Browser Hijackers or background click fraud. The category 1 and 2 are human clicks while the category 3 and 4 are software clicks. The difference between category 1 and 2 is the fraudulent traffic IP for the category 1 may or may not be sourced from suspicious location, e.g. developing country, university etc., while the traffic IP of category 2 is always from suspicious locations. The difference between category 3 and 4 is that the category 3 click fraud is active, which means that the client user initiate the fraud, and the category 4 click fraud is passive, which means that the click fraud activities are not aware by client user. (Ge, L., Kantardzic, M., King D., 2005)

3. REVIEW OF THE CURRENT RESEARCH AND COMMERCIAL SOLUTIONS FOR THE CLICK FRAUD DETECTION

Several commercial solutions, e.g. Clicklab, LLC, Web Traffic Intelligence, Inc. etc. are available for click fraud detection. They all use similar technology by adding a sampler or collecting javascript or iframe code on web pages to track client information. Whenever the client views the web pages, the javascript or iframe executes on client browser and sends back information to the logging server. The most common client side parameters include client IP, client user agent, client browser settings, client computer settings, link-out click,

user mouse activities etc. Figure 2 shows the architecture of commercial click fraud solutions. These solutions include the following steps:

a)   A tracking javascript or iframe code was added on each tracked web page's bottom.

b)   A client computer requests a web page. (Figure 2 message #1)

c)   The web server responds to the web page with tracking code. (Figure 2 message #2)

d)   The tracking code executes on client computer and sends the detailed tracking information back to log server. (Figure 2 message #3)

The companies provide web reports about click fraud activities as well as paper reports to their subscriber. The reports normally include the statistics on traffic origin IP, traffic user agents, page view time, heuristic fraud score, etc. Some company such as Whosclickingwho.com can have a warning message popped up from their javascript tracking code in real time, if a web request from a single IP location is higher than a threshold number.

The information, those commercial solutions were collected, can be classified in to two levels:

First Level: Static client parameters such as IP origin, user agent, monitor display setting, web browser setting, java and javascript enabled, web page title etc. Click Defense, Clicklab etc. commit the first level log.

Second Level: Dynamic client parameters such as mouse clicks, mouse location, key stroll, scroll bar clicks, page view times, even client side clip board message etc. Web Traffic Intelligence Inc. does the second level log.

The difference between these two levels is in the content of the message 3 in Figure 2. If the tracking code just sends back to the logging server once, this is static client parameters collecting. While the tracking code keeps sending back user's activities, the logging server will have dynamic client parameters.
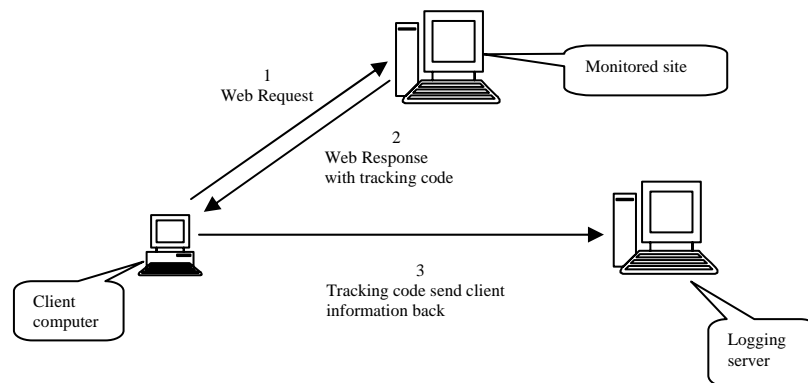
Figure 2. Typical commercial solution to click fraud

The commercial solutions, such as Whosclickingwho.com and Click Defense Corporate etc. have a significant draw back, that is, it can not detecting category 3 fraud. If traffic is generated by robotic software, the software may not execute the javascript or loading iframe tag. Then the detecting hosts will not collecting any of those traffic, thus, will not report any of this kind of fraudulent click.

There are some other problems exist on the commercial solutions. For example, the Whosclickingwho.com and Click Defense Corporate don't have real time use activity information, such as mouse movement, key strobe etc., which is very important to detect category 4 click frauds. Another significant problem of the existing commercial solutions is that they don't have a way to stop click fraud dynamically. Then those solutions are just click fraud reporting system not real click fraud detection and prevention system.

There are not many research activities on click fraud detection and prevention methodologies reported recently in the scientific references. Some of the articles explain techniques which could be applied directly to the click fraud detection process, and the other are more general approaches introducing methods for Web log data analysis, which could be applied in the click fraud systems with some accommodations. Metwally's group at UCSB (Metwally 2005) proposed a solution based on Bloom Filters to detect duplicates in data streams. The technique could be utilized in various web-based applications including click fraud detection. This paper also discussed the space and time requirements in both the contexts of sliding and landmark

stream windows. The authors ran a set of experiments with synthetic data, and demonstrate that the proposed approach yields extremely low error rate in duplicate click detection. Anupam et al. (Anupam V., et al., 1999) proposed a simulated click fraud by setting up two collaborate site. It is in the category 4 fraud, based on our classification, and the authors showed that it is difficult to detect these activities just from web log files. They conclude that if practiced widely, this attack could accelerate a move away from PPC programs, and toward programs in which referrers are paid only if the user makes a purchase (pay-per-sale).

4. COLLABORATIVE CLICK FRAUD DETECTION AND PREVENTION (CCFDP)

To detect the four categories of a click fraud, first we need to collect sufficient amount of appropriate data in real-time. Selected attributes of communication should be enough discriminatory not only to discover fraud activities, but also to specify the type of a click fraud. Second, we should have sensitive detection algorithms that will identify the click fraud in most cases in real-time. We developed the CCFDP system involving the collaboration between client side log and server side log. The architecture of the system is given in Figure 3. The main three parts in the CCFDP system are: 1) Global Fraudulent Database -GFD (Figure 4) which stores the server side log, client side log, and a fraud score report data; 2) Monitored web server site with filter program, such as ISAPI filter or CGI; 3) Client computer which could be normal user, click fraud user or software. The click fraud detection and prevention process in our system consists of the following 5 steps:
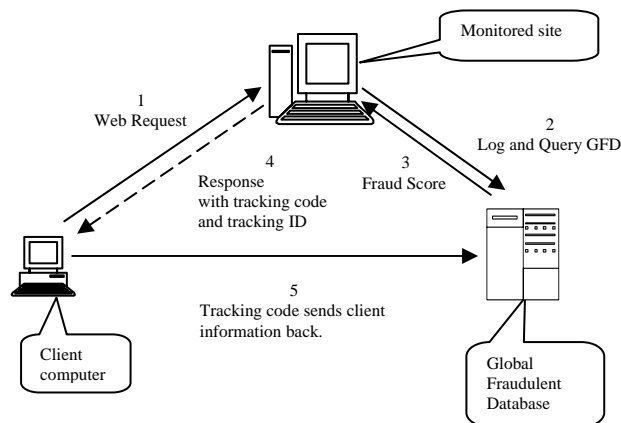
Figure 3. Typical **CCFDP** flowchart
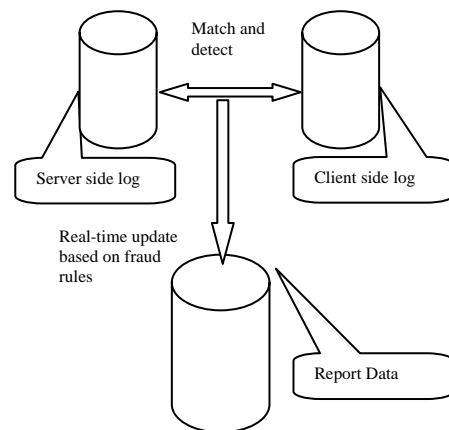
Figure 4. Global Fraudulent Database(GFD)

    a)   Client computer, which could be possible fraudulent computer, sends web request to a web site (Fig. 3 message #1);

    b)   The web site send server side data and query GFD (Figure 3 message #2). The log data includes a tracking ID, Client IP, Client User Agent, Visited Page, Referrer Source, Time Stamp and two Cookies, a Session Cookie and a Permanent Cookie;

    c)   GFD logs the sever side data and return Fraud Score (Figure 3 message #3);

    d)   Web server sends back response with tracking code to client computer under the following condition (Fig. 3 message #4): i.) If the returned fraud score is higher than a threshold designated by customer, web server will block the web request and send a warning page instead. ii.) If the fraud score is lower than the threshold, the server will send the page with javascript tracking code back to client computer.

    e)   The tracking code executes on client computer and keeps sending client side log back to GFD (Figure 3 message #5). The javascript tracking code will send GFD both static and dynamic parameters. The static parameters include tracking ID, Client IP, Client User Agent, Visited Page, Referrer Source, Cookies, Time Stamp, Display Settings, Brower Settings, Page Title, and the dynamic parameters include Mouse Over, Mouse Click, Scroll Bar Movement, Key Strobe and Clicked Link. (Ge, L., Kantardzic, M., King D., 2005)

5. ALGORITHMS TO DETECT CLICK FRAUD

Using the data collected by the architecture above, we develop the following detection algorithms to identify the four major category click fraud traffic.

- *Fraud Category 1: Affiliate or competitor click frauds*

  If the affiliates or competitors click advertisers' site many times in a short period of time, their IP will be highly repeated. At the same time, the referrer parameter will be highly repeated too if the clicks are linked from same source. For some case as AOL, using dynamically generated IP, the client side cookies will reveal the clicker's identity. We can set the cookies to residue in client computer for years and log the cookies every time they visit an advertiser's site. In case of the cookie functionality is disabled on client computer, which is about 2% of the entire browser (based on the hosting.com click fraud research database), their browser user agent (Browser Identity) combining IP address can uniquely identify them. Although some users will clean their cookie regularly, in a short period of time, e.g. during the visiting session, we can assume the cookie is consistence. Since we have a global fraudulent database, we have a global fraudulent score for each ip.

$$
\begin{aligned}
&input \quad (V_{ip}, V_R, V_U, V_C, V_T, V_A, V_{TrID}, V_o) \\
&S_V = 0 \\
&if \ V_{IP} \in F_{ip} \cup V_R \in F_r \quad then \\
&\quad S_V = S_{max} \\
&\quad return \ S_V \\
&end \ if \\
&if \ count \ (V_{IP}) > Count_{ip \ threshold} \quad in \ 24 \ hours \quad then \\
&\quad S_V = S_V + \Delta_{ip} \\
&end \ if \\
&if \ count \ (V_C) > Count_{cookie \ threshold} \quad in \ 24 \ hours \quad then \\
&\quad S_V = S_V + \Delta_c \\
&end \ if \\
&if \ count \ (V_R) > Count_{referrer \ threshold} \quad in \ 24 \ hours \quad then \\
&\quad S_V = S_V + \Delta_R \\
&end \ if \\
&return \ S_V
\end{aligned}
$$

ALGORITHM 1. Category 1 Fraud Score

Algorithm 1 will identify a request vector $(V_{IP}, V_R, V_U, V_C, V_T, V_A, V_{TrID}, V_O)$ as category 1 fraud if the fraud score $S_V > S_{\text{Threshold}}$. If S_{max} is the maximum fraudulent score, we always have $0 < S_V < S_{max}$.

In the algorithm 1, $Count_{ip \ threshold}$ is a heuristic ip count threshold constant number. Δ_{ip} is the fraud score increase if the count of an ip exceeds the threshold. For example, if $Count_{ip \ threshold} = 100$, and the count of the same ip during the past 24 hours greater than 100, the fraud score will increase Δ_{ip}. $Count_{cookie \ threshold}$ is a heuristic permanent cookie count threshold constant number. Δ_c is the fraud score increase if the count of a permanent cookie exceeds the threshold. $Count_{referrer \ threshold}$ is a heuristic referrer count threshold constant number. Δ_R is the fraud score increase if the count of referrer exceeds the threshold. All of accumulated count numbers are based on 24 hours period.

- *Fraud Category 2: People in developing countries or university kids produce the click frauds*

  Since the click is real people activity, the detecting technique used by category 1 can be used here. And furthermore, if the click's origin IP block is from those country or university, which is not normally advertisers' target customer, we will give the clicks high fraud score. The fraud score for algorithm add an additional criterion. If the request's IP is from high score area, the fraud score will add Δ_h.

- *Fraud Category 3: Software click frauds*

  The IP and cookie technique may not apply to this kind of fraud because program may use thousands of free proxy servers to access advertiser's website and the click agent programs, most of the time, won't accept cookies. However, the referrer parameter is still a good indicator to identify this type of fraud. There are two steps to reveal this kind of fraud. First, we developed a technique to collect user events such as mouse click count, key strobe and mouse hover over by using JavaScript, and page view time to every page

$$
\begin{aligned}
&input \quad (V_{ip}, V_R, V_U, V_C, V_T, V_A, V_{TrID}, V_o) \\
&S_V = 0 \\
&if \ V_{IP} \in F_{ip} \cup V_R \in F_r \quad then \\
&\quad S_V = S_{max} \\
&\quad return \ S_V \\
&end \ if \\
&if \ V_{IP} \in high \ score \ area \ then \\
&\quad S_V = S_V + \Delta_h \\
&end \ if \\
&if \ count \ (V_{IP}) > Count_{ip \ threshold} \quad in \ 24 \ hours \quad then \\
&\quad S_V = S_V + \Delta_{ip} \\
&end \ if \\
&if \ count \ (V_C) > Count_{cookie \ threshold} \quad in \ 24 \ hours \quad then \\
&\quad S_V = S_V + \Delta_c \\
&end \ if \\
&if \ count \ (V_R) > Count_{referrer \ threshold} \quad in \ 24 \ hours \quad then \\
&\quad S_V = S_V + \Delta_R \\
&end \ if \\
&return \ S_V
\end{aligned}
$$

ALGORITHM 2. Category 2 Fraud Score

loaded. If there are no user events and the page is resided on client computer in very short period of time, this traffic is fraud. Second, we developed a new way to detect this kind of fraud by comparing two set of logs, server side log and client side log. Not matter how sophisticate the click software is; the server side log will definitely record all of the traffic activity. If there is an entry in server side log without its matches in client side log, this request is fraud because the javascript code does not execute on the client side browser. When we analyze the difference between those two logs, we can find the category 3 click fraud.

The algorithm 3 will identify a visitor request vector $(V_{IP}, V_R, V_U, V_C, V_T, V_A, V_{TrID}, V_O)$ as category 3 fraud if the fraud score $S_V > S_{\text{Threshold}}$. If the return value $S_V > S_{\text{Threshold}}$, the request is category 3 fraud. If the tracking ID V_{TrID} in the request does not exist in client side

```
input    (V_ip, V_R, V_U, V_C, V_T, V_A, V_TrID, V_o)
S_V = 0
if V_IP ∈ F_ip ∪ V_R ∈ F_r    then
    S_V = S_max
    return S_V
end if
if V_TrID ∉ tracking ID set in client side Logs then
    S_V = S_max
    return S_V
end if
if count (V_R) > Count_referrer_threshold   in 24 hours
    S_V = S_V + Δ_R
end if
if count (V_A no mouse activity) > Count_mouse_threshold
    S_V = S_V + Δ_m
end if
return S_V

ALGORITHM    3. Category  3 Fraud  Score
```

logs, the request is fraud category 3. And $Count_{mouse\ threshold}$ is a heuristic mouse activity threshold constant number. Δ_m is the fraud score increase if the count of referrer exceeds the threshold. The mouse activity here refers to all of the mouse movement, mouse click, or key strobe, e. g. if there is a moveover event in client side log, then this will count as "has mouse activity" no matter if we find mouse click or key strobe or not.

- *Fraud Category 4: Adware, Spyware, Browser Hijackers or background click frauds*

This kind of fraud can be hard to detect just by analyzing server side web log because traffic is loaded to different client's computer, that means the IP will be different, and the page load activity is the same as regular traffic. However there is a significant indication of such click fraud, that is, there is no and/or rare human interactive during the page's viewing period and the page residue time is short. The client side JavaScript user activity log we developed can find this fraud accurately.

If the return value $S_V > S_{\text{Threshold}}$, the request is category 4 fraud. This category fraud can be detected by user mouse, keyboard activity and page view time. $Count_{time\ threshold}$ is a heuristic page view time threshold constant number. Δ_t is the fraud score increase if the count of referrer exceeds the threshold. $Count_{mouse\ threshold}$ is a heuristic mouse activity threshold constant number. Δ_m is the fraud score increase if the count of referrer exceeds the threshold.

```
input    (V_ip, V_R, V_U, V_C, V_T, V_A, V_TrID, V_o)
S_V = 0
if V_IP ∈ F_ip ∪ V_R ∈ F_r    then
    S_V = S_max
    return S_V
end if
if count (V_T < Time Window) > Count_time_threshold
      in 24 hours  then
    S_V = S_V + Δ_t
end if
if count (V_A no mouse activity) > Count_mouse_threshold
      in 24 hours  then
    S_V = S_V + Δ_m
end if
return S_V

ALGORITHM    4. Category  4 Fraud  Score
```

6. EXPERIMENTS

We include a large user database in GFD. Using these user data, we will be able to 1) improve the algorithms; 2) discover the rule of new type of activity; 3) tune the parameters in the algorithms. The CCFDP user data have two sources, server side and client side. We matched the server side log to client side data by using Tracking ID to find out the software click in four commercial sites, hosting.com, productresearch.info, internetfrog.com, and hellometro.com. We matched the server side log and client side log and identify the result in Table 1. Because the **CCFDP** use both server side log and client side log, it can detect software click traffic, which can't be detected by javascript solutions alone. At some sites, more than 50% of the server hit

comes from software clicks. Our software click result shows that category 2 click fraud is a significant portion of the total traffic.

Table 1. The software click ratio for different sites on April 20, 2005

Site	Server Hit	Software Click	Software Click Ratio
Hosting.com	5546	3274	59%
Internetfrog.com	12362	1249	10%
Productresearch.info	6987	4664	67%
Hellometro.com	3775	2369	63%

Table 2. Client side log statistics on April 20, 2005

Site	Browser Hit	Click link Count	Mouse Over Count	Mouse Click Count	Key Strobe Count	Scroll Bar Count
Hosting.com	2272	913	1857	988	162	987
Internetfrog.com	11113	9560	15339	9951	2253	3599
Productresearch.info	2323	990	1603	1001	28	266
Hellometro.com	1456	682	1053	709	20	367

Table 2 displays the statistics from client side log. User activity from client side is the key criteria in finding category 1, 4 click frauds. For example, if the majority web requests from an IP or referred by a source have no mouse and keyboard activities, we will have confident to say those web requests are fraudulent requests. The browser hit column in Table 2 is the total javascript log entry count. The "Click link Count" column in Table2 is the count if the client clicks a link in current web page and navigates to other page. The other columns in Table 2 are the mouse and keyboard activity counts.

Table 3. Fraud category percentage for the traffic on April 20, 2005 traffic.

Site	Susceptible Activity in Cat .1	Susceptible Activity in Cat .2	Susceptible Activity in Cat .3	Susceptible Activity in Cat .4
Hosting.com	2%	60%	2%	4%
Internetfrog.com	3%	12%	10%	13%
Productresearch.info	2%	68%	7%	0%
Hellometro.com	2%	64%	8%	1%

The number above is the susceptible activity belongs to the four click fraud categories on April 20, 2005. From the data above, fraud category 3 - software click is the most significant fraud type. Since the site Productresearch.info and Hellometro.com site block the most traffic from country other than US and Canada, the category 4 susceptible traffic is less than the other two sites.

Table 4. IP geographic distribution for server side traffic on April 20, 2005

Site	No. 1 Country (%)	No. 2 Country (%)	No. 3 Country (%)	Others(%)
Hosting.com	US (55%)	Hungary (5%)	United Kingdom (4.5%)	Others (35.5%)
Internetfrog.com	US (60%)	United Kingdom (9%)	Canada (5%)	Other (26%)
Productresearch.info	US (86%)	Canada (11%)	Germany (1%)	Others (2%)
Hellometro.com	US (85%)	Canada (10%)	Germany(0.5%)	Others (4.5%)

Table 5. Time distribution for server side traffic on April 20, 2005

Site	0AM - 6AM	6AM-12PM	12PM – 18PM	18PM – 0AM
Hosting.com	21%	26%	29%	24%
Internetfrog.com	14%	29%	28%	29%
Productresearch.info	26%	23%	24%	27%
Hellometro.com	26%	24%	24%	26%

Table 4 displays the geographical distribution of the traffic from the server side log. The traffic in this table includes both the fraudulent traffic and normal traffic. The web traffic's geographical origin is a good indicator to detect click fraud. For instance, the Hosting.com's 5% traffic from Hungary is software click. Since the Productresearch.info and Hellometro.com site block the majority traffics other than US and Canada, we have very little traffic from other source.

Table 5 displays the time distribution of the traffic from the server side log. The time distribute of traffic is another indicator of fraudulent click. In table 5, the traffic is almost evenly distributed during 24 hours period. However, if we find traffic spikes during a period, that traffic during will be susceptible.

7. CONCLUSION

In this paper, we present the architecture and characteristics of the Collaborative Click Fraud Detection and Prevention (CCFDP) system. The system identifies all four classes of click fraud by using both server side log and client side log. The server side log differentiates our approach from existing commercial solutions, and it allows detection of very frequent software click fraud. To improve the detection process, we add to the client side log extended parameters such as mouse movement, mouse click, key strobe etc. Our analysis is extended with these parameters, and it gives the possibility to detect all four major click fraud types.

Based on large database we collected in our preliminary experiments, we plan to apply some data mining techniques to extract new information about different types of click fraud. This information will help us to improve sensitivity of our detection and prevention algorithms.

REFERENCES

Anupam V., et al., 1999. On the Security of Pay-per-Click and Other Web Advertising Schemes, *Computer Networks*, Vol. 31, Issues 11--16, pp. 1091-1100.

Banerjee, A., et al. , 2001. Clickstream clustering using weighted longest common subsequences. *In Proceedings of the Wokshop on Web Mining, SIAM Conference on Data Mining, Chicago*, IL, USA, pp.33-40.

Berendt, B., et al., 2000. Analyzing navigation behavior in Web sites integrating multiple information systems, *VLDB Journal, Special Issue on Databases and the Web*, Vol. 9, No. 1, pp. 56–75.

Click Defense Corporate, http://www.ClickDefense.com.

Click Risk, http://www.ClickRisk.com.

Clicklab, LLC, http://www.ClickLab.com.

Direct Response Technologies, Inc., http://www.keywordmax.com

Ge, L. Kantardzic, M., King, D., 2005, CCFDP: Collaborative Click Fraud Detection and Prevention System, accepted for *18th International Conference on Computer Application in Industry and Engineering – CAINE 2005*, Honolulu, USA.

Gehrke, J., et al., 2001. On Computing Correlated Aggregates Over Continual Data Streams. *In Proceedings of the 20th ACM SIGMOD International Conference on Management of Data*, pp. 13–24.

Interactive Advertising Bureau, http://www.iab.net/standards/measurement.asp.

Koutsoupias, N., 2002. Exploring web access logs with correspondence analysis. *Methods and Applications of Artificial Intelligence*, *Second Hellenic Conference*.

Lycos, Inc., http://www.wired.com/news/culture/0,1284,66845,00.html?tw=wn_tophead_4

Metwally, A., et al., 2005, Duplicate detection in click streams. *WWW 2005*, pp. 12-21.

Shahabi, C., et al., 1997. Knowledge discovery from users web-page navigation, *In Proceeding of the IEEE RIDE97 Workshop*, Birmingham, England, pp. 20-29.

Tan, P. and Kumar, V., 2002. Mining association patterns in web usage data. *International Conference on Advances in Infrastructure for e-Business, e-Education, e-Science,and e-Medicine on the Internet*.

Tracking ROI Corporate, http://www.TrackingROI.com.

Web Traffic Intelligence, Inc., http://www.clickalyzer.com.

Whosclickingwho.com, http://www.whosclickingwho.com.

CAN DIGITAL CONTENT E-COMMERCE PROFIT FROM P2P NETWORKS?

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ABSTRACT

In the running days, P2P is mostly regarded as something which is bad and completely incompatible with "normal" digital content E-Commerce platforms. The traditional way to look at the problem consists in just looking at classic digital content stores and P2P distribution of content as two competitors – the increase in P2P digital content file-sharing results in a direct increase of traditional digital content stores and vice-versa. Although this might be true in some cases, there are other situations in which there is no direct connection between the two metrics. However, it is a fact that in general terms, unauthorized sharing of copyrighted content over P2P contributes to the anti-P2P feeling from the content copyright owners and distributors.

The major goal of this paper is to explain how P2P networks can be used to conduct online E-Commerce of digital content, without circumventing the original content copyright.

The really big question that should and can be placed is: can digital content E-Commerce profit from P2P networks? In the authors' opinion the answer is yes.

KEYWORDS

Digital Content, P2P, Copyright, B2C, C2C, DRM

1. INTRODUCTION

The first idea that the authors would like to express in this paper are the differences that exist between the analog and the digital world – they are intrinsically different from each other and they have a direct impact on the way content is exchanged and traded. Copyright, especially digital content copyright, is a hot topic today. Why? Because, by opposition to what happened to old analog content, it can be copied in such a way that the copied version retains exactly the same characteristics and quality of the original. In the analog world, when a copy of the content is made (at least by traditional means) there are always pieces of information which are lost and the quality of the copy degrades gradually. In the digital world, when a digital-formatted content is copied, a bit is always a bit – i.e. the copy is equal, bit by bit, to the original. This is really a problem because it allows copies as good as the original to be distributed almost in an unlimited way.

This brings to attention another key issue – distribution. In the analog world, even with a perfect way of making analog copies, distribution can never be extremely massive. A user can make analog copies of audio or VHS tapes to give to his friends; however he probably has not the time or the capacity to make 10.000 copies of the same content to distribute in a massive way. Of course, the user could make a single copy of his VHS tape to give to his friend, and his friend could make another copy from its own copy to give to a third friend. This scenario can be repeated to exhaustion and is more commonly known as super-distribution. However, this super-distribution model doesn't work so well on the analog world, because every time the user makes a new copy from a copied VHS tape, it looses quality. It will end up loosing so much quality that the users will no longer be able to access the content. But how does this work in the digital world?

In the digital world, the user can make as many copies as he likes without loosing any quality of the original content. If we consider for instance a DVD, nowadays there are in the market, at a fairly low price, Dual-Layer DVD drives that can make copies from an original DVD without loosing any quality. The user

can provide these copies to a friend who in turn can make a copy for himself and a copy to his own friends. Again this may repeat itself almost indefinitely as a super-distribution scenario. The problem lies in the fact that this specific super-distribution scenario works – the 100th copy of 25th friend is exactly equal (bit by bit) to the copy made by the 1st user from the original DVD. This can even be more serious if the original digital content can be compressed in such a way that its size is reduced whilst its quality is maintained.

Thus compression is the other issue in this analog versus digital world comparison. While in the analog world, content cannot be compressed in order to reduce its size, in the digital world there are technologies which are capable of reducing the digital content size while preserving its quality. Perhaps two of the most well known compression technologies that can be applied to digital content are: MPEG-1 Audio Layer III (MP3) for digital audio content and DivX for compression of video digital content (mostly applied for DVD compression). Simply put, DivX is an advanced digital media format that lets the users play, create and share digital video by turning large videos into DivX files. The DivX codec (short for compressor/decompressor) can compress video to a convenient size without losing any noticeable quality, as well as it can play those videos back on almost any device. For example, the DivX codec can compress an MPEG-2/DVD file to nearly one-tenth its original size or a home movie (DV) 25:1. Compression makes digital content distribution much simpler and faster in modern digital networks.

Table 1. Analog versus the Digital world

Characteristic	Analog	Digital
Copy	Unlimited copies are possible, but the quality degrades gradually	Unlimited copies are possible, with exactly the same quality of the original
Distribution	Distribution is possible but fairly limited. Super-distribution is possible up to a certain limit	Distribution is not only possible but unlimited. Super-distribution is a model that is possible
Compression	It is impossible to compress analog content	Compression is not only possible as it is a good way to reduce considerably the size of digital content without loosing any quality
Network	It is impossible to place analog content on a digital network	Digital networks are the medium of excellence for distributing and exchanging digital contents. The more bandwidth available the better
Architecture	This is not applicable	The distribution and network characteristics can even be enhanced by the type of architecture that is adapted to digital content distribution

This brings to attention another issue which is also important in the digital world while comparing to the analog world – digital open networks. These networks – the Internet, for instance – provide the necessary means to allow digital compressed content to be easily distributed in a very fast and simple way. The increasing network bandwidth growth, with the advent of broadband connections, is making sharing even easier, decreasing considerably the amount of time a user has to wait to access digital content over the network. In the case of the analog world, it is impossible to pick a copy of a tape with the user favorite song or movie and place it on the Internet, on a web page, for other users to download.

The final issue that will be brought to this discussion, and the central issue of this paper, refers to the content sharing network architecture. Of course this doesn't apply to the analog world, because it is impossible to share analog content over a digital network. In the digital world content can be placed on the digital network and pulled or pushed to any other networked users. The architecture that is adopted to enable content distribution and sharing directly affects the performance of digital content distribution – the question of using a centralized architecture versus a completely decentralized one. There are some evidences from

most of the experiences that are running on the Internet, that the decentralized distribution model outcomes the centralized one. The most visible face of this completely decentralized distribution architecture is Peer-to-Peer (P2P). The P2P computer network is a network that relies on the computing power and bandwidth of the participants in the network rather than concentrating it in a relatively few servers. P2P is used to connect nodes via largely ad-hoc connections. These decentralized networks are very well suited for sharing digital content files (audio, video, data) or even real time data, such as telephony traffic – Skype is one good example of this.

Therefore, for all of the previous referred reasons, P2P architecture is regarded by digital content authors and distributors as a big menace. When reading both IFPI [1, 2] and MPAA reports they both refer largely to P2P networks as the primary guilty of digital content piracy growths. Nevertheless, the most recent report of IFPI refers the fact that 2004 has marked the turning point for online digital music services, and that they have increased considerably their sales [2]. There are even some examples of how P2P has helped promoting content creators. For instance 'Ten Mile Tide', a six-piece band, used Kazaa as a tool to create a global audience for their music. To date, Kazaa users around the world have downloaded and shared over 10 million 'Ten Mile Tide' songs. The band has since launched a second album, quit their day jobs and is touring the USA.

But still the really big issue remains: is P2P incompatible with the digital content E-Commerce?

2. P2P IN DIGITAL CONTENT E-COMMERCE

In this part of the paper, the authors will make a small comparison between the centralized and decentralized digital content distribution models, and introduce a digital content E-Commerce system based on P2P networks.

2.1 Centralized versus Decentralized Distribution in Digital Content E-Commerce

In the world of digital content, audio content still has the lead over visual content. Actually there is already an impressive list of on-line music B2C E-Commerce sites. Three of the most well known are: Apple iTunes [7], Napster [8] and Real Networks Rhapsody [9]. Together, these sites represent most of the sales in the digital music E-Commerce business, with a total of more than 7 million music tracks downloaded per week in December 2004, in the United States [2]. The business model that is traditionally adopted by these E-Commerce digital music services is centralized. This means that all the digital music tracks are stored on a centralized server (or servers) and the users have to connect to it in order to obtain the content (Figure 1).
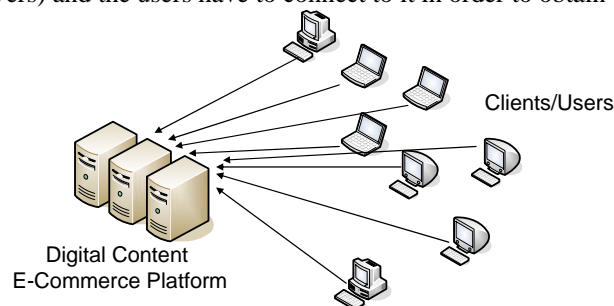
Figure 1. Digital Content centralized platform

Although new business models are emerging, this centralized E-Commerce model is used to sell music in typically two different models: "pay-per-track" and subscription. The former typically offers either music tracks at 0.99USD or entire albums at around 10USD, and the latter allows an unlimited access to the service's jukebox for a subscription fee. The way the services work and the prices practiced are generically the same for all the services, greatly lacking a more customized approach and market segmentation for these business models. It also lacks the possibility to address a more granular way for defining the digital content access conditions. All the services require the user to install a specific purpose player to be able to buy,

download and listen to the content: Microsoft Windows Media Player for Napster service, Apple iTunes for the iTunes service, and Real Rhapsody Player for the Real Rhapsody service. Each of these services presented use proprietary Digital Rights Management (DRM) technology to control the way users access and use content – more, they are completely non-interoperable between them, meaning that a protected iTunes music track will only play on the iTunes PC player or on an iPod, while a Napster protected music track will only play on Windows Media player or on a compatible device. It is not possible to use the same software or devices to access all the different content on the different stores. The downloaded music tracks can be played on a computer, on a specific purpose portable device and on media centers (in some cases) [15]. The DRM technology in place controls the way users are allowed to transfer their music tracks from device to device and limits the number of transfers and copies.

This centralized B2C model may be of interest for the case of digital music, in which the files are relatively small and faster to download, but for larger content files such as movies – which can take up to hundreds or even thousands of megabytes – it is not. The user will most likely not spend entire days or even weeks (depending on the available bandwidth) to download his favorite movie that he wanted to see that same night. This is the main reason why P2P can have an important role to play here. What is intended on this paper is to use a centralized E-Commerce Platform, but with the content distribution occurring over a P2P network (Figure 2).
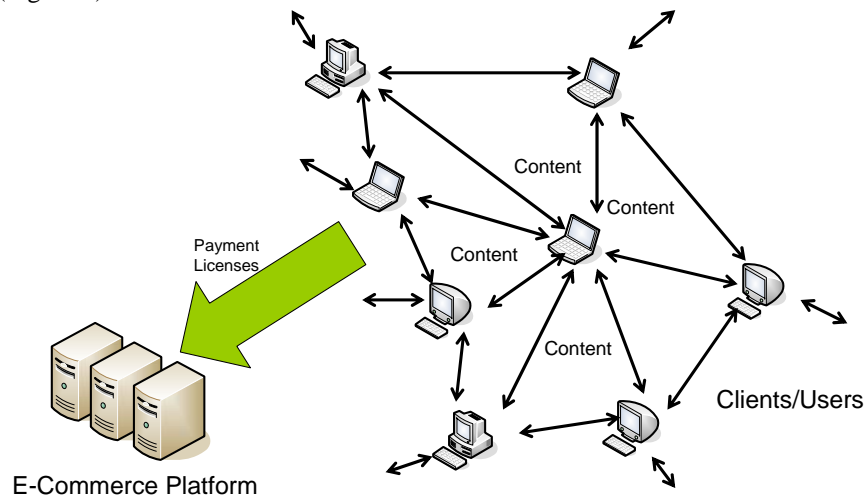
Figure 2. Digital content decentralized platform

What this new model represents, is the possibility to have a complete separation between the actual content distribution and the E-Commerce platform. The E-Commerce platform will be able to handle the content billing issues and the DRM issues apart from the content itself. The idea behind this is to have a simplified content distribution scenario that actually lets users share their own acquired and protected content on a P2P network. Every time a user fetches a DRM-protected digital content from a P2P network, or directly from a friend, it will need to contact the digital content E-Commerce platform in order to obtain the necessary credentials that will allow him to render the content [16].

In terms of E-Commerce this will continue to allow the traditional B2C model that is commonly applied to today's online digital music services, and will allow also C2C relationships between the different users. With this in place is possible to envisage scenarios where users can sell digital content among each others – similar to what we can find on the analog world with second hand books or disc recordings markets. The potential for new business models and revenue schemes is thus very vast.

This model even helps on the disintermediation of the distribution chain. Considering that there is a band that has the means to produce and protected digital music, using the DRM platform, and then they can automatically put and share their own content on the P2P network. They will have to establish and negotiate their own terms and conditions with the e-Commerce platform that will work as an intelligent broker between the band and the final user.

2.2 The P2PDoRM System

Current P2P systems have no true regulatory mechanism, with very weak or virtually non-existent methods for protecting and enforcing usage rights on the content they help distributing. This is precisely where the P2PDoRM system enters. In concept it is completely disruptive of the *status quo*. Its very essence lies in bringing together the better of two worlds: the potential of mass digital content distribution in reasonable short amounts of time combined with the protection of the Intellectual Property Rights and usage rights enforcement associated to that content (and defined by whoever created it or the legal owner) [15, 16, 17]. It is part of an on-going project that will implement the first P2P system that is truly DRM-enabled. This will be accomplished through the integration of a P2P system, one that is preferably based on open standards and on some kind of open source model, and an open source DRM platform called DoRM - Digital object Rights Management [17].

This DRM platform has been subject of continuous evolution and its being used in many European Union funded R&D projects [3, 4] and itself the result of several research activities that take place there. DoRM is a framework of several DRM components that interact with each other in a secure way and in a service-oriented perspective. One of its services consists of an E-Commerce DRM-enabled platform providing a generic enough E-Commerce gateway for the implementation of any business rules and models.
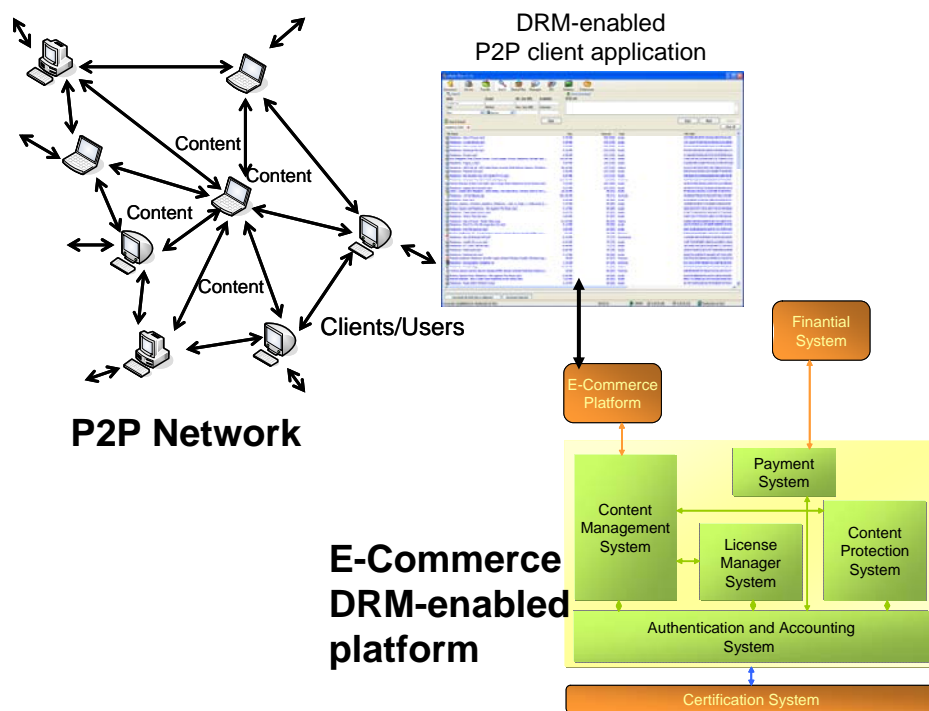
Figure 3. Architecture of the P2PDoRM system

The core components that comprise DoRM cover the wide range of the innards of a DRM system, as well as some external entities (Figure 3). Inside the framework there is a Content Protection System, implemented based on the MPEG-IPMP paradigm [5, 6], where the core system is completely independent of whatever tools are available for encoding/decoding the content, encrypting/decrypting the content, and so on. The Content Protection System can be seen as a black box that takes content in digital non-protected format and output it in a DRM-protected format, using whichever tools the content preparer devised (remember that the DoRM framework is completely independent of whatever tools are these). There is a Content Management System which is responsible for uniquely identifying content in the system, by means of assigning and maintaining a unique ID system and registering content on the platform. Again, being a platform based on open standards, the current implemented method for this unique ID system is a subset of MPEG-21 DII (Digital Item Identification) DOI (Digital Object Identifiers) [11, 12]. The License Manager System is the

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part of the platform that is responsible for defining and issuing licenses for content access, on request. When a user wants to access a particular content that is registered and protected by the DRM platform, the License Manager System is contacted and a license is produced for that specific combination of user/content, and with specific usage rights. Again, this sub-system is implemented with regards to open standards.
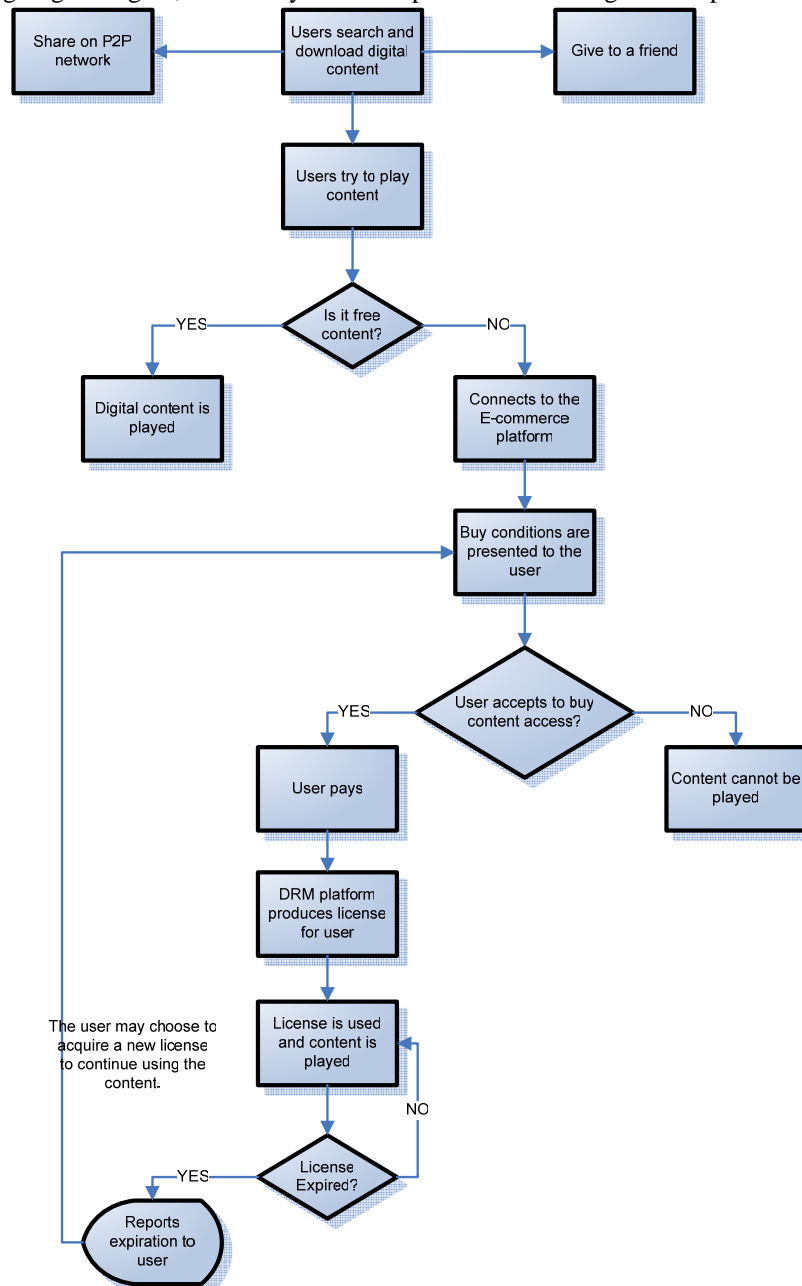
Figure 4. Flux of operations on the P2PDoRM platform

The rights licensing system is based on XML, using ODRL (Open Digital Rights Language) for rights expression [10, 19]. The Payment System is the financial gateway for processing payments. It is a proprietary gateway for interacting with external Financial Systems (typically banks and credit institutions) and provides the means for successful financial transactions occurring in the E-Commerce side of the system. The Authentication and Accounting System are transversal to the whole framework and are responsible for the

very tight authentication and security mechanisms that rule the platform. All communications throughout the framework are properly authenticated and secured in their context, rather than in form[1]. Regarding the external part of the system, there are two very important components. The Certification System is responsible for issuing certificates to the several DRM components. This system stands as an independent CA - Certification Authority, having the role of a top-level trust authority for the whole system. The E-Commerce platform is the actual commercial gateway to the DRM system, and provides the actual implementation of the business rules that are behind a specific business model. It will be responsible for negotiating licenses with users, conducting payment transactions, show lists of recommendations for similar content protected by the DRM platform, etc [18].

On the other side of the equation stands the P2P platform. This will be comprised of a P2P network and the corresponding client application. The network itself will provide the communication channel to a massive audience, a tool for accessing the content that was protected in the first place by the DRM system.

Since the actual process of distributing the content is completely independent of the actual content purchase and rules negotiation, content is roaming freely in the P2P network (Figure 4). This P2P network is of course fed (it does not matter when or with which frequency) by the content providers, the owners of the specific business using the platform [13, 14]. The users are free to conduct searches, download and spread whatever content they please. Free content (in this case the analogy is "free beer" instead of "free speech") is marked as such by the content providers, and protected content the likewise. However, due to the DRM protection of the system, when a specific content is accessed the interaction with the DRM system begins. Free content is played immediately at the user's request. Protected content triggers a set of actions that will ultimately dictate if the content is playable for that user or not. If a user does not own the licenses necessary to play this content, the E-Commerce system of the DRM platform is thus contacted. The user is taken through a series of screens (integrated or not with the actual P2P software that he is using) that enables him to purchase the actual rights to access that content. This rights-negotiation step is very specific to the business model that is implemented in this E-Commerce system. It could range from negotiating a simple license based on expiration by play count or expire date for one music, to a complete set of market segmented options, specifically tailored for one specific group of users. Again, the both the DRM system and certainly the P2P system are completely independent of these business rules [13, 14]. After the negotiating process a payment transaction occurs, which will trigger a license production order for that specific user/content pair. The player software is now made aware that a new license is available for rendering that content, and the content is thus played.

3. CONCLUSIONS

Currently P2P is regarded mostly as a menace rather than as an opportunity for digital content E-Commerce. The traditional digital content services, mostly composed by digital music services, are well established using a traditional B2C business model, in which the users have to go to a centralized E-Commerce platform to acquire and download the digital content. Non-interoperable Digital Rights Management (DRM) technologies are used to control and manage how the digital content can be used at the client side.

DRM plays a key-issue in this type of E-Commerce, working as the means to make harder the digital content circumvention and piracy. However, the authors would like to stress that their position in this paper is clearly in the sense of dissociating P2P has a mean to distribute efficiently content, from P2P as a mean to share pirated content. We uphold the usage of P2P networks to share both protected and unprotected content, but in the first case users will need to obtain appropriate credentials to access to it.

Therefore, a system called P2PDoRM was presented to enable the digital content E-Commerce over P2P networks. The system works in an integrated way with state-of-the-art DRM technology to protect and manage the rights over digital content. The DRM platform is composed by several elements that provide both the E-Commerce and billing platform, but at the same time assures the protection of content through robust protection methods and manages the content rights clearance to final users.

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[1] According to the Horton Principle what should be secured is what is being meant, rather than what is being said. In short, data should be secured along with the rules on how to reconstruct it on the other side of the transmission.

In the system it is possible to have the better of two worlds: the content protection and E-Commerce functionalities of the DRM platform, and the distribution facility provided by the P2P network, assuring a much more efficient method for digital content fruition.

As a final conclusion of this work, the authors are perfectly convicted that digital content E-Commerce is possible using P2P network, provided that the appropriated means to impede copyright circumvention are in place – P2PDoRM provides such means.

REFERENCES

[1] IFPI, "The recording industry commercial piracy report 2004", IFPI, http://www.ifpi.org, 2004

[2] IFPI, "IFPI:05 Digital Music Report", IFPI, http://www.ifpi.org, 2005

[3] OCCAMM web-site, http://sharon.cselt.it/projects/occamm/

[4] MOSES web-site, http://www.ist-moses.org/

[5] ISO/IEC 14496-13:2003, Information technology -- Coding of Audio-Visual Objects -- Part 13: IPMP Extensions

[6] Lacy J., Rump N., Shamoon T., Kudumakis P., 'MPEG-4 Intellectual Property Management & Protection (IPMP) Overview & Aplications', AES 17th International Conference on 'High Quality Audio Coding', Villa Castelletti, Signa, Italy, Sept. 2 - 5, 1999. J. Audio Eng. Soc., Vol. 47, No 5, p. 392, May 1999

[7] Prunela A., "Windows Media Technologies: Using Windows Media Rights Manager to Protect and Distribute Digital Media", MSDN Magazine, December (2001), http://msdn.microsoft.com/msdnmag/issues/01/12/DRM/default.aspx

[8] Lenzi R. et al, "Apple iTunes Music Store", technical report, The Interactive-Music Network, June 2003

[9] RealNetwork Rhapsody, http://www.real.com/rhapsody/

[10] "Open Digital Rights Language (ODRL) Version 1.1", W3C Note, September 2002, http://www.w3.org/TR/odrl/

[11] ISO/IEC 21000-3 Information technology -- Multimedia framework (MPEG-21) -- Part 3: Digital Item Identification

[12] Chiariglione F., Kudumakis P. on behalf of MOSES EC IST project, "Distribution of digital content", Digital Media Project GA2, Contribution No 56, Los Angeles, U.S.A., April 2004

[13] Rosenblatt, B., 'Integrating DRM with Peer-to-Peer networks: Enabling the future of online content business models', Whitepaper GiantSteps – Media Technologies Strategies, November 2003

[14] Einhorn, M., Rosenblatt, B., 'Peer-toPeer Networking and Digital Rights Management: How Market Tools can solve Copyright Problems', Policy Analysis No. 534, Cato Institute, February 2005

[15] Serrão C., Neves D., Kudumakis P., Barker T., Balestri M., "OpenSDRM – An Open and Secure Digital Rights Management solution ", IADIS 2003, Lisboa, Portugal, May 2003

[16] Serrão C., "Open Secure Infrastructure to control User Access to multimedia content", WEDELMUSIC2004, September 2004, Barcelona

[17] Siegert G., Serrão C., "An Open-Source Approach to Content Protection and Digital Rights Management in Media Distribution Systems", ICT Conference 2003, Copenhagen December 2003

[18] Serrão, C., Dias, M., Delgado, J., "Using Web-Services to Manage and Control Access to Multimedia Content", ISWS05 - The 2005 International Symposium on Web Services and Applications, Las Vegas, USA, 2005

[19] Serrão, C., Dias, M., Delgado, J., "Using ODRL to express rights for different content usage scenarios", ODRL2005 – 2nd International ODRL Workshop 2005, 7-8 July, 2005

IMPLICIT TRAINING OF VIRTUAL SHOPPING ASSISTANTS IN 3D ELECTRONIC INSTITUTIONS

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ABSTRACT

The growing demand for shopping assistants in E-Commerce was identified by many researchers. Some retailers try to address this need by introducing totally autonomous agents; others make extensive use of human resources, shifting operators from telephone lines to chat-based interactions with online customers. The recently developed 3D Electronic Institutions methodology provides facilities to conveniently combine these two approaches. Initially, an autonomous agent tries to deal with customer's requests. When the limitations of its intelligence are reached a human operator takes over and satisfies the "out-of-scope" inquiry. At the same time, the agent observes the human operator and learns how to handle similar inquires in the future. We argue that this learning aspect can be realized by means of 3D Electronic Institutions and believe that this "agent training" will be feasible and far more successful than it is possible in nowadays form-based E-Commerce solutions.

KEYWORDS

Sales Assistants, 3D Electronic Institutions, Learning.

1. INTRODUCTION

Millions of people around the world spend an average of 20 hours per week in Virtual Worlds based computer games. Usually those users have to pay a monthly fee of 10$ just for being able to participate (Hunter & Lastowka, 2003). Apparently, outside of pornography and eBay, 3D Virtual Worlds are one of the few online businesses that are making money on the Web. Norrath, the online world created by Sony, has more residents than Miami and higher per capita GNP than Bulgaria. In Virtual Worlds people are not only paying real money for the experience of being there, but also trade virtual goods. The most expensive virtual item (a virtual island) was sold for 26500 USD in the Project Entropia multi-user game (Hunter & Lastowka, 2003). If selling virtual items in Virtual Worlds is that profitable, why not selling real items there?

The use of 3D technology for selling real items was a hot topic in late nineties. Many people tried to enhance their sites with 3D models to offer customers better product presentation facilities. Unfortunately, the majority of the investments in 3D shopping didn't pay off. The major reason for the lack of success of 3D technology in E-Commerce is coupled with issues like costs and performance (Hurst, 2000). Nevertheless, recent developments prove that in the near future 3D applications may be faster and cheaper to create than quality photographs (Früh et al, 2005). The broad availability of fast Internet access also supports this trend.

Proving the usefulness of 3D visualization Daugherty et al. (2002) claim that a virtual experience (3D product presentation) has the potential to be richer than both direct (manipulation with a real product) and indirect (2D form-based product presentation) experience because it can be simulated, framed, annotated and contextualized. However, the conducted study showed that when tactile affordances are the most relevant for the product (e.g. touching the fabric), a virtual experience may have the same effect as indirect experience.

The possibility of scanning physical interaction behaviors of 3D objects proposed by Pai et al. (2001) draws even more optimistic picture. Researchers have managed to produce a fully automatic device for measuring the characteristics of different materials and attach this information to the 3D models of the scanned objects. These characteristics include deformation response, contact textures and contact sounds. Using this technology in combination with haptic devices that allow users to feel virtual objects (Whitton, 2003) may have a consequence that the feeling of touching the fabric becomes transmittable through the web.

In addition to product presentation 3D Virtual Worlds can provide several other benefits to E-Commerce environments. Social interactions play an important role in real world commerce and will definitely be important factors in the future of E-Commerce (Preece & Maloney-Krichmar, 2003). Satisfaction of impulsive decisions, similarity of the user interface with the real world, more ways to convey information, collaborative shopping possibility are just a few more examples (Bogdanovych et al, 2004) of potential benefits of the technology. Moreover, 3D E-Commerce environments built as 3D Electronic Institutions (Bogdanovych et al, 2005) provide facilities for implicit training to improve the believability of shopping assistants. Under "implicit training" we understand training of the autonomous agents by observing humans to help those agents to act like humans, without any explicit training efforts from the humans.

Many researchers, whose work is focused on virtual characters (and shopping assistants in particular), face the problem of making these characters believable. The believability has a lot of different characteristics, e.g. personality, social role awareness etc. New aspects of believability are constantly discovered and introduced to the research community (e.g. Prendinger & Ishizuka, 2001; Magnenat-Thalmann, 2005). The implementation complexity grows but passing the Turing test is still far from being possible.

In our work, instead of trying to discover and implement different characteristics of believability, we focus on the simulation theory. The main hypothesis of this theory can be best summarized by the cliché "to know a man is to walk a mile in his shoes". We strongly believe that simulation and imitation are the key technologies for achieving believability. To increase the believability of shopping assistants we propose that autonomous agents observe the behavior of human operators in E-Commerce environments and imitate it.

The better observation means the agents have the better can they imitate their principals. An efficient way to achieve full observation is to have a human fully immersed into an E-Commerce environment based on our 3D Electronic Institution technology. This technology provides context, background knowledge and similar embodiment for all participants, including humans and the autonomous agents who imitate the humans. This information valuably facilitates the training of the autonomous agents.

The remainder of the paper is structured as follows. Section 2 presents the state of the art for virtual shopping assistants in E-Commerce. Section 3 describes the 3D Electronic Institutions technology. In Section 4 we present the extension of the 3D Electronic Institutions technology to be used for implicit training. Concluding remarks and details of the future work are given in Section 5.

2. STATE OF THE ART

"Shopping assistant" is one of the most persuasive sales tools in traditional commerce. Shopping assistants offer help in a store, provide additional information on products and simplify decision making process helping to find a good that satisfies customer's requirements and various constrains. One of the major drawbacks that E-Commerce is facing today is the lack of such sales clerks. There is strong evidence that in brick and mortar stores customers find interaction with a sales person very beneficial. People value and are willing to pay for the reduction of perceived risk, the optimal configuration of the transaction for their specific usage context, and the enhancement of the in-use experience, which shopping assistants can provide them with. Therefore, shopping assistants are able to cause dramatic increase in sales. A study conducted by "Celio" showed that contact with a shopping assistant resulted in 18% more purchases (Chowdhury, 2004).

The demand for customer service and assistance in E-Commerce is going to be growing. Modahl (2000) suggests that we are now in the ten year transition in the way consumers shop and save. The majority of

internet purchases are still done by technology optimists, which are ready to deal with the lack of support for the sake of new and convenient technology, while mainstream customers are just starting to shop online. When the majority of mainstream shoppers arrive, either sites are going to have to offer more customer service and sales support on their sites, or they are going to see skyrocketing customer service costs.

If there is a problem to be clarified, online shoppers of today have to use expensive telephone service or accept long waiting times from e-mail communication. In case of the telephone service, either consumers who have to pay high per minute rates or the vendors that provide free customer service numbers have to deal with significant telephone service costs. Moreover, the majority of customers don't feel enthusiastic about switching from Web browsing to the telephone service. The situation with e-mail as the way of customer support is not much better. Many e-mail inquires take multiple correspondences to be satisfied, e-mail isn't real time while customers expect the answers back right away, quality assurance is difficult. According to Gutzman (2000) the only customer service option that seems to fit the speed of the Internet is real-time chat.

Commercial success of the chat technology was documented by Earthlink (2005). Tracking customer actions at Earthlink's site for ISP services showed that 70% of the customers were leaving without purchasing even when they saw broadband was available in their zip code for a "best offer" price. Following this observation the shopping team decided to integrate a chat feature into the website to provide confused customers with real-time online support, and conducted a case study for better understanding of the attitude of the shoppers towards chat service. The results showed that 15% of people who chatted with sales assistants converted and 80% of consumers gave the chat a good or excellent rating. Moreover, 61% of chat users preferred chat to other options of customer support.

One of the great advantages of chat from the site owners' point of view is that it is also much less expensive than the telephone service. A phone call costs in average around $6.00, but the average chat is $2.40 (Maguire, 2002). But even further cost reduction can potentially be achieved with the help of automated chat tools where customers' questions are answered by a computer program (autonomous agent) rather than a human being. These automations combine natural language processing algorithms with complex databases to give consumers answers to their queries and can even connect a customer with a human if the autonomous agent is unable to answer a question after several attempts (Prince, 2005). The drawback of this approach is that the intelligence of such autonomous agents is usually very poor. In order for them to be able to act believable and provide customers with reasonable feedback without switching to human-operators straight away enormous resources have to be used for explicit training. This training usually means that human operators have to type in huge list of possible customers' questions and for each of the questions provide an enormous variety of answers, which is very inefficient and resource demanding.

Surprisingly enough, none of the present solutions consider implicit training. The most important characteristic of implicit training is that human-operators train software agents by doing their routine job (answering customers' questions) in contrast to doing training as a routine job. We propose a scenario where initially only human operators answer customers' requests while corresponding autonomous agents observe their behavior and learn from them. Eventually, after testing and validation of the behaviors learned by the agents, they will start communicating with the customers without human help. In case a customer puts an inquiry that an agent is not trained to deal with, the agent requests help from an available human operator. The human replaces the software agent (with or without explicitly notifying the customer about this) and answers the non-standard inquiry. Unlike explicit training, the autonomous agent meanwhile observes the human operator and learns how to deal with similar enquires in the future (extends his intelligence). We believe that such human-computer cooperative approach offers the most feasible way to achieve reasonable efficiency in providing shoppers with trustful expertise.

The idea of training of autonomous agent by humans is not new, but is not as popular within the community as the other types of learning. One of the early examples of this approach is "programming by demonstration" (Bauer et al, 2000), where agents are trained by humans to recognize relevant text on a web page. Similar technique is also used in robotics, where humans (or other robots) are used to demonstrate some actions which a robot tries to imitate (Ekvall & Kragic 2005). In (Aleotti et al, 2003) robots acquire their behaviors from the provided demonstration of how to solve a certain task, given the necessary initial knowledge to the system. The trainee (robot) then automatically interprets what is to be done from the observed task, thus eliminating the need for tedious textual or iconic programming. Alissandrakis et al, 2001 proposed a successful approach for training robots by humans despite dissimilarities in the embodiments.

There are also some achievements in the area of training chatter bots using natural language (Rule, 2003). Transplantable Artificial Neurological Unit (TANU) chatter bots demonstrate the ability to participate in a

conversation with a human in a very reasonable way, after some training by a human is conducted. Authors claim that an average person only goes through about 70,000 important states in a 5 year span. So creating 70,000 states properly interconnected with transitions will make a very smart chatbot. The TANU network runs language aware transitions, so a transition that supports an event "Can you teach?" will be associated automatically with a transition from the source state when it receives "Can you educate?", "Can you tutor?", "Can you lecture?", "Can you instruct?" and "Can you edify?". Unfortunately, adding new states and transitions to the network doesn't happen automatically but have to be done manually by human operators.

As we see, the major drawback of all the aforementioned approaches is the explicit nature of training. Explicit training is a very resource demanding technique, which becomes too expensive with complex scenarios. For these scenarios implicit training is much more appropriate. We anticipate that implicit training is feasible only when the teacher is fully observable. In case of E-Commerce, it is possible when a human operator is present "in" the World Wide Web, rather than "on" the World Wide Web. We argue that to achieve this humans and autonomous agents have to be embodied as avatars in 3D Electronic Institutions.

3. 3D ELECTRONIC INSTITUTIONS

3D Electronic Institutions is a concept that appeared from the combination of the Electronic Institutions and 3D Virtual Worlds technologies. This combination resulted in a working methodology, supported by a number of tools, for designing highly secure and reliable immersive 3D E-Commerce solutions. Applying 3D Electronic Institutions methodology requires 3 important steps to be accomplished:

- Specification of an Electronic Institution using ISLANDER (Esteva et al, 2002).
- Annotation of the Electronic Institution specification with components of the 3D Virtual World.
- Automatic generation of the corresponding 3D environment.

The specification phase introduces a dramatic difference to the development of 3D shopping environments compared to the majority of present agent-based solutions. Instead of focusing on the implementation details of each particular agent (agent-oriented approach), a system-oriented view is taken. We assume that participating agents may be heterogeneous and self-interested, and we cannot rely on their correct behavior. Therefore, the institution is designed as a set of limitations which every participant have to comply with. This assumption permits that agents behave autonomously and make their decisions freely up to the limits imposed by the institution. The limitations include a common ontology, a set of permitted activities (scenes) that the agents can be involved in, participants' role flow within the institution (connections between scenes), synchronization points (transitions), institutional norms (obligations) and the dialogues that govern the enactment of different scenes. The specification is produced with ISLANDER tool, a UML-like editor that also performs several verifications (integrity, protocol correctness, and norm correctness).

While the specification strictly defines the limitations, it also helps to understand what participants need in order to operate in the institution. Some elements of the specification have conceptual similarities with building blocks in 3D Virtual Worlds, which makes it possible to automatically generate a 3D representation of the specification. The scenes and transitions, for example, are transformed into 3D rooms, connections correspond to doors, and the number of participants allowed in a scene determines the size of a room (see Bogdanovych et al, 2005 for details).

The created 3D Electronic Institution is ready to be executed. The generated 3D Virtual World can be visualized and the 3D Electronic Institutions infrastructure will take care of the validity of interactions between participants, verify the permissions of participants to access different scenes and will make sure that all the institutional norms and obligations are imposed. To make sure that the institution is fully protected from deviant behavior a special type of agent (governor) is used as a mediator between the institution and a participant. The only way for a participant to talk and act in the institution is through a governor.

Conceptually, 3D Electronic Institutions have two different levels of execution: *institutional level* and *social level*. The institutional level makes sure that the institutional rules are not violated. On this level all a participant can do is to send a text message to the corresponding governor for verification, requesting to perform an action in the institution. If under the current circumstances the action is allowed to be performed without violating the rules, the agent receives back a response and the action is performed (visualized). The way these actions are visualized can not be changed, as well as their execution can not be terminated. For human participants sending of text messages is transparent as it happens as a result of the actions in the

Virtual World (e.g. when an avatar representing a human collides with the exit door of the room, the corresponding "exitScene()" message will be automatically generated and sent to the governor).

Actions that are not controlled by the institution are performed at the social level. These actions are executed directly by the participant without prior verification by the governor. For example, there is no need for the institution to specify how the participants should walk from one room to another.

Figure 1 presents an example of a simple institution and shows the actions performed on both social and institutional level. The institutional level actions include: (enterScene, exitScene, enterTransition, exitTransition and login). On the social level these are: moving, clicking, colliding, rotating etc. The black arrows on the picture show the trajectory of the participant's movement through registrationRoom, meetingRoom to TradeRoom. The black figure represents the participant, other figures correspond to internal agents (employees of the institution) Receptionist and Auctioneer. The Receptionist welcomes the participant in the RegistrationRoom, verifies the login and password and unlocks the doors to other scenes if the identity of the participant is proven. The Auctioneer sales different goods in the TradeRoom. It announces the current product to be auctioned, waits for incoming bids and sells it to the winner of the auction. The MeetingRoom is used for social interaction between buyers.
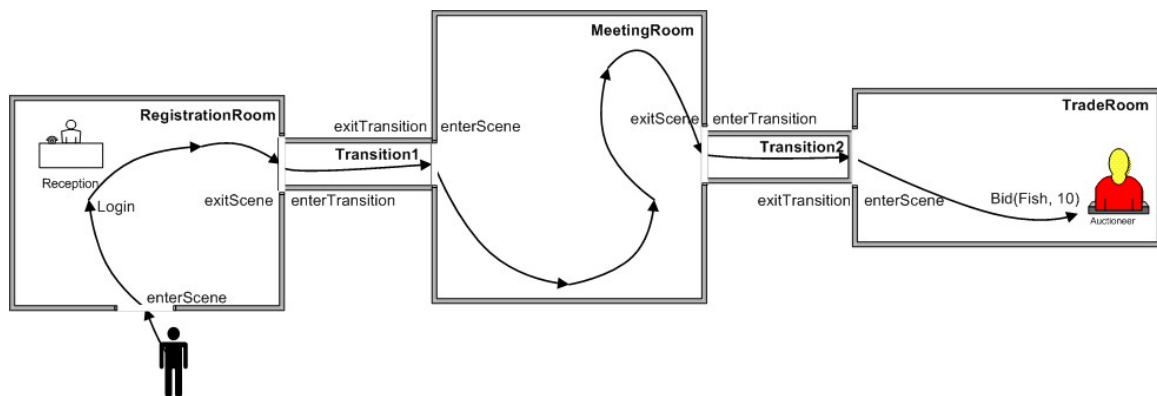
Figure 1. Two Levels of Execution in 3D Electronic Institutions

4. IMPLICIT TRAINING IN 3D ELECTRONIC INSTITUTIONS

In 3D Electronic Institutions the couple agent/principal is represented by an avatar. The autonomous agent is always active, and when the human is driving the avatar the autonomous part is observing the behavior of the human part, learning from his/her behavior patterns. The vision that inspires our proposal is graphically expressed in Figure 2. The avatars are fully controlled by either humans or autonomous agents through an *interface* (the interface is a sort of *glove puppet* that translates all decisions of its *puppeteer* into terms of the institution machine understandable language). Our view is that the agent and the human co-operate in the solution of the tasks the human has to deal with. We want to permit that either the human takes full control over the avatar or that the autonomous agent is in full charge of the decision making process. Moreover, we want to allow other types of interaction among them, such as the human giving guidelines to the agent, or the agent suggesting potential solutions to the human (via the interface), in a sort of "expanded intelligence" mechanism similar to the "expanded reality" that nowadays virtual reality tools offer.

Such duality (agent/principal) is a general feature of 3D Electronic Institutions and every participant (either a buyer or a shopping assistant) is integrated into the system via such architecture. This particularly means that each autonomous agent in the institution is trained by humans in the same way, which permits a decentralized approach to user modeling. Each autonomous agent only observes its principal and dynamically updates the user model of the principal. In case an agent (e.g. shopping assistant) needs to obtain the information about another agent (e.g. buyer), instead of trying to observe the behavior of other's avatar and use very sophisticated modeling techniques, the agent simply sends a direct request to the autonomous agent responsible for the avatar. If the agent on the other end agrees to share the information it will reply with the relevant part of its current user profile. Such solution significantly reduces the amount of computations and

the size of stored data. It also permits easier control over privacy (e.g. if a participant doesn't want to be observed he/she just prohibits the agent to share personal information with others).
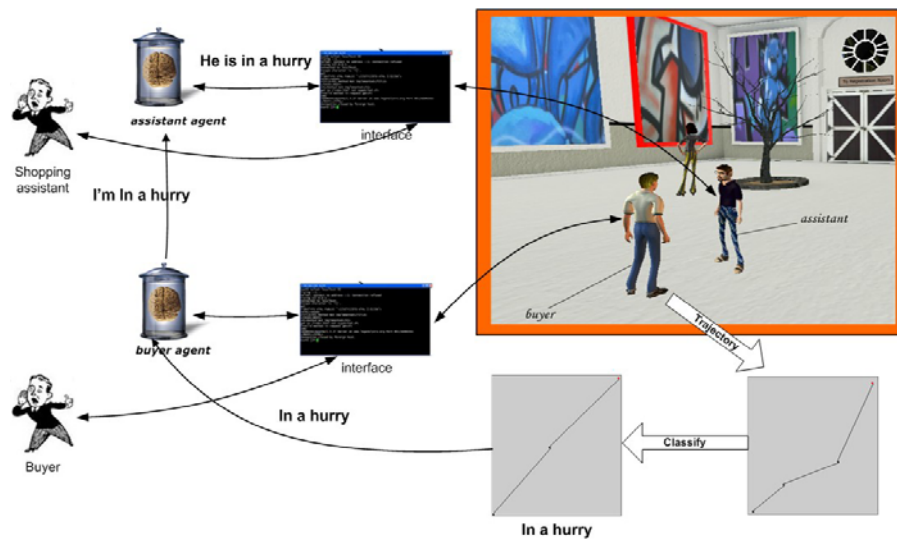
Figure 2. Implicit Training and User Modeling

As it was described in the previous section, the 3D Electronic Institutions comprise two different levels of execution. For effective building of user profiles and for making the implicit training of participants possible the actions from both levels have to be observed by autonomous agents. In the model we propose the institutional level gives context for learning and the actions of the social level are very important for teaching human characteristics to autonomous agents.

The actions of the institutional level, on the one hand, help the autonomous agent to understand when to start and stop recording the actions of the social level and which context to assign to the recorded sequences. On the other hand, analyzing the sequence of institutional level actions helps, in a long run, to understand how to reach different scenes and states in those scenes.

One of the valuable sources of information that can be obtained in the social level is the trajectory of the user. According to (Bauer & Deru, 2005) the trajectory of human's movements is tightly connected with the cognitive load. Figure 2 outlines the case of a human controlling the avatar marked as buyer and an autonomous agent controls the avatar of a shopping assistant. The simple scenario starts by the shopping assistant representative agent that notices a buyer approaching its avatar. Before getting involved into a conversation the shopping assistant requests information on human's "shopping mood" from the buyer representative agent. The agent analyzes the trajectory of the principal (from the moment when the principal entered the institution) and realizes that the human is in a hurry. This information is sent back to the shopping assistant representative agent. Before the human starts a conversation, the shopping assistants already knows that its responses have to be very short and precise.

Technologically such scenario can be supported by shallow reasoning. We record a classification list of trajectories generated by avatars driven by humans, the time the avatar spent on the trajectory and the number of utterances in which the avatar was engaged. Depending on these values, there is a class label associated with each trajectory (e.g. "in a hurry", "exploring", "waiting"). The final classification is refined by a human expert. At classification stage we use only the information about the initial (approaching) trajectory. In order to classify the trajectory of the avatar we compare it with every trajectory in a classification list and identify it as the most similar one from the list. The classification list is filled manually by system designers and each trajectory there is annotated with a text label (e.g. "in a hurry"). Technically, the trajectories are specified as arrays of landmarks. Each of the landmarks corresponds to the position of the avatar in a given moment in time. The position is permanently updated by the system every 10 Msec, so the information about the avatar's velocity is easily reconstructed from the distance between two neighboring landmarks. This simple representation allows efficient trajectory comparison and classification. To increase the performance of the classification on the first step of the algorithm the irrelevant landmarks (noise) are removed using the

approach presented at (Perng et al, 2000). After this, a combination of *Levenshtein Distance* and *Euclidean Distance* algorithms is applied to compare the analyzed trajectory with each trajectory stored in the classification list. As the result of the comparison, the trajectory from the classification list with the lowest distance value is selected and the corresponding text value is extracted to be used as a behavior label.

The actions of the social level are used not only to predict the "shopping mood" of the human. The autonomous agents record all those actions to imitate human behavior in a believable way. Regarding this point we base our research on the Bayesian method proposed by Le Hy et al, (2004). The application of this approach involves the observation of the set of environment variables in combination with the actions made by a human to produce a probabilistic table for predicting the next action to be executed by the agent.

To better explain how the training on each level is happening we refer back to the example on Figure 1. Imagine that an agent tries to learn how to represent a human in this simple institution. Initially, when a 3D representation is generated from the specification, the visualization of behavior of the autonomous agents in the institutional level is usually preprogrammed in a very simple way (e.g. entering a scene is visualized as making the avatar disappear in the previous room and showing it in the middle of the entered room). The actions of the social level can not be visualized on this stage. Now let's observe what happens if the human takes control over the avatar to complete the scenario from Figure 1. The autonomous agent starts recording the actions of the social level when it receives the message "enterScene" as the result of human entering the RegistrationRoom. When the login message is sent by the human through the interface the agent realizes that the context in the social level has changed (which means that all new actions have to be observed in a new context). In the similar way the agent records all other actions and assigns context to them when human moves through scenes and transitions to the TradingRoom. In the institutional level the agent records the whole sequence of the institutional messages sent by the human (enterScene, exitScene, enterTransition, exitTransition, login, bid). Now let's assume that after participating in the fish auction the human has bought a box of fish for the price of 10\$ and left the institution. The next time the human enters, he/she expects that the corresponding autonomous agent is already smart enough, and uses a special command "Do:bid(fish, 10)" to instruct the agent to buy the fish. The first thing what the agent does is searching the prerecorded sequence of institutional actions for the appearances of bid() function. Once the function is found, the agent knows which sequence of the institutional level actions will lead to achieving the goal. On the social level the agent knows which actions it has to execute for believable imitation of the human performance. The aforementioned reasoning will result in the following behavior: the avatar enters through the door to RegistrationRoom, the avatar reproduces the trajectory of the human and approaches the reception desk, the request for login information is received and the agent sends the login details. In the similar way the agent continues its movement to the TradingRoom, where it offers 10\$ for the box of fish. If the agent wins the lot – the scenario is finished; if the price this time is higher – the agent will request the human intervention.

5. CONCLUSION AND FUTURE WORK

We presented the concept of implicit training that is used for teaching human behavioral characteristics to autonomous agents in 3D Electronic Institutions. These environments and the proposed approach are beneficial for E-Commerce as an embedded training technology for increasing the acceptance and believability of virtual shopping assistants. Though we undertook a very detailed exploratory research of the implicit training concept the validation of it was not yet performed due to the insufficient implementation. The goal of the paper was to present our theoretical findings and position our research and described technological solution in the context of a new generation E-Commerce technology. Future work will include the implementation of the aforementioned algorithm for implicit training and extension of the already existing path recognition software with the possibility of automated generation of the path classification list.

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REFERENCES

Aleotti, J. et al, 2003. Toward Programming of Assembly Tasks by Demonstration in Virtual Environments, *12th IEEE Workshop Robot and Human Interactive Communication.* October 31 - November 2, 2003.

Alissandrakis, A. et al, 2001. Through the Looking-Glass with ALICE — Trying to Imitate using Correspondences. Proceedings *of the First International Workshop on Epigenetic Robotics.*

Bauer, M. et al, 2000. Programming by example: programming by demonstration for information agents. *Communications of the ACM.* Volume 43 , Issue 3. pp. 98-103.

Bauer, M. and Deru, M. 2005. Motion Based Adaptation of Information Services for Mobile Users. *Working Notes of the UM05 Workshop on Machine Learning for User Modeling*. Edinburgh, Scotland.

Bogdanovych, A. et al, 2004. E-Commerce Environments as 3D Electronic Institutions. In *Proceedings of the E-Commerce 2004 Conference (EC2004)*, Lisbon, Portugal, pp. 237-242.

Bogdanovych, A. et al, 2005. Narrowing the Gap between Humans and Agents in E-Commerce: 3D Electronic Institutions. *Proc. of the 6-th International Conference on Electronic Commerce and Web Technologies*, pp. 128-137.

Chowdhury, S. 2004. *Next Generation Business Handbook. New Strategies from Tomorrow's Thought Leaders.* John Wiley & Sons, pp. 494-495.

Daugherty, T. et al, 2005. Experiential E-Commerce: A Summary of Research Investigating the Impact of Virtual Experience on Consumer Learning. *Online Consumer Psychology: Understanding and Influencing Consumer Behavior in the Virtual World.* Lawrence Erlbaum Associates, pp. 457-489.

Eartlink. 2005. How to Convert More Online Shoppers with Live Chat Invites. *Practical Know-How & Case Studies.* Sherpa marketing.

Edwards, S. & Harshavardhan, G. 2001. The Novelty of 3D Product Presentations Online. *Journal of Interactive Advertising*, 2(1).

Ekvall, S. and Kragic D. 2005. Grasp Recognition for Programming by Demonstration, *In IEEE/RSJ International Conference on Robotics and Automation.*

Esteva, M. et al, 2002. ISLANDER: An Electronic Institutions Editor. In *Proceedings of the 1st International Joint Conference on Autonomous Agents and Multiagent systems (AAMAS '02),* pp. 1045-1052.

Früh, C. et al, 2005. Data Processing Algorithms for Generating Textured 3D Building Facade Meshes from Laser Scans and Camera Images. *International Journal of Computer Vision,* 61(2), pp. 159-184.

Gutzman, A. 2000. Online Customer Service: Do or Die the Law of Averages, *CRM on the Web CRM Library.*

Hunter, D. & Lastowka, F. G. 2003. To Kill an Avatar. *Legal Affairs Magazine.* Issue July-August 2003, pp. 20-24.

Hurst, M. 2000. Why 3D shopping makes no sense. [online] cited at http://www.goodexperience.com.

Klein, S. & Loebbecke, C. 1999. Signaling and Segmentation on Electronic Markets: Innovative Pricing Strategies for Improved Resource Allocation. *Proceedings of the 6th Symposium on Emerging Electronic Markets,* pp. 127-142.

Le Hy, R et. al, 2004. Teaching Bayesian Behaviours to Video Game Characters. *Robotics and Autonomous Systems.* Vol. 47. pp. 117-185.

Magnenat-Thalmann, N. et al, 2005. Believability and Interaction in Virtual Worlds. *Proceedings of the 11th International Multimedia Modelling Conference, (MMM 2005).* pp. 2-9

Maguire, J. 2002. Case Study: LivePerson Searching for the Personal in E-Commerce. *Ecommerce-guide.com*, 23.02. 02.

Modahl, M. 2000. *Now or never: how companies must change today to win the battle for internet consumers*, New York, HarperBusiness. ISBN: 0066620120.

Pai, D. K. et al, 2001. Scanning Physical Interaction Behavior of 3D Objects, *in Computer Graphics (ACM SIGGRAPH 2001) Conference Proceedings.*

Perng, C. et al, 2000. Landmarks: a New Model for Similaritybased Pattern Querying in Time Series Databases. *Proceedings of the 16th International Conference on Data Engineering*, pp. 33-42.

Preece, J. & Maloney-Krichmar, D. 2003, *The Human-Computer Interaction Handbook*, Lawrence Erlbaum Associates Inc., chapter Online Communities: Sociability and Usability, Mahwah, USA, pp. 596-620.

Prendinger, H., Ishizuka, M. 2001. Let's talk! Socially intelligent agents for language conversation training. *IEEE Transactions on Systems, Man, and Cybernetics*, Part A 31(5): pp. 465-471

Prince, M. 2005. E-Commerce: Help May Be on the Way, *The Wall Street Journal*, March 21, 2005.

Rafaeli, S. & Noy, A. 2005. Social Presence: Influence on Bidders in Internet Auctions. *EM-Electronic Markets.* Volume 15(2). pp. 158-175.

Rule, D. S. 2003. Artificial Intelligence (AI) Chatbot *http://www.codetools.com/useritems/AI_Chatbot.asp.* 12.2003.

Whitton, M.C. 2003. Making Virtual Environments Compelling. *Communications of the ACM.* Volume 46, Issue 7 (July 2003), SPECIAL ISSUE: "A game experience in every application", pp. 40-47.

ON THE ACCEPTANCE OF MOTES IN MAINSTREAM HEALTH MONITORING

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ABSTRACT

The need for providing health services to a growing aging population is escalating as there are increasing constraints in hospital space and trained medical staff. As a result of the growing number of people who need some form of medical aid (such as monitoring, surgery, treatment) new solutions need to be applied to deal with this urgent situation. This paper discusses a recent addition to health monitoring – Wireless Sensor Networks (Motes) – and its possible acceptance as a reliable and efficient monitoring tool. An acceptance model, Unified Theory of Acceptance and Use of Technology (UTAUT) has been applied to determine how viable this technology will be in medical institutions and patients' homes. Thus, input derived from our preliminary survey provides a real-world opinion of Motes and how well the model reflects current attitudes and future outlook.

KEYWORDS

Motes, acceptance model, health monitoring

1. INTRODUCTION

Identified areas of research significance in wireless applications include consumer awareness and satisfaction with mobile services, upcoming trends that may influence future adoption and social and work practices that may favour the adoption and use of wireless application services [16]. This preliminary study attempts to answer these research needs by investigating the degree of awareness, future adoption and uptake of wireless sensor networks (WSNs) (in particular Motes) in the Health Monitoring arena. The authors have conducted a survey based on the acceptance model, *The Unified Theory of Acceptance and Use of Technology* (UTAUT) to help predict user acceptance or rebuttal of Wireless Sensor Networks and their reasons.

This paper explores the factors that could influence the uptake of wireless sensor networks (motes) as a first stage for a proposed empirical study on the potential effects of WSNs in health enterprises. Part two provides a technical overview of WSNs and its significance as wireless network technology, while part 3 describes the intended application for WSNs. Part 4 justifies the selection of UTAUT as a tool for the potential adoption or rebuttal of WSNs. Part 5 outlines the study design and methodology, namely a preliminary cross-sectional study used to explore the factors that could influence consumers' views on this technology. In part 6 the authors discuss their findings. In the conclusion the authors explain how this preliminary work will serve as a foundation for further research into the implementation of this technology.

2. TECHNOLOGY OVERVIEW OF MOTES

Motes, commonly known as "Smart Dust," are tiny microcomputers that employ wireless media to communicate with other Motes. Made with off-the-shelf parts, they are relatively low cost compared with other wireless devices with the same functionality and allow for what is known as Commodity-Based Wireless Networking. They range in size from a few centimeters to a matter of millimeters; as a result, they can be placed in the most space-constrained area. Each Mote has the capability of providing various sensor measurements, ranging from measuring the surrounding magnetic field and sound level, to measuring temperature and acceleration. With a variety of sensor types, applications for these Motes can be realized such as in military applications (enemy detection) or in health applications (monitoring of vital statistics). However, these and many other applications require another feature inherent in every Mote.

Every Mote has the ability to self-form an ad-hoc wireless network with other Motes [3], [4]. As an individual component, these Motes have limited benefits. As a network, however, more advantages can be recognized. An obvious benefit is the ability to cover a larger area. The sensor network utilizes a multihop protocol that allows Motes to forward packets from other Motes to one that is close by, but cannot be reached by the original sending Mote [3], [4]. This also leads to another benefit: the network is adaptable. Depending on the arrangement of the devices (either due to new Motes within range or failed Motes in the network), they can form a network that provides the best path for communication [3].

Because these Motes are wireless and can self-form into a network they may be placed in remote regions which people find difficult to access. All these benefits however come with a price. The Motes' small size limits the amount of power available to each device yet the effect of this constraint is reduced since most of the component parts of a Mote consume little power. As an example, Berkeley's Mica family of Motes uses widely available AA 4.5V batteries as their power source [3]. In addition to this, the individual components can be programmed to sleep when not in use. By employing a particular sleep algorithm, power savings can be optimal [3].

3. HEALTH MONITORING

Health Monitoring encompasses several aspects:
- Monitoring of an individual's vital statistics (body temperature, blood pressure, etc)
- Monitoring of an individual's surroundings (ambient lighting, room temperature, air pressure, etc)
- Early warning system for doctors and medical professionals (via signals sent directly to the medical professionals from the monitoring equipment)
- Context aware applications (saved settings for an identified individual, etc)

The use of Motes solves and achieves many of the problems and goals raised by the four points above. Current devices used for monitoring an individual's vital statistics, though highly accurate, are bulky and require wired connection between the individual and the monitoring device. Using Motes would reduce the amount of space required by these devices and only the Mote(s) would be connected to the patient.

Monitoring an individual's surroundings provides supplementary statistics, which may show a correlation with the patient's immediate state. It also serves as a tool for context-aware applications; for example, room settings in a hospital can be adjusted according to the requirements and condition of the patient.

The biggest advantage that health monitoring provides is the fact that it serves as an early warning system for doctors and other medical professionals (Emergency Medical Services). Statistics gathered from the Motes may show a trend or correlation between each type of variable that may, upon reaching a set threshold, alert the health professionals. These statistics may be accessed via a web server to authorized individuals at any moment and location, thus, making it a very flexible system. Our first research testbed has demonstrated that the use of the network management tool, Multi Router Traffic Grapher, MRTG, enables data from the motes to be displayed graphically on the web and thus allows medical staff the ability to access patient data from anywhere in the world by the use of a simple web browser [13]. Our second research testbed implemented a similar system using PDAs. We were able to show that MRTG's compression is such that even with months of data, the amount of space required would only be a matter of hundreds of kilobytes. A remote feature of our system is also available, where authorized users are able to view the information

graphically on a website. This data can be displayed on a laptop or PDA which has Internet connectivity. Our system is more easily set up than the proprietary implementations.

3.1 Examples of Health Monitoring Projects

The healthcare market is among the fastest growing markets for WiFi and other Wireless Technologies[12]. There are already numerous research projects in this area, a number of which have gone commercial. Many wireless mobile devices have been developed to monitor people's health and wellbeing especially those suffering from diabetes, high blood pressure or heart disease. For example, the US company Globus uses the Paradigm Diabetes Management System, a blood glucose monitor and insulin pump that work together to manage diabetes wirelessly [9]. The European Community's MobiHealth (2002-2004) demonstrated the Body Area Network (BAN) consisting of software programs, hardware devices (including sensors) and Bluetooth communication between devices such as the MobiHealth GPRS Pregnancy Body Area Network (BAN) [7]. Schwiebert et al (2001) [14] have described their challenges in wireless networking of human embedded smart sensor arrays in developing a retina prosthesis.

4. UNIFIED THEORY OF ACCEPTANCE AND USE OF TECHNOLOGY (UTAUT)

The authors have applied the Unified Theory of Acceptance and Use of Technology (UTAUT) to predict the potential adoption of WSN technology. The Unified Theory of Acceptance and Use of Technology (UTAUT) (Fig. 1) by [19] is an amalgamation of several published acceptance models (see Table 1), combining common constructs among the models. These acceptance models shared seven major concepts according to their constructs, of which four are considered direct determinants for user acceptance namely [19]:

- Performance expectancy
- Effort expectancy
- Social influence
- Facilitating conditions
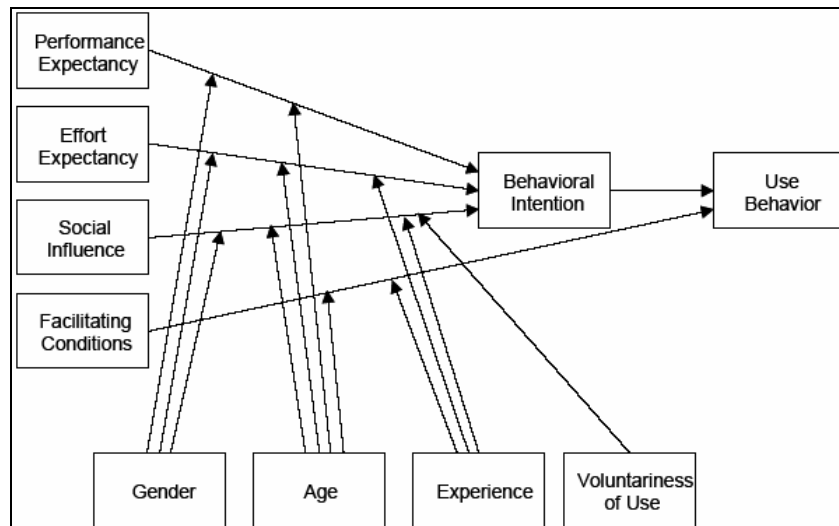
Figure 1. Original Unified Theory of Acceptance and Use of Technology Model [19]

Along with these determinants are moderators (gender, age, experience and voluntariness of use) which affect the strength of the determinants. These determinants and moderators influence an individual's behavioural intention (his/her planned intention towards the technology) – generally, to use it or not [19].

The rest of the section will discuss a slightly modified UTAUT to fit with the indirect use of technology – specifically with wireless sensors that are intended for use in a healthcare situation but without dealing with the actual technology.

4.1 Performance Expectancy

Originally defined as the "degree to which an individual believes that using the system will help him/her to attain gains in job performance," this determinant has been modified to fit according to gains in standard of living/quality of life due to the use of the technology [19]. Performance Expectancy is the strongest determinant of intention [19]; however, its effect is moderated by age and gender. It has been shown that technology use is different along gender and age lines. For example, men – especially young men – tend to be more receptive to new technology. [11] The two moderators are interrelated as differences in age represent psychological and societal differences [19].

> H1: The influence of Performance Expectancy on behavioural intention will be moderated by *gender* and *age*, such that the effect will be stronger for men and particularly for younger men [19], [2].

Results from our survey confirmed that younger men did have a more affirmative response towards the Motes' usefulness. Further discussion is presented in Part 6.

4.2 Effort Expectancy

This is traditionally the "degree of the ease of use of the system [19]." Unlike the original model, only the age and gender are significant in influencing an individual's effort expectancy. Experience implies interaction with the system, which would not be the case; thus, it will not be included. Gender and age are still included as moderators, having more effect for women. Previous research has shown that this determinant will have a stronger influence on behavioural intention with women than with men, and more so with those who are older [18].

> H2: The influence of Effort Expectancy on behavioural intention will be moderated by *gender* and *age*, such that the effect will be stronger for women, particularly older women [19], [2].

Our sample did not include a sufficient number of female participants to validate H2; however, this will be discussed in a later section.

4.3 Social Influence

This determinant refers to the "degree to which an individual perceives that people he/she considers important believe that the individual should also use the new system [19]." As more people – especially those who are considered important – use the technology, the more likely it is to be given credentials as a safe and widely used technology. Four moderators have a direct influence on social influence: gender, age, voluntariness and experience. With gender differences, women are predicted to place more importance on this factor than with men due to psychological differences (i.e.– sensitivity, emotional, subjectivity) [18], [10]. In addition, as he/she grows with age, this determinant will be more salient as social factors become increasingly pertinent. However, as experience grows (and hence more awareness and objectivity), the importance placed on Social Influence decreases [17]. Due to social perception of the technology – from the number of people using it to its reputation – an individual can be significantly influenced in his/her decision to use it.

> H3: The influence of Social Influence on behavioural intention will be moderated by *gender*, *age*, *voluntariness* and *experience,* such that the effect will be stronger for women, particularly for older women and for those in the early stages of their experience [19], [2].

From our results, we can validate that younger persons who have limited experience do have stronger response to Social Influence. This result will be expanded in the Findings and Discussion section.

4.4 Facilitating Conditions

This determinant deals with the "degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system [19]." It has been augmented to reflect a more individual basis where cost of using the system, compatibility with lifestyle/surroundings and aesthetics are considered. Research has shown that this determinant is not as significant in influencing an individual's behavioural intention when Effort and Performance Expectancy are present [19]. The reason is that Effort Expectancy suggests the presence of facilitating conditions and similarly with Performance [19]. A power analysis was used to detect the likelihood of a type-II error.

> H4a: Facilitating Conditions will *not* have a significant effect on behavioural intention [19], [2].

It has also been shown that Facilitating Conditions do have an effect on the usage of the technology. With growing experience, its effect is stronger due to people's increased ability to sustain use of the technology. Age is additionally a moderator in this case, as older individuals tend to require more support in dealing with the system [19].

> H4b: The influence of Facilitating Conditions on usage will be moderated by *age* and *experience*, such that the effect will be stronger for older individuals, particularly those with increasing experience [19], [2].

Note that usage here cannot be validated as the Motes have only recently become commercially available and the main users at present are researchers. It only provides validation up to an individual's perceived intention on usage.

5.   METHODOLOGY

The purpose of this paper is to identify the current perception of Motes, and in general, wireless sensor networks, and determine its viability as a commercial product and/or lifesaving tool. The use of an opinion survey combined with a reference theory is the first stage in making early predictions of the rate of uptake.

Conducting such a survey serves a number of purposes. It validates a known or new acceptance model, which can be used on developing new technologies. As previously mentioned – with Motes still in the research and development phase – only a part of the UTAUT model is employed. Instead, it presents researchers an idea of how the public perceives the new technology (whether they were previously aware of it or not). The results can lead to a new direction for the research – tailored for eventual public and commercial use.

To obtain as broad coverage of issues as possible, and because of a limited number of initiatives in Australia, web-based surveys were used in this research instead of face-to-face interviews. This ensures independence of time and place, and means that we could obtain responses from people from all around the world. Methods such as focus groups and personal interviews are more difficult to arrange for global responses. It also means that different time zones are not a problem, since the respondent can fill in surveys at any time and at their convenience. It offers a simple means of obtaining the results in a secure and anonymous fashion without having to undergo several procedures to ensure ethical standards, as this is meant to be the first stage.

5.1 Measuring Criteria: Survey

As previously discussed, criteria used for user acceptance to a new technology follows the UTAUT model. To measure each criterion, a set of questions was formulated to relate to the Motes technology (Tables 2 to 4). Questions regarding his/her gender, age, education and career, in addition to his/her awareness of the technology, were solicited. The survey participant would rate each question according to its relevance to him/her. A five-scale Likkert measurement system was used – which ranged from 'Strongly Disagree' to 'Strongly Agree' – as opposed to previous validated measurement systems of seven levels [15]. This takes

into account that the time period that the survey was conducted was short, as the number of available respondents would not be sufficient for larger scales.

The survey was undertaken anonymously, using a free survey creation tool – Quask (www.quask.com). The survey (Fig. 2) was run entirely as an Internet-based survey for approximately two months with the results collected and tabulated. Invitation to participate in the survey was given via electronic mail to mainly staff and students from post secondary institutions in Australia and Canada. Individuals from this sample were more likely to provide more informed responses due to their technical background.

Participants ranged from younger students to older professionals to meet the requirements for analysis. Individuals were solicited from two countries with similar societal values and economies: Australia and Canada. The distinction was not made in the survey, which has the implication that societal differences can play a role in user acceptance. The researchers had no way of knowing if people from other countries chanced upon the survey and completed it. However, the fact that these two countries are very similar may reduce that effect, if any. A possible side-effect may just represent a higher variance in the responses. After two months, a total of 59 individuals participated. Undergraduates and postgraduates, as well as academics and other (industry, medical) professionals were among the participants.

A key group has been sufficiently represented among those surveyed: IT/engineering, which comprises of students, academics and professionals. This group would be the first to recognize the technology and would provide the strongest indicator to the future of Motes. Of the 59 that were surveyed, 56 were in this group (28 IT/engineering students – post and undergraduate, 24 IT/engineering professionals, 7 IT/engineering academics). Only 3 were outside the group and were under Medical. The researchers saw this population as an appropriate sample for this preliminary study which would give reliability and validity to the statistics as a precursor to the industry study to follow.

It is important to note that within this group the majority of those surveyed were male (50 were male, only 9 were female) and part of the 20-35 age group (9 were over this age group). With a majority male sample population, this is currently representative of the demographics within this field.

The UTAUT theory was investigated by asking about the respondents' knowledge of the existence of Motes - if they stated they had not heard about the devices a small pop up section outlined briefly what motes were and how they worked (See Figure 2). Most of those surveyed have not previously been exposed to Motes (10 out of 59 have heard of the technology); however, many of them have been exposed to the concept of wireless sensor networks.

The following tables outline how the questions of the survey fit into the categorization of the UTAUT theory. Averaged results for the questions are also shown.

Table 1. Question set for survey, performance/quality

Performance/Quality Expectancy	Average Score (SD, V)
Using the system would enable me to do more things I would not normally do (either because of safety issues or concerns)	4 (1, 1)
Using Motes to monitor my health would improve my quality of life	4 (1, 1)
I feel that using Motes increases my chances of survival in case of a medical emergency	4 (1, 1)
I feel that this will be an improvement towards previous and current monitoring systems	4(1, 1)

Table 2. Question set for survey, effort expectancy

Effort Expectancy	Average Score (SD, V)
Learning to use the system would be easy	3 (1, 1)
My interaction with the Motes will be clear and understandable	3.3 (0.8, 0.6)
I think that they would be easy to deal with	3.2 (0.9, 0.8)
I would expect not to spend much time configuring/maintaining it	3.2 (0.8, 0.6)
I think that they would be flexible to deal with	3.6 (1, 1)

Table 3. Question set for survey, facilitating conditions

Facilitating Conditions	Average Score (SD, V)
I feel that I would be able to control the system in any situation	3 (0.8, 0.6)
I have the resources necessary to use Motes	2.9 (0.73, 0.53)
I feel I have the technical knowledge necessary to use Motes	3.2 (1, 1.1)
I expect guidance and technical assistance would be available to me	3.8 (0.9, 0.8)
Using the system is compatible with most, if not all, aspects of my life	3.5 (0.8, 0.6)
I feel that it would fit well with my lifestyle	3.4 (0.7, 0.6)
I feel that the system is compatible with other systems that I use	3.2 (0.8, 0.7)
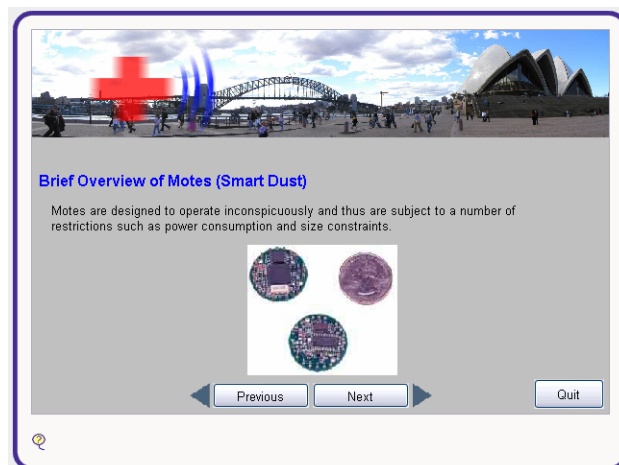
Figure 2. Motes survey [5]

6. FINDINGS AND DISCUSSION

The following tables provide the average score for each indicator. It can be seen that the results do indicate a correlation with the four determinants with a few exceptions. Table 4 shows that the Performance Expectancy effect was stronger for younger men. A slight difference with women aged 36-50 may seem to contradict the hypothesis; however, that result is most likely not representative of the female population as the number of female participants was distinctly low. Similarly, in Effort Expectancy, the effect seemed to be much stronger with younger men instead of with older women. Table 6 shows the results support Social Influence hypothesis – where the effect is stronger generally with younger women and those with minimal experience (students). A power analysis performed on the non-significant Facilitating Conditions showed a high likelihood (over 90%) of detecting medium effects. Power analysis aims to indicate whether an experiment was suitably designed. A high power leads to a higher ability of detecting reasonable departures from the null hypotheses. Due to a limited sample size, a power analysis would also indicate whether the size was adequate enough to provide a high power.

Table 1. Mean score for performance expectancy determinant

Performance Expectancy - Mean (SD, V)					
Male			Female		
20-35	36-50	51-65	20-35	36-50	51-65
3.78 (0.71, 0.5)	3.5 (1.32, 1.74)	-	3.32 (0.55, 0.3)	4.25 (0.5, 0.25)	3.5 (0.58, 0.33)

Table 2. Mean score for effort expectancy determinant

Effort Expectancy - Mean (SD, V)					
Male			Female		
20-35	36-50	51-65	20-35	36-50	51-65
3.34 (0.81, 0.65)	3.14 (1.26, 1.6)	-	3.17 (0.92, 0.85)	3.2 (0.84, 0.7)	3.6 (1.52, 2.3)

Table 3. Mean score for social influence determinant

	Social Influence - Mean (SD, V)					
	Male			Female		
	20-35	36-50	51-65	20-35	36-50	51-65
Student	3.62 (0.87, 0.76)	3.13 (1.13, 1.27)	-	3.81 (0.98, 0.96)	-	-
IT/A	3.47 (0.82, 0.67)	2.15 (0.88, 0.77)	-	3.75 (0.5, 0.25)	3.25 (0.96, 0.92)	3.5 (0.58, 0.33)

Table 4. Mean score for facilitating conditions determinant

	Facilitating Conditions - Mean (SD, V)					
	Male			Female		
	20-35	36-50	51-65	20-35	36-50	51-65
Student	3.28 (0.73, 0.53)	2.79 (0.7, 0.49)	-	3.18 (0.72, 0.52)	-	-
IT/A	3.34 (0.89, 0.78)	3.26 (1.4, 1.96)	-	3.14 (0.38, 0.14)	3.86 (0.9, 0.81)	3.57 (0.53, 0.29)

We can see that it is possible that the acceptance of Motes can be predicted using UTAUT. The early stages of exposure to the technology (17% have heard of Motes, which only became a known research area within the past couple years) resulted in a less pronounced response on the questions from the participants. However, as the results do follow the UTAUT model, it can be seen that the perception of Motes is a positive one and would lead to an affirmative intention to use it.

Overall, our results favoured the outlook that Motes provide an improvement within their lives, one of the goals of health monitoring. This coincided with a positive view of its ease of use, albeit, less pronounced due to their inexperience and minimal exposure. With the sample being mostly students in the 20-35 range, the tendency is to conform according to social pressures [19], [1], [15]. This is due to the fact that they are at a relatively early stage of their experiences and must rely on opinions and decisions from more experienced individuals, whether accurate or not [14], [1], [15]. The results show that the effect is higher than with older groups.

7. CONCLUSION

Our research has attempted to explore the factors that may affect the adoption of Motes as a tool in health monitoring. This paper employed the UTAUT model to determine these factors and provide an initial outlook of Motes. Preliminary results from the survey did show positive support for the acceptance of the technology. Although the impact of Motes as a health tool cannot be currently realized, the increasing amount of research into developing health monitoring systems shows that the interest is there and that it is here to stay. Projects such as the MobiHealth and CodeBlue [15] from Harvard and Boston University show that it is already possible to create an effective and feasible monitoring system. With further research into the perception of Motes in health monitoring, the results can be further validated and extended to a wider group. The results have already been shown to follow the UTAUT model; thus, the necessary ingredients for technology acceptance are present. As a result of this preliminary survey we are now conducting a second, follow up survey aimed at a wider and more international cohort to ascertain the acceptance of Motes in healthcare environments in other countries.

REFERENCES

[1] Agarwal, R. and Prasad, J, 1997. The Role of Innovation Characteristics and Perceived Voluntariness in the Acceptance of Information Technologies. *Decision Sciences*, Vol. 28, No. 3, pp. 557-582

[2] Anderson, J. E. and Schwager, P. H. SME Adoption of Wireless LAN Technology: Applying the UTAUT Model. *Proceedings of the 7th Annual Conference of the Southern Association for Information Systems.*

[3] Crossbow Technology Inc (2004) [Online]. Available: http://www.xbow.com

[4] Culler, D.E. et al, 2004. Overview of Sensor Networks. *IEEE Computer Society*.

[5] Davidson Measurement (2004). [Online] Available: http://www.davidson.com.au

[6] Davis, F. D. et al, August 1989 User Acceptance of Computer Technology: A Comparison of Two Theoretical Models. *Management Science*, Vol. 35 No. 8, p 982, 22p

[7] Konstantas, D., 2004. The Mobihealth Project. *IST Project IST-2001-36006, European Commission: Deliverable 2.6* [Online] Available:http://www.mobihealth.org

[8] Malan, D. et al, April 2004. CodeBlue: An Ad Hoc Sensor Network Infrastructure for Emergency Medical Care. *International Workshop on Wearable and Implantable Body Sensor Networks, Imperial College*. London, England.

[9] Managing Diabetes With Wireless Insulin Pump: Patients Input Diet Plan, Device Matches Insulin Levels. POSTED: 4:54   pm   EST   February   16,   2004   [Online] Available:http://www.thewbalchannel.com/womansdoctor/2850769/detail.html

[10] Miller, J.B. , 1976. *Toward a New Psychology of Women*, Beacon Press, Boston.

[11] Minton, H.L. and Schneider, F.W, 1990. *Differential Psychology*, Waveland Press, Prospect Heights, IL.

[12] PBI Media, 2003 Strong Prognosis For Wireless In Healthcare, *Communications Today*. [Online] Available:http://www.findarticles.com/cf_0/m0BMD/35_9/98013124/p1/article.jhtml

[13] Riudavets, J. et al, 2004. Multi Router Traffic Grapher (MRTG) for Body Area Network (BAN) Surveillance. *4th WSEAS Int. Conf. On APPLIED INFORMATICS AND COMMUNICATIONS (AIC'04)*, Tenerife.

[14] Schwiebert, L. et al, 2001. Research challenges in Wireless networks of Biomedical Sensors. *ACM SIGMOBILE 7/01 Rome Italy; ACM ISBN 1-58113-422-3/01/07*.

[15] Taylor, S., Todd, P., 1995a. Assessing IT Usage: The Role of Prior Experience. *MIS Quarterly*, Vol. 19, No. 2, pp. 561-570.

[16] Valeri, L. and Robinson, N. Defining a Strategy Roadmap for mBusiness Applications and Services: Background Draft paper, IST-2001-39164. [Online] Available: http://www.mobiform.org

[17] Venkatesh, V. and Morris, M.G., 2000. Why Don't Men Ever Stop to Ask for Directions? Gender, Social Influence, and Their Role in Technology Acceptance and Usage Behavior. *MIS Quarterly*, Vol. 24, No. 1, pp. 115-139, 2000.

[18] Venkatash, V. et al, 2000. A Longitudinal Field Investigation of Gender Differences in Individual Technology Adoption Decision-Making Processes. *Original Behaviour and Human Decision Processes*, Vol. 83, No. 1, pp 33-60.

[19] Venkatesh, V. et al, 2003. User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly*, Vol. 27 No. 3, pp 425-478.

DESIGNING SOUND E-GOVERNMENT SERVICES BY MODELLING & INTERACTIVE PROCESS ANIMATION

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ABSTRACT

The paper presents a methodology and a toolset to design and validate electronic business transactions in the context of public administrations. The toolset makes use of a subset of formally defined UML, enriched by the notion of 1st order logic business rules, to model and simulate end-to-end transactions in a interactive way. It is argued that the soundness and the appropriateness of electronic transactions can be improved by allowing the future users themselves – as opposed to the IT analysts involved in the modeling of the transaction - to validate the correctness of the transaction flow and the messages exchanged before they are implemented. To achieve this objective, the UML models are transformed into a workflow-based transaction simulation, or animation, that the future users can use to validate their correctness. This a-priori validation step helps to improve the quality of the future services and enhances their acceptance level, as well as it helps to speed up the development time and reduces cost. The business case of this paper is based on work results of the EU project IDA.

KEYWORDS

UML, business process simulation, E-GOV transactions, e-Business

1. INTRODUCTION

E-Government is currently being discussed as a strategic initiative in many countries and organizations (some examples are [2,8,10]), the objective being to offer better and more convenient services to citizens and companies, at lower costs and more efficiently making it easier for those who want to set-up new collaborative services.

When designing or customizing the business processes underlying an e-Government service to a new domain or sector or to the needs of a particular country, experts from many areas of expertise must contribute: experts on the political, social and legal matters, experts that know the existing administrative processes, business roles and responsibilities, IT experts, experts in information security etc.

Due to the different backgrounds and areas of expertise of these experts, effective communication and a shared understanding of the targeted government services in question is a critical factor of success. Without a shared understanding, there is the risk that the IT application will not or only partially match the business requirements, which leads to re-work and hence to increased efforts and cost.

This paper illustrates the benefits of formal modelling with regards to the design and the customization of electronic transactions based on standards in the domain of e-Government[1,6]. It also illustrates the benefits of animating the models created in order to facilitate the validation of their soundness and appropriateness for the business experts, that is, the future user community. The early implication of the users can help to improve the acceptance level of the transaction as well as it renders the complex services more tangible and hence helps to improve their quality, upfront, already at the analysis stage of the future service and not at the time when it is deployed.

In section 2, we present the modelling methodology and a toolset that we developed to support the design and the validation of electronic transactions. Section 3 shows how this toolset has been applied to the domain

of e-Government. In section 4 we address the domain of privacy and legal restriction that impact on administrative data interchange. Section 5 finally wraps up with conclusions and points the way forward.

2. THE EFFICIENT PROJECT

The EFFICIENT R&D project (E-business Framework For an EFFICIENT Capture and Implementation of End-to-end Transactions) aims at enhancing the quality and the effort of system development associated with multi-partner electronic transactions while reducing the time to market and augmenting the STP (Straight Through Processing) level. The methodology proposed by the project is two-fold:

- A modelling step that turns the business requirements associated with a new e-Government service, defined by experts from the different administrations and user groups that participate, into computer readable models.
- An interactive animation step rendering the computer models created more tangible in order to allow the subject matter experts (those who set the requirements) to validate their correctness and soundness without having to be familiar with the formal modelling language used.

In EFFICIENT, an e-Government transaction is described in terms of the following information layers (see Figure 1):

- The business layer provides a top-level view on the business scenario that governs the transaction. It depicts the transaction configuration and allows the trading partners to develop a common understanding about the business goals, the vocabulary used and about the roles and responsibilities of each participant11.
- The *specification layer* details the flow and the content of the business documents (messages) that the trading partners exchange in the transaction, as well as the rules governing the exchange.
- At the *technical layer* the business transaction is simulated creating a shared understanding between the participants and facilitating its verification and validation.
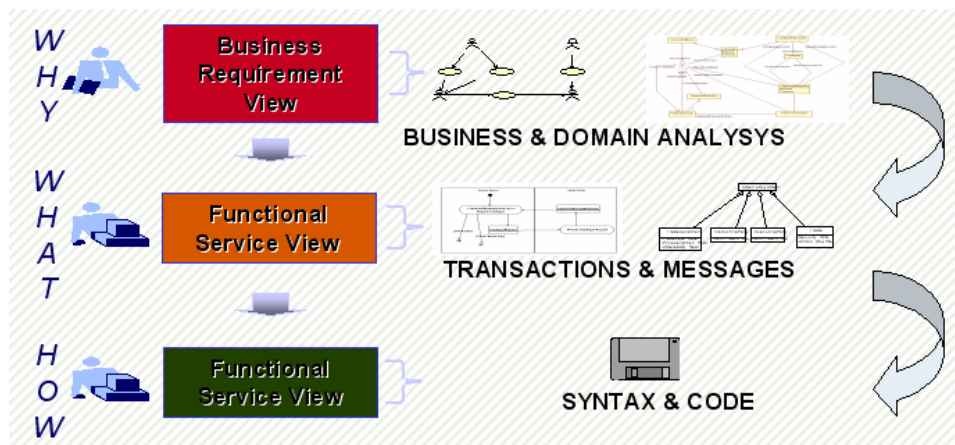
Figure 1. The modelling layers of the EFFICIENT toolset

2.1 Technical Details

EFFICIENT uses MagicDraw [17], a commercial UML CASE tool for the representation of the static and dynamic aspects of an e-Government transaction. A plug-in to MagicDraw was developed to implement the functionality required for model verification and code generation.

Once the transaction has been designed and formally verified, the infrastructure needed for the orchestration (animation) at the technical layer is automatically generated from the UML models developed

at the specification layer. The flow of the business transaction, modeled in an UML activity diagram, is translated into an XPDL [14] file that initializes the workflow engine, the core component of the EFFICIENT server. Each message, specified in a restricted UML class diagram, translates into an XMLSchema [16]; the business rules that govern the transaction are transformed into an Xlinkit [20] representation. These files are stored in an database used by the workflow engine.

The EFFICIENT client component is internet-based. The messages that the business partners exchange in a transaction are displayed using the XMLSchema definitions and an implementation of the Xforms[21] recommendation.

The technological choice we have taken in the EFFICIENT project follow two principles: to choose open-source tools wherever possible and adopt standards when they exist. These principles allow us a maximum of flexibility and facilitate the interoperability with existing products and frameworks. The list tools and standards we use are the following:

- WMFOpen [13], an open-source workflow engine, which is fed with the XML Process Definition Language (XPDL) standard definitions for process orchestration (animation). Note that unlike BPEL [19], XPDL supports the concept of *"subflow"* with a clearly defined interface between a calling and a called process. EFFICIENT uses this feature of process composition in that it allows a transaction designer to re-use previously defined transaction models as well as to import industry specific standard sets of transactions (such as Rosettanet [12], PIPs, EDIFICE [23], SWIFT [22], the results of the IDA project and others). A re-use of existing components and industry standards reduces the effort involved in transaction development and increases the time-to-market. Also, in the context of e-Government transactions where we have to deal with complex *security and privacy constraints* concerning the exchange of data between administrations, the notion of *subflow* allows us to encapsulate business activities and the corresponding data requirements in separate sub-processes, which can be managed in a decentralized way.
- SOAP [15] as the core messaging protocol
- XML:DB API [24], to access the eXist [18] XML database.
- W3C XMLSchema, for the description of messages
- Chiba [25], an implementation of the XForms recommendation of the W3C.
- Xlinkit for a first-order logic business rules language and engine that constraints the transaction at both the content and the flow level.

3. EA2 CASE STUDY

EFFICIENT has been used as a tool for decision support in the project EA2 [5] (Euro Asian EDI Adaptation), funded by the Co-operation Office of the European Commission, addressing the transfer and the adaptation of an e-Business infrastructure based on international EDI standards to the socio-economic context of the republic of Vietnam. A case study was performed to illustrate the methodology developed for the tailoring of a set of standard electronic transactions to the particular needs of the target country. Two transactions from the domain of e-Government were chosen as a pilot, an Import-Export scenario and a public Call for Tender, based on intermediate work results of the European IDA [4] (Interchange of Data between Administrations) program. In this paper, we refer to the Call for Tender transaction for illustration purposes.

The following sections detail the different static and dynamic properties of the Call for Tender transaction and outline the process of validating their correctness and feasibility both from an IT (soundness, performance, completeness) and from an usage perspective (appropriateness, legal considerations, particular needs). It will be argued that only a joint effort of the IT experts and business experts leads to a sound specification of the electronic transaction. The EFFICIENT toolset is used to create a shared understanding between both groups and to guide them through the process of building and agreeing on the different aspects of the transaction.

3.1 Design of the Business Domain

When designing a new transaction or customizing an existing one, first the actors involved need to be identified. In the IDA *Call for Tender* transaction, the following actors exist:

- The Contracting Authority or CA: the party that issues a request to buy goods, services or works. It can be a state, a regional or local authority, a body governed by public law, associations formed by one or several of such authorities or one or several of such bodies governed by public law.
- The economic operator or EO: a contractor, a supplier or service provider who aims at proposing his services, goods or works in response to the request of the Contracting Authority.

Next, the different parties or actors need to agree on a common set of concepts to make sure they have a common understanding of what we call the business domain, that is, that they "speak the same language". The business domain is made up of the key concepts of the business sector and details the relationships that hold between them. In EFFICIENT, the business domain is modeled using a specific UML class diagram, which consists of classes with their properties (attributes) and the relationships (associations) that hold between the classes. A part of the business domain of our transaction is shown in Figure 2.
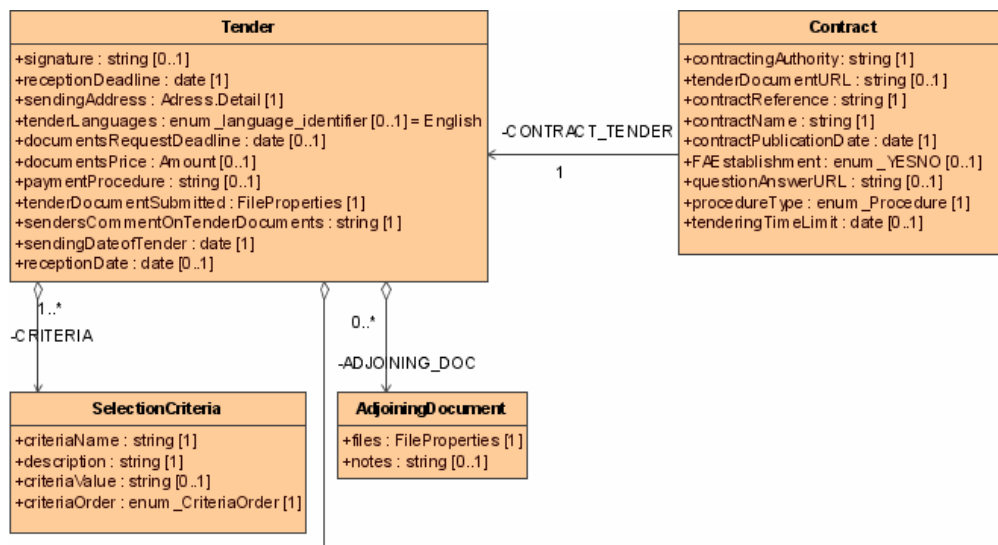
Figure 2. Part of the Call for Tender Business Domain

3.2 Design of the Dynamics of the Transaction

Once the basic vocabulary and a common understanding of the business domain have been achieved, we can then describe the business process underlying the transaction. We use a UML activity diagram to detail the flow of business documents among the participating actors, and the activities (responsibilities) each participant will need to carry out at what stage of the transaction. The activity diagram is composed of swimlanes representing the different roles that occur in the transaction and activities performed. Each business document the actors exchange is defined by a UML class diagram detailing its structure and information content (see section 2.3). Figure 3 depicts the first part of the Call for Tender activity diagram: two types of actors participate in the transaction, an Economic Operator and a Contracting Authority. The Contracting Authority (CA) published a call for tender to a list of pre-selected economic operators. Each Operator that receives the call for tender information can signal his/her interest. Those who want to participate will receive the contract documents from the CA. With the contract documents they can examine if they will be able to meet the requirements stated, compile the prequalification document requested and send them back to the CA. The CA will assess each candidate's qualification and inform the Economic operator with an RTP_RESPONSE document.
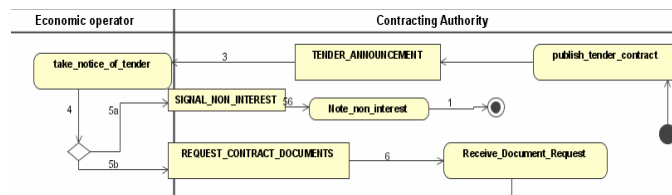
Figure 3. Beginning of the Call for Tender transaction

3.3 Specify the Structure of Business Messages

In the next phase, we define the information content for each of the business documents used in the activity diagram. The decision on what needs to be in and what doesn't for a particular document is based on the information needs of the document recipient in order to perform the business activities he's requested to. In EFFICIENT we model business documents by UML class diagrams, which are built by selecting a subset of the classes and relationships from the business domain.

The class diagram for the message "Tender_Announcement" is given in Figure 4. It contains information about the tender contract, the lots the tender is split into as well as information about the Contracting Authority.
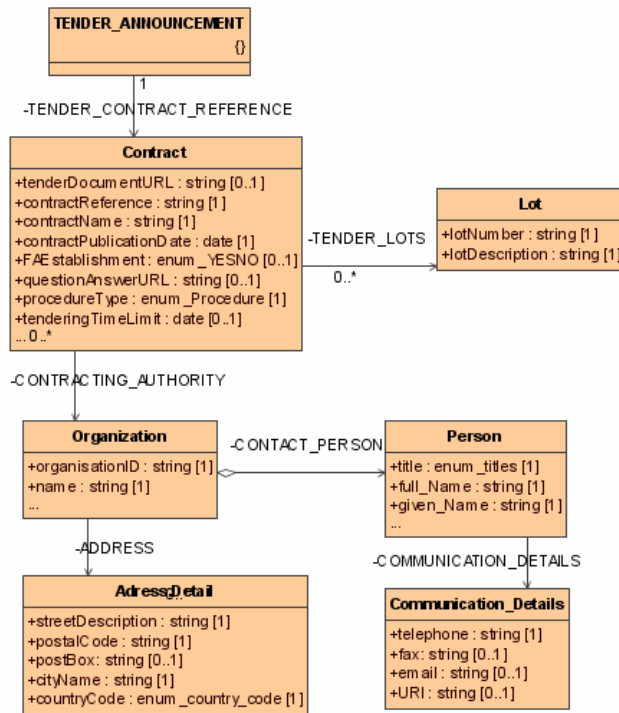
Figure 4. The class diagram of the "Tender_Announcement" message

3.4 Adding Business Rules (constraints)

Rules may be added to constrain the information content that may be input in a business document, in analogy with the value domains and rules that apply to paper-based forms used by administrations. Figure 5 shows a rule that requires the value of the *ContractReference* element of the document "REQUEST_CONTRACT_DOCUMENTS" to be identical with the *ContractReference* that was input in the preceding "TENDER_ANNOUNCEMENT" document. More about business rules, their structure and the way they are implemented is given in [7].
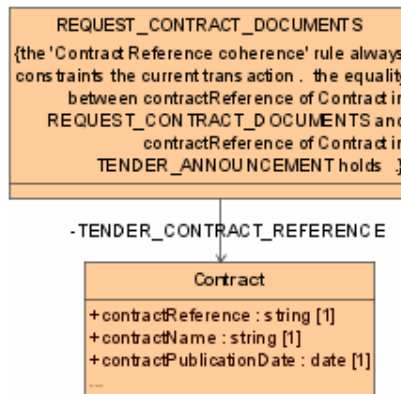
Figure 5. Inter-messages rules on the "Request_Contract_Document"

3.5 Generation of the transaction mock-up (simulation)

Once the transaction has been designed and formally verified, the infrastructure needed for the orchestration (animation) at the technical layer is automatically generated from the UML models developed at the specification layer. The flow of the business transaction, modeled in an UML activity diagram, is translated into an XPDL, file that initializes the workflow engine, the core component of the Efficient server. Each message, specified in a restricted UML class diagram, translates into an XMLSchema; the business rules that govern the transaction are transformed into an Xlinkit representation. These files are stored in an xml database used by the workflow engine. More about these aspects can be found in [3]

3.6 Validation and Customizing of the Call for Tender Transaction

As already detailed in section 3.5, The EFFICIENT toolset supports the automated generation of code necessary for a workflow-based simulation environment (animator). The code generated for the animator includes the transaction flow monitor, the code generated from business rules as well as the interfaces for reading and writing xml-encoded business documents (messages).

The animator is Internet based with a workflow (WF) engine at its core that coordinates the execution of the business process. Figure 6 illustrates the behaviour of the workflow engine for the message exchange between the Contracting Authority and the Economic Operator.
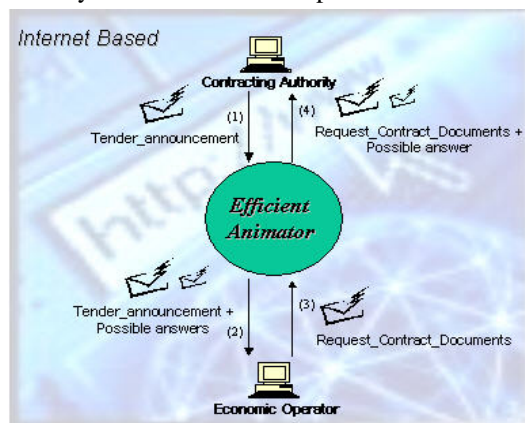
Figure 6. Exchange of messages in the EFFICIENT Animator

The Contracting Authority (CA) sends a "Tender_announcement" (see the generated use interface on Figure 7) message to all Economic Operators (EO) that participate in the Call for Tender. The animator

receives the message and verifies whether it satisfies the requirements specified by the UML data models. If it finds no error, it forwards the message to the recipients and determines the set of possible answers (messages that may follow the current one) as defined in the UML activity diagram. The EO can then either declare that he is not interested in participating in the Call for Tender, or he can request the tender contract documents from the CA.

Figure 7. Part of the "Tender_Announcement" form

4. PRIVACY CONCERNS IN DATA INTERCHANGE

Data exchange between administrations differs from private data exchange in that what may or may not be shared (and hence exchanged) between administrations is regulated by law. In EFFICIENT, we meet these requirements in that we are currently about to integrate the possibility to model and animate sub-processes in separate transactions. Each such nested transaction is embedded in the global control flow where it is called and controlled from a higher-level process. As with other activities of the activity diagram, a nested transaction receives the data it requires to perform the set of encapsulated business activities from the calling process; it then carries out the activities associated and delivers a set of values (data) as result. At the same time as the notion of sub-flow helps encapsulating administrative functions along with the associated data, it enables a decentralized control of the overall electronic service an administration may offer. Each component of the overall service may be delegated to one or several independent administrative units that deal with their respective responsibilities without having to share all their data by referring to a centralized data repository that would keep all the data. A sub flow may be associated with a separate role in the UML activity diagram in order to assign it a separate workplace (identified by its IP-address) and hence make the simulation as realistic as possible. While for the design and simulation purposes the sub-flow concept may be a viable solution, in an operational environment it requires a distributed control of the process based on several independent workflow engines. The EFFICIENT animator does work with a central workflow-engine only; this bears the disadvantage that, although the interactive validation (simulation) may be realized in a distributed way, they various sub flows share a common database. It is currently being evaluated whether we will extend the architecture of our tool to implement a decentralized flow control that uses multiple workflow engines.

5. CONCLUSION

EFFICIENT is a tool for design and validation of electronic transactions; it involves the business experts that define the requirements, the roles and responsibilities associated with new service transactions and enable them to validate the soundness and the correctness of a future transaction before it is implemented. The

validation process involves the end-users (those who know the application domain best) and allows them to participate in the conception phase; this increase the level of appropriation of the service transaction as well as it raises the acceptance level. More information can be found at our website, http://EFFICIENT.citi.tudor.lu.

Future work is in two directions. On the one hand there is a need for improving our understanding of the value associated with an e-service and how this value is brought about throughout the course of the electronic transaction [9]. Further effort lies in the implementation of additional functionality such as a transaction monitor and the simultaneous animation of several transactions (with a role specific work list); we also work on more expressive business constraints to further be able to refine the dynamic and static aspects of a transaction. An example is the specification of time constraints on the activities that make up a transaction; Also, as explained in section 4, it will be evaluated if additional value could be gained by implementing a distributed process control with multiple workflow engines each of which would control a part of the service.

REFERENCES

[1] Maria Bergholtz, Prasad Jayaweera, Paul Johannesson and Petia Wohed, 2002, "Process Models and Business Models - A Unified Approach", *International WorkShop on Conceptual Modelling Approaches for e-Business*, ER 2002 Tampere, Springer LNCS.

[2] http://www.staat-modern.de/-,10010/E-Government.htm , Bundesministerium des Inneren : Moderner Staat, Moderne Verwaltung, ,Bundesregierung Deutschland.

[3] R. Eshuis, P. Brimont, E. Dubois, B. Grégoire, S. Ramel, 2003. *Animating ebXML Transactions with a Workflow Engine*, In Proc. CoopIS 2003, volume 2888 of LNCS, Springer.

[4] http://europa.eu.int/scadplus/leg/en/lvb/l24147a.htm

[5] http://www.edivn.org.vn/EA2/

[6] Prasad M. Jayaweera, 2004. "A Unified Framework for e-Commerce Systems Development", Kista : Dept. of Computer and Systems Sciences, Univ./KTH, PhD thesis.

[7] Amel Mammar, Sophie Ramel, Bertrand Grégoire, Michael Schmitt, Nicolas Guelfi, 2005. *EFFICIENT: A Toolset for Building Trusted B2B Transactions*. Accepted for 17th Conference on Advanced Information Systems Engineering (CAISE'05), Porto, June 2005.

[8] New Zealand e-Government strategy: Government,nz @your services, http://www.e-Government.govt.nz/docs/e-gov-strategy-dec-01/strategy-dec01.pdf, 2001.

[9] M. Schmitt, B. Grégoire, C. Incoul, S. Ramel, P. Brimont and E. Dubois,2004. If business models could speak! EFFICIENT: a framework for appraisal, design and simulation of electronic business transactions, ICEIMT 04, http://EFFICIENT.citi.tudor.lu.

[10] Stabsstelle IKT-Strategie des Bundes: Behörden im Netz, Das österreichische E-Government ABC, Bundeskanzleramt Oestereich, 2004.

[11] Pascal van Eck, Jaap Gordijn, Roel Wieringa,2004: Value-Based Design of Collaboration Processes for e-Commerce. EEE 2004: 349-358.

[12] Rosettanet, eBusiness standards for the global supply chain, www.rosettanet.org

[13] http://wfmopen.sourceforge.net/

[14] http://www.wfmc.org/standards/XPDL.htm

[15] http://www.w3.org/TR/soap/

[16] http://www.w3.org/XML/Schema

[17] http://www.magicdraw.com/

[18] http://exist.sourceforge.net/

[19] http://www-128.ibm.com/developerworks/library/specification/ws-bpel/

[20] http://www.xlinkit.com

[21] http://www.w3.org/MarkUp/Forms/

[22] http://www.swift.com/

[23] http://www.edifice.org/

[24] http://www.xmldb.org/

[25] http://chiba.sourceforge.net/References

A MULTI-PERSPECTIVE EFFECTIVENESS EVALUATION METHODOLOGY FOR MGOVERNMENT (MPE²M-mG)

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ABSTRACT

The benefits, which can also be considered as incentives or drivers, of implementing mGovernment services, include increasing effectiveness of government processing (back office) and services (front office). The objective of this study is to identify a method that best assesses and measures the effectiveness of mobile services (mServices) rendered by mGovernment entities, regardless of the type of the end-user. It has been developed as a follow-on to the generic management framework developed by the researchers to guide government in managing the adoption of wireless and mobile technologies for the implementation of mGovernment services. The Adaptive Management Approach is combined with two measurement methodologies to produce a Multi-Perspective Effectiveness Evaluation Methodology for mGovernment (MPE²M-mG).

KEYWORDS

mGovernment, effectiveness, evaluation, mobile, services, management.

1. INTRODUCTION

Effectiveness may be defined as the extent to which the goals of a certain policy measure have been achieved. A government initiative measure is said to be effective if the goals are reached, i.e. if the outcomes match with the goals. Government is said to be effective when it renders its services to its constituents, and produces a desired result . Effectiveness evaluation is used to describe the relationship between inputs and desired outcomes, that is, between the amount of resources used and the desired effect or result achieved by a project or program (The City of Norfolk VA 2005). According to Paul Epstein (1998) "effectiveness measures service responsiveness to public needs and desires; service quality is an important effectiveness consideration". Accordingly, in order to evaluate effectiveness of mGovernment services both of the inputs and outcomes have to be defined and then evaluated and measured as accurately as possible.

Inputs are the resources that are provided by the mGovernment. Implementing these resources creates opportunities but also provides challenges. For example, a monetary amount, human capital or a tax deferral is considered an input once it is provided as a resource by the government. Although each input would, or could help to, create certain opportunities (such as more employment or the establishment of a small or medium size business (SME)) certain challenges would still be apparent such as the lack of institutional guidance or strategic thinking. On the other hand, outcomes of a process are 'something that follows as a result or a consequence' (Merriam-Webster) from the outputs. An increase in competitiveness, or growth in economy are examples of outcomes. As outcomes bring in benefits which achieve the initial goals, they also invoke some risks, for example, security risks associated with wireless technologies, financial risks linked with the purchase of expensive and easily stolen mobile devices as well as probable interoperability problems.
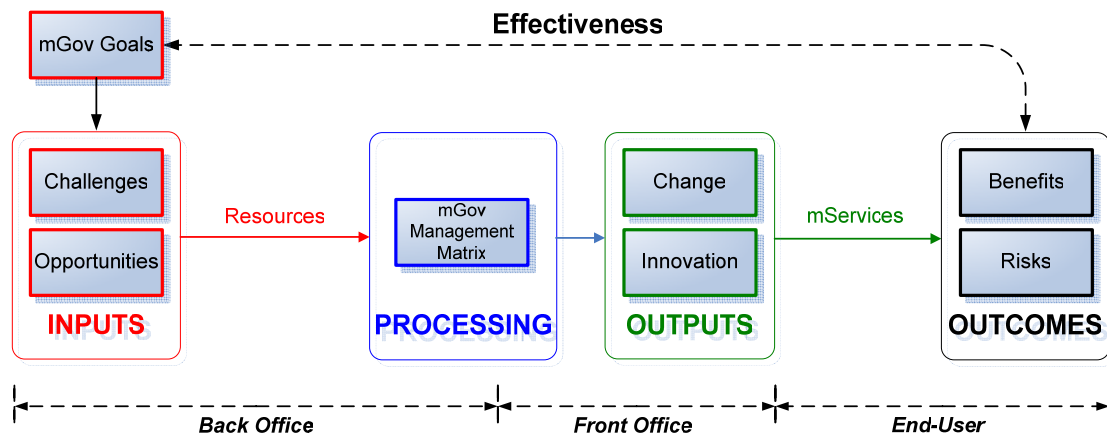
Figure 1. Effectiveness as a relation between inputs and outcomes. Source: Adapted from El-Kiki et al 2005

Inputs of the mGovernment are practically processed at the 'back office', whilst outcomes are the results gained from the services rendered by the 'front office' as shown in Figure 1. The mGovernment back office undertakes all the activities and processes in order to produce a service, such as finance, human resources, Information Technology (IT) support, facilities management, marketing and communications. Front office activities and processes cover the supply of a service to the end-user, who can be any of the mGovernment constituents, i.e. citizens, businesses or other government agencies.

Effectiveness evaluation, as one of the elements used to measure performance, covers all of the activities performed by both back and front offices to produce a service. As a management tool used to assess whether policies, regulations or measures meet their intents based on evidence of their outcomes, evaluation should not only focus on whether the mGovernment goals have been achieved, but it should also bring together all of the stakeholders who affect or participate in making policies producing a service. The Bournemouth Council in England have implemented use of mobile devices to assist in council decision making. Each weekend Council cabinet members may quickly outline their plans for the town to a public audience at the university. The audience then vote on the proposals using key pads, with other votes coming in by e-mail, text and online. The council believes this is one way to check if they are satisfying the people's need for information and to engage young people with this method, although it is open to all age groups (Textually.org 2005).

Wohltorf & Albayrak (2003) adumbrate eight benefits which an end-user seeks in order to accept an mService: mobility, pastime, information quality, efficiency (time & money), spontaneity, convenience, currency (up-to-date) and reachability (own & others). These benefits accompanied by risks, are the two types of outcomes which are inherent in any major mobile and wireless project. Loudon & Loudon (1991) argue that risk is taken to be a negative outcome that has a known or estimated probability of occurrence based on experience or some theory. This negative outcome becomes a 'silent problem' when it is relevant to stakeholder concerns and interests (Willcocks and Margetts 1994).

On the other hand, outputs are the direct effects of mGovernment management processing such as an increased number of activities or services, or a better-educated workforce. Increasing the number of services or introducing a new service is viewed as the response to the processing which can take the shape of change and/or innovation (El-Kiki, Lawrence et al. 2005). Comparing outputs with outcomes, outputs are usually much more practical to measure than outcomes, and can be more useful in specifying responsibility. Outputs are also, usually, easier to cost than are outcomes, as outcomes are indirect and affected by several variables (UN Expert Group 2003).

A successful multi-perspective effectiveness evaluation methodology for mGovernment services must be available to analyse what the end-users' desired benefits are, and what their silent problems could be, and what should be done to deal properly with both. This evaluation will measure the end-user satisfaction which is an essential factor in both analysing the current, and predicting the potential, mGovernment audience. Accordingly, this study will help to provide answers to questions such as:

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1. To what extent will policy, program or initiative goals and objectives be defined and achieved when applied to mGovernment services?
2. Are there other or alternative methods for achieving those goals and objectives?
3. To what extent does the evaluation lead to more Research and Development (R&D) activities at the mGovernment management level?
4. What is the influence of the type of end-user, service, and sector and R&D activities on innovation and change for a certain government agency if it provides mobile services?
5. What is the adequacy of the quality of the mServices provided relative to the citizens' needs, desires and willingness to pay?
6. Are resource values being maintained by offering mGovernment services?
7. Are citizens' trust, privacy and security concerns being addressed adequately?

In addition, for the sake of simplifying the idea of this study, not all the inputs or outcomes of an mGovernment service are considered. Accordingly, the effectiveness assessment product aims to provide an initial indication rather than an authoritative evaluation. Part 2 of the paper provides a background overview of measuring effectiveness and part 3 outlines the methodology of the paper. Part 4 describes the multi-perspective mGovernment Effectiveness Evaluation Methodology while the conclusion and future directions are contained in Part 5.

2. BACKGROUND ON EFFECTIVENESS MEASUREMENT APPROACHES

The following review for methods and approaches evaluating governmental policies is provided by Evert Vedung (2000) in Table 1. These methods expound the basic concepts for designing an evaluation process without handling the technical details pertaining to data collection and analysis.

Table 1. A summary of some effectiveness measurement methods (adapted from Vedung, E. 2000)

Effectiveness Evaluating Method	Explanation & Comments
Goal-attainment Model	• basic evaluation approach • evaluator judges whether the goals of the program have been reached • effects are a result of the support measures.
Side-effects Model	• takes the goals of the support measure into account • examines both positive and negative side effects.
Goal-free Evaluation Model	• assesses the effects of an (economic) intervention • ignores the objectives of the measure, • believes pre-occupation with the objectives of the measure narrows the view of the evaluator.
Comprehensive Evaluation Model	• incorporates the implementation • sometimes involves the planning process of the support measure in the evaluation • may include parts of the intervention other than the outputs and outcomes, such as the processes of implementation and feedback.
Client-oriented Model	• may include clients' (or beneficiaries') goals, expectations, concerns or needs as the criterion of merit. • based on whether a measure satisfies the clients' concerns and expectations - in contrast with the question whether the measures' goals have been met. • market-drive perspective acknowledges the fact that recipients' objectives and drives do not necessarily coincide with the programme management's goals.
Stakeholder Model	• acknowledges the effects of the intervention in the recipients' clients, competitors suppliers. • organises an evaluation around the organisations (people) that have an interest in or are affected by the intervention.
Policy Commissions	• Swedish alternative to the stakeholder approach • stakeholders are not consulted but perform the evaluation. • stakeholders invited by the government to participate in an ad hoc policy

	commission to advise the government on the effectiveness of the scheme.
	• government does specify the issues that should be part of the evaluation, but does not interfere with its completion.
	• policy commissions are future-oriented.
	• commissions' analyses are focused much more on alternatives for future action than on impacts of past policies.
	• in practice, the work of these policy commissions is much more a political enterprise than thorough research work.
Cost-effectiveness	• economic approach
	• measures inputs in purely estimated monetary terms
	• outcomes are measured in terms of actual impact
	• inputs and outcomes are divided in such as way that the cost per unit of outcome quantified.

3. STUDY METHODOLOGY

This paper represents the next stage in our study of the potential of mGovernment to provide effective services to constituents of a state or country (El-Kiki, Lawrence et al. 2005). The focus of our initial literature review concentrated on existing response models for mGovernment. Academic databases, mainly Proquest and Computer and Information Systems Abstracts (CSA), were consulted to search for papers that dealt with the impact and response of either ICT or wireless and mobile technologies on government. Kushchu and Borucki (2004) devised the Mobility Response Model; another useful framework for mobile government was developed by Goldstuck (2003) and the authors devised a generic framework in (El-Kiki, Lawrence et al. 2005).

As mGovernment is a new area of research, there are very few completed studies, so exploratory research is a legitimate methodology (Hussey and Hussey 1997). Such exploratory research assists in establishing the theoretical foundation for further examination and has been vital in developing a viable, theoretical framework as set out in our previous paper (Sekaran 2003) and which is further expanded in this paper.

It became apparent to the researchers that the measurement of effectiveness for mGovernment services such as mobile payment for mGovernment services (Mallat, Rossi et al. 2004), would be of vital importance if the delivery of such services is to be handled by mobile devices which currently face such technical challenges as handover, roaming, dropout, lack of technical standards and security issues.

Our investigations have resulted in a new evaluation methodology which is the result of applying the Adaptive Management Approach or AMA (Holling 1978) to a combination of two measurement tools called Goal/Question/Metric or GQM (Solingen and Berghout 1999), and Balanced Scorecard Approach or BSA (Kaplan and Norton 1992). We have called this new evaluation methodology Multi-Perspective Effectiveness Evaluation Methodology for mGovernment (MPE2M-mG) as in figure 2.
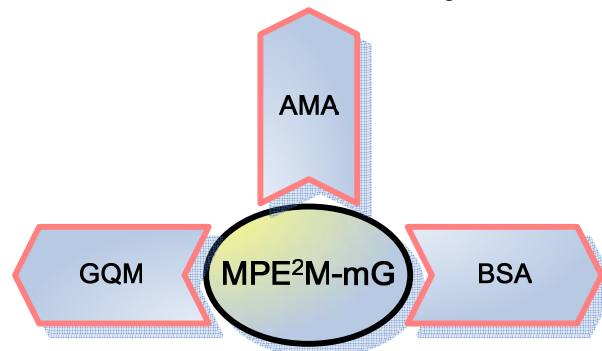
Figure 2. Multi-Perspective Effectiveness Evaluation Methodology for mGovernment

Adaptive management is a formal, systematic and rigorous approach to learning from the outcomes of management actions, accommodating change and improving management. It involves synthesizing existing knowledge exploring alternative actions, and making explicit forecasts about their outcomes. The key

characteristics of adaptive management (Nyberg 1998) are set out below and explained in the context of providing an mGovernment service such as Table 2:

Table 2. AMA applied on mGovernment in Hungary. Source: Derived from Information Policy (2004)

Key	Result and examples	mGovernment in Hungary
Acknowledgement of uncertainty about what policy or practice is "best" for the particular management issue.	Public authorities developed mobile government services through SMS and WAP technologies.	This is undertaken because Mobile phone penetration rate is 81% (in contrast with 30% for computers).
Thoughtful selection of the policies or practices to be applied.	Hungarian Government Introduced mobile phones into public administration procedures.	Mobile phones are a highly inclusive technology in Hungary.
Careful implementation of a plan of action designed to reveal the critical knowledge.	A special vehicle history report available via a premium rate SMS service run by the Hungarian Ministry of Interior.	For the sake of effectively communicating with different constituents.
Monitoring of key response indicators.	A diversity of data may be collected from the above and from other mServices introduced in Hungary e.g. • Payment of parking fees • Notification of school results and processed forms • Application to use public premises	Currently implementing methods for monitoring the effectiveness of these applications.
Analysis of the outcome in consideration of the original objectives	By implementing quantitative methods e.g. log files and statistics analyses (regression, factor, variance, etc); and qualitative methods e.g. questionnaires, best practices, SWOT and historical analyses.	Has the special vehicle history report available via a premium rate SMS service run by the Ministry of Interior been effective? What is the effectiveness of the other mServices?
Incorporation of the results into future decisions.	Maximizing benefits by adding a new mService, modifying or terminating an existing one.	Could mobile voting be added to the list of mServices offered by the government?

Meanwhile, GQM defines a certain goal, refines this goal into questions, and defines metrics that should provide the information to answer these questions. By answering the questions, the measured data defines the goals operationally, and can be analysed to identify whether or not the goals are attained. This GQM defines metrics from a top-down perspective and analyses and interprets the measurement data bottom-up (Solingen and Berghout 1999). The researchers found that this method would be suitable for adaptation for the measurement of effectiveness of mGovernment services such as the Hungarian examples found in Table 2. Accordingly, in order to derive proper indicators and metrics we have developed an approach which is defined on the basis of GQM paradigm by Basili & Weiss (1984), as explained in part 4.

Balanced Scorecard Approach is another framework for measuring and evaluating performance from a management system perspective. It is meant to be a management system, and not only a measurement system, to provide feedback around both the internal business processes and external outcomes in order to continuously improve strategic performance and results. This approach takes four perspectives: customer (citizen & business) perspective, operational / internal business process perspective, innovation / learning perspective, and financial /economic perspective. Thus In the Bournemouth Council and the Hungarian mGovernment services examples, management would need to measure and evaluate their systems from these four perspectives. Both GQM and BSA are combined to work on the evaluation step of the AMA, as the next section details this new method for evaluating the effectiveness of mGovernment services.

4. MULTI-PERSPECTIVE EFFECTIVENESS EVALUATION METHODOLOGY FOR MGOVERNMENT (MPE^{2}M-mG)

The researchers propose the following as suggested steps for a complete effectiveness evaluation process for mGovernment services. Authors adopt AMA and adapt it as the backbone framework for effectiveness evaluation process. The provision of mobile payment for a government service such as payment of parking

fees to a Council, as a typical mGovernment service, is used as an example. Figure 2 illustrates six cyclic steps which actualize the concept of AMA.
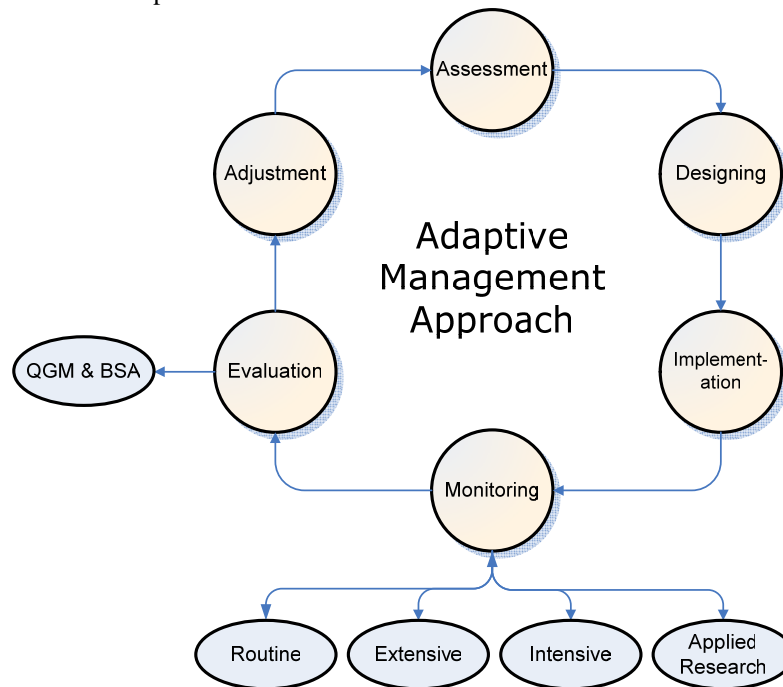
Figure 3. Effectiveness evaluation process implementing AMA. Source: Adapted from J.B. Nyberg (1999)

4.1 Problem Assessment (Research Question)

The scope and dimensions of the mService effectiveness problem are defined, usually in a form of a question. The basic research question for our 'mobile payment for a government service' example would be: does it work? Accordingly, additional questions should be derived covering the scope and dimensions of this mService. Those questions will lead to, or be translated into, goals, and, in turn, goals will lead to deriving metrics which are used in the evaluation step. In fact, this is how the QGM approach is initiated. Examples for additional questions for the Hungarian applications such as the parking payment could be:
- to what extent are the goals and objectives of this service defined and achieved?
- to what extent are allocated resources used for this service?
- to what extent are the end-users satisfied using this service? (Refer to Table 2)

4.2 Designing a Management Plan

A management plan and monitoring system is designed for capturing reliable data about the effectiveness of the mPayment service provided by mGovernment. Issues and assumptions are made explicit at this step, in order that the policy makers and evaluators make suitable decisions regarding the data to be collected which mainly depend on aspects that need to be analysed, and the methods with which that data are analysed. For example how many citizens are paying via their mobile device in the Hungarian example, is it cost effective, is it only reaching the young people etc? This means that this step results in a model which is used to describe the support, measure and provide evidence of the measure's effect (European Commission 1997). This can be done using both quantitative (objectives) and qualitative (subjective) methods. Log files and statistics are examples of the quantitative methods, whilst questionnaires, best practices and historical analyses are examples of the qualitative methods, which also tend to be cognitive. The collected data could be:
- qualitative and/or quantitative data by interviewing users of the mobile service application and/or collecting user statistics for the mobile service;

- primary or secondary data for example by examining other mGovernment initiatives in other countries

4.3 Implementation

Both management plan and monitoring system are put into action. In this case it might be useful to follow the advice of Rheingold (2005) who suggests that employers should be questioning their 21 year old newly hired employees to learn about mobility. Does the mGovernment service plan and monitoring system take into account the people who are using the service?

4.4 Monitoring

Monitoring determines how effective actions have been in meeting the objectives of the effectiveness evaluation. Varying arrays of questions impose different monitoring intensities as follows:
- Routine: such as using yes/no questions.
- Extensive: such as using categories like good, fair and poor.
- Intensive: more detailed quantitative data collection.
- Applied research: such as a controlled approach for example using an ethnographic researcher to follow and observe the users in action.

4.5 Evaluation

Collected data do not mean the solution to the research questions created at the first step. Analysing and evaluating these data reveal the answers which will be interpreted into decisions and actions by the decision makers and evaluators. At this step the authors suggest the following tool that facilitates a thorough analysis and evaluation of an mService effectiveness. This tool is the combination of both QGM and BSA approaches as mentioned previously. If it is applied to mobile payment for a government service, as an example, it must detail goals from four different perspectives (citizens/businesses, operational/internal business, innovation/learning and financial/economic). These goals are considered the answers to questions set at the first step, which represents the conceptual level of the QGM approach. The operational level of QGM assigns indicators to each goal. In turn, every indicator is interpreted into metrics at the quantitative level. Table 3 illustrates this MPE^2M-mG methodology. It is worth mentioning that only examples of goals, indicators and metrics are included, which means more detail must be handled in a real case study. The sum of all metrics values is represented by 'V', which means a numeric figure measuring the effectiveness of this mService.

Table 3. A Multi-Perspective Effectiveness Evaluation Methodology for mGovernment

QGM \ BSA Perspectives	Conceptual Level / Goals	Operational Level / Indicators	Quantitative Level — Metrics															
			MT1	MT2	MT3	MT4	MT5	MT6	MT7	MT8	MT9	MT10	MT11	MT12	MT13	MT14	MT15	Totals
Citizens / Businesses	Value for money	Pricing	(A)															(A)
			(B)															(B)
	Quality of Service	Availability		(A)														(A)
				(B)														(B)
		Reliability			(A)													(A)
					(D)													(D)
		Accuracy				(A)												(A)
		Responsiveness					(A)											(A)
		Courtesy and Helpfulness						(A)										(A)
	Efficient – Transaction	Usability							(A)									(A)
									(B)									(B)

Perspective	Objective	Attribute														V
		Timeliness							(A)							(A)
		Privacy								(A)						(A)
		Privacy								(B)						(B)
		Security									(D)					(D)
	Strategic Data	Accountability										(A)				(A)
Operational / Internal Business	Citizens' & Businesses' Satisfaction	Productivity											(A)			(A)
		Productivity											(B)			(B)
		Productivity											(C)			(C)
		Interoperability												(A)		(A)
		Technology													(A)	(A)
		Technology													(B)	(B)
Innovation / Learning	New mPayment Facilities	Productivity											(A)			(A)
		Productivity											(B)			(B)
		Productivity											(C)			(C)
		Usability						(A)								(A)
		Usability						(B)								(B)
	Better Operational Efficiency	Availability		(C)												(C)
		Availability		(D)												(D)
		Availability		(E)												(E)
		Availability		(F)												(F)
		Reliability			(B)											(B)
		Reliability			(C)											(C)
		Reliability			(E)											(E)
		Accuracy				(A)										(A)
		Responsiveness					(B)									(B)
		Responsiveness					(C)									(C)
		Responsiveness					(D)									(D)
		Security									(A)					(A)
		Security									(B)					(B)
		Security									(C)					(C)
		Security									(E)					(E)
	More Value for Constituents	Usability						(A)								(A)
		Usability						(B)								(B)
		Timeliness							(B)							(B)
Financial / Economic	Value for money	Profitability	(A)													(A)
		Profitability	(B)													(B)
	Reduced Cost / Economic Growth	Profitability													(A)	(A)

	Value of Mobile Payment Service Metrics	**V**
MT1	(A) Percentage of mPayment service charges to those of other ordinary methods of payment	
	(B) Percentage of reduction in costs	
MT2	(A) Customer uptime percentage	
	(B) Number of disconnections	
	(C) Number of repeat disconnections	
	(D) Number of unplanned disconnections	
	(E) Number of "maintenance events"	
	(F) Number of planned disconnections	
MT3	(A) Failed service attempts percentage	
	(B) Service downtime percentage	
	(C) Dropped transactions percentage	
	(D) Failed transactions percentage	
	(E) Failed user disconnects percentage	
MT4	(A) Number of errors	
MT5	(A) Average help desk response time	

	(B) Average one-way delay/latency
	(C) Average round time delay/latency
	(D) Average response time
MT6	(A) Degree of satisfaction
MT7	(A) Degree of understandability
	(B) Degree of learnability
MT8	(A) Degree of citizen's perception of on-time transactions
	(B) Percentage of transactions completed by due date
MT9	(A) Size-of-anonymity-set metrics
	(B) Entropy-based metrics
MT10	(A) Number of security breaching incidents reported externally to law enforcement (Office of Management and Budget 1996)
	(B) Percentage of transaction that had formal risk assessments performed and documented
	(C) Percentage of total transactions that have been processed following certification and accreditation
	(D) Percentage of perceived security
	(E) Percentage of employees with significant security responsibilities who have received specialized training
MT11	(A) Accountability-for-result metric
MT12	(A) Number of transactions per (period of time)
	(B) Number of finalised transactions per (period of time)
	(C) Number of transactions per employee
MT13	(A) Level of Systems Interoperability (LISI)
MT14	(A) Type of facilities offered by the technology
	(B) Ubiquity degree of the technology
MT15	(A) Return on Investment (ROI), (services targeted at businesses tend to have higher usage than those targeted at citizens and, consequently, deliver the highest value (Accenture 2003).

The evaluation step concludes with a comparison between the resulting value V and a threshold value established as a measuring criterion by decision makers and evaluators, as follows:

- Less Effectiveness: $V_{new} < V_{threshold}$
- Same Effectiveness: $V_{new} = V_{threshold}$
- More Effectiveness: $V_{new} > V_{threshold}$

Based on this comparison, decisions are made to continue, adapt or terminate this mService.

4.6 Adjustment

In reality, additional, and unplanned-for, results and ideas may be generated during the evaluation process. For example, the idea of how this mService could be improved, or why it should continue if it does not prove effective or fulfil its goals. These results and ideas should be included in the final evaluation report as they may provide significant perception about the general performance of the mService. Hence, adjustment to the management plans, monitoring systems, objectives and models created at the second step (designing) is crucial to reflect different understanding and forecasting for more realistic measuring criteria.

5. CONCLUSIONS AND FUTURE DIRECTIONS

This study proposed a methodology to assist in the evaluation of the effectiveness of mGovernment services. By interpreting questions about the effectiveness of an mService into goals, indicators and metrics are derived. An intuitive, sequential and simple evaluation approach is implemented utilizing the Adaptive Management Approach. Quantitative and qualitative methods should be used to gather data for the evaluation step. As effectiveness measurement means criteria that result from the evaluation process, these criteria will also used as thresholds future indices and benchmarks.

Further research will focus on conditions of applying the effectiveness evaluation methodology discussed in this study, and how the performance of mGovernment, in general, can be affected once this element (effectiveness) is adjusted to a certain rate. Our next step will be to apply the methodology to an existing mPayment, mGovernment service to test its viability.

REFERENCES

Basili, V. R. and D. M. Weiss (1984). "A Methodology for Collecting Valid Software Engineering Data." IEEE Transactions on Software Engineering SE-10(6): 728–738.

El-Kiki, T., E. Lawrence, et al. (2005). A Management Framework for Mobile Government Services. CollECTeR.

Epstein, P. D. (1998). Using Performance Measurement in Local Government. New York, National Civic League Press.

European Commission (1997). Evaluating EU Expenditure Programmes. A Guide. ex post and Intermediate Evaluation, DG XIX.

Goldstuck, A. (2003). Government Unplugged, Mobile and Wireless Technologies in the Public Service, Centre for Public Service Innovation, in partnership with Technology Research (State Information Technology Agency) Council for Scientific and Industrial Research - icomtek.

Holling, C. S. (1978). Adaptive environmental assessment and management. Chichester, John Wiley and Sons, Ltd.

Hussey, J. and R. Hussey (1997). Business Research methods: Qualitative and Quantative Approaches, USA Pearson Education.

Information Policy (2004). Information Policy. 2005.

Kaplan, R. S. and D. P. Norton (1992). The Balanced Scorecard – measures that drive performance. Harvard Business Review: 70-79.

Kushchu, I. and C. Borucki (2004). A Mobility Response Model for Government, mGovLab, International University of Japan. 2005.

Loudon, K. and J. Loudon (1991). Management Information Systems: A Contemporary Perspective. New York, Macmillan.

Mallat, N., M. Rossi, et al. (2004). "Mobile Banking Services." Communications of the ACM 47(5): 42-46.

Merriam-Webster Outcome. 2005.

Nyberg, J. B. (1998). Statistics and the practice of adaptive management. Statistical Methods for Adaptive Management Studies. Victoria, BC., B.C. Ministry of Forests, Land Management Handbook. 42: 1-7.

Nyberg, J. B. (1999). An Introductory Guide to Adaptive Management for Project Leaders and Participants. 2005.

Rheingold, H. (2005). The Source of Innovation. Connected Workforce. S. Aspinall and A. J. Langer. London, Premuim Publishing.

Sekaran, U. (2003). Research Methods for Business: A Skill Building Approach, Southern Illinois University.

Solingen, R., van and E. Berghout (1999). The goal/question/metric method: a practical guide for quality improvement of software development. London; Chicago, McGraw-Hill.

Textually.org (2005). Interactive Vote on Town's Future. 2005.

The City of Norfolk VA (2005). Glossary/Index, Budget Office. 2005.

UN Expert Group (2003). Improving Public Sector Effectiveness. Dublin, Ireland, Department of Economic and Social Affairs, Division for Social Policy and Development - United Nations - New York.

Vedung, E. (2000). Public Policy and Programme Evaluation,. London, Transaction Publishers.

Willcocks, L. and H. Margetts (1994). "Risk Assessment and Information Systems." European Journal of Information Systems 3(2): 127-138.

Wohltorf, J. and S. Albayrak (2003). Decision Cockpit for Mobile Services. Berlin, Germany, DAI-Labor of the Technische Universitat.

CONTENT SPREADING IN PEER-TO-PEER NETWORKS

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ABSTRACT

Peer-to-Peer (P2P) networks have facilitated the distribution of content, legal or otherwise, with little accountability across a wide variety of jurisdictions. Music, movies and software are all readily distributed through anonymous P2P networks, and much of this distribution is in violation of the copyrights associated with the content. The financial loss world-wide due to the piracy of content via P2P networks is believed by some to be in the range of billions of dollars (Blackburn 2004). In this paper, we investigate the topology of P2P networks and the factors that influence how content spreads from one user to another in such networks. We start by assuming that the nodes in large P2P network infrastructures, such as the follow a power-law distribution. Next we consider some of the factors that affect both the content acquisition and distribution preferences of users of these types of networks. By quantifying the mean acquisition and distribution preferences of the users, we are able to study how various factors, such as legal attacks against specific types of users or technological attacks aimed at the content itself, affect the spread of content in these networks. We show that legal attacks aimed at large distributors (i.e., hubs) have little chance of significantly changing the rate at which content spreads in these networks, but that other forms of technological attack such as flooding the network with degraded content can be very effective in significantly reducing the rate at which content spreads.

1. INTRODUCTION

Peer-to-peer (P2P) networks for file sharing have actually existed for quite some time, but only recently have they been used on a scale that has led to significant problems for the music, movie, and software industries. The first "killer" application was the Napster P2P network, circa 1999, and it was mainly devoted to sharing music encoded as mp3 files, largely in violation of music copyrights. The success of Napster was mainly due to the growth of the Internet and the mp3 compression format. It has been shown that on-line piracy associated with the use of these types of networks has had a large aggregate negative effect on music sales (Blackburn, 2004). Record companies, along with the Recording Industry Association of America (RIAA), have tried to combat this piracy though various means that we will consider in this paper (Blackburn, 2004). However, these efforts have also resulted in making subsequent file sharing systems more robust and decentralized as we shall see (Biddle et al, 2002).

The problems associated with the illegal sharing of music grew as the popularity of the Napster network grew, eventually leading to a RIAA lawsuit aimed at Napster (RIAA). This legal "attack" led to the demise of the original Napster network, but did not abate the growth in popularity of successors, such as the Gnutella and BitTorrent networks, that lack a centralized server making them the "Achilles heel" for RIAA lawyers. Specifically, P2P file sharing systems using the Gnutella framework, such as Kazaa, Limeware, Morpheus and Grokster, have more than picked up the slack left over by the disappearance of Napster. Indeed, continuing advances in compression and storage technologies, along with the increased availability of

broadband access, have facilitated the sharing of movies and other large multimedia files on the same scale that music files are shared. These systems are so effectively decentralized that to completely shut down, one would need to delete the associated software from every one of millions of connected computers. Nevertheless, legal attacks appear to be the common response. For example, in a case recently heard before the United States Supreme Court, MGM prevailed in its lawsuit against Grokster (Electronic Frontier Foundation).

The BitTorrent network, which has become the movie industry's Napster, is an ingenious P2P system which addresses the problem of asymmetric Internet connections, such as ADSL and cable modems, by providing multiple uploads for each download. BitTorrent now accounts for a large part of all the P2P traffic on the Internet (CacheLogic). The movie industry's response has been a series of legal attacks largely aimed at servers or users with fast connections distributing large amounts of content. Our simulations will consider the effect that the removal of these "hubs" has on the ability to share content.

It is against this backdrop that we have studied the affects of technological and legal attacks on P2P file sharing networks. Our simulations assume distributed network architecture with a backbone network of super nodes or hubs which play a role similar to centralized index servers. We describe this model in more detail in the next few sections.

2. THE MODEL

We model a file sharing network as a graph whose nodes represent users, and edges represent connectivity between the users. Furthermore, we assume a particular topology for P2P networks, namely as a scale-free network whose nodes have a power-law distribution. We will then look at how content spreads in these networks, and how the behavior of users affects this spreading. A user's behavior depends on many societal, legal, business and ethical factors. How these factors manifest themselves within a particular individual is difficult to ascertain, and furthermore, likely changes over time. We will attempt to capture these within our simulations using two parameters, f_{acq} and f_{dist} that correspond to the mean values (averaged over all users) of the user's inclination to acquire and distribute content, respectively.

2.1 Acquisition Preferences

First note that not all pieces of content are equal in terms of desirability. Furthermore, if we take into account that massive amount of content that is distributed by P2P networks, the chances that a user may be interested in obtaining a particular piece of content is generally quite small. Next, once it has been determined that a user is interested in obtaining a piece of content, they must decide if they will accomplish this through legitimate or illegitimate means. We denote the latter in our simulations using f_{acq}.

Whether a user decides to acquire a piece of content through legitimate or illegitimate means depends, among other things, on the market price of content, Legal risk involved with illegal downloads, Delivery latency in acquiring content, Ethics and Quality of content available. Note that each of these factors influences the decisions of different users differently, so we take an average value for f_{acq} in our simulations.

2.2 Distribution Preferences

Users of P2P file sharing networks can be classified based on whether they are willing to distribute content or not. We define the parameter f_{dist} as the fraction of users in the network willing to share content. Some of the factors that influence f_{dist} include Altruism, System restrictions that require a synchronized upload (as in BitTorrent), Legal Risk, etc.

Once again, we do not model f_{dist} directly as a function of these parameters. Rather we will assume an average value over all users, and then we will analyze how changes in f_{dist} affect the spread of content in the system. Studies circa 1999 show that approximately one third of all users who participate in P2P content sharing distribute content (Adar & Huberman, 2000).

2.3 Network Topology

There is sufficient evidence to suggest that P2P networks can be modeled as networks with a power-law distribution in their node degree (Barabasi & Albert, 1999; Watts & Strogatz, 1998). Such networks are also called scale-free networks. These networks aroused the interest of researchers after Barabasi and his colleagues found that the structure of the Internet yielded a scale-free connectivity map (Albert et al, 1999). These networks have also been found to model a wide variety of phenomena including human social contact (Girvan & Newman, 2003; Lijeros et al, 2001), collaborations between movie actors (Watts & Strogatz, 1998), hyperlinks of the world wide web (Albert et al, 1999), etc.

Recent measurements of P2P systems such as Gnutella and Freenet show that they obey power-law degree distributions (Clip 2 Company 2001). We shall assume a power-law distribution for the P2P networks in this paper. Note that we are only postulating a model, with no direct evidence. Given the similarity of P2P networks to many other phenomena that are modeled efficiently by these distributions and the measurements of some P2P systems mentioned above, this is not an unreasonable model to assume.

The basic property of scale-free networks is that the distribution of degrees of each node follows a power law. That is, the probability that a node has degree d is proportional to $d^{-\gamma}$, where γ is a parameter of the network. Scale-free networks are characterized by an uneven distribution of connectedness. Instead of the nodes being randomly connected, some nodes act as "highly connected" hubs, a fact that has a dramatic influence on how the network behaves. The ratio of these very connected nodes to the number of nodes in the rest of the network remains constant as the network changes in size (Barabasi & Albert, 1999).

Scale-free networks are robust to failure of random nodes when compared to randomly distributed networks. Since the number of hubs is insignificant compared to the total number of nodes in the network, it is statistically improbable for all the hubs to fail under random conditions. Hence connectivity in the network is maintained in the case of random failures. As we will show later, any attack aimed at degrading the network must be targeted at bringing down the hubs (Barabasi & Albert, 1999).

3. SIMULATION

In this section we simulate content spreading in scale-free P2P networks. We will look at how different parameters affect the spread of content through the network. We shall also look at the effectiveness of some of the techniques being used to stop the spread of illegal content on these networks.

3.1 Setup

We use a standard procedure to construct a scale-free network for our simulations (Barabasi & Albert, 1999). We consider a 10,000 node scale-free network with $\gamma = 3$. A different choice would result in a different network topology (although still scale-free), but the results will scale accordingly. At any particular time or epoch t, we assume that a fraction f_{acq} of all users wish to acquire content. In all of our experiments we set f_{acq} = 0.003, which means that at every step we assume 30 out of 10,000 users are actively trying to obtain the content. If the user does not already possess the content, then they try to acquire it through the network. If at least one of the user's neighbors has the content, and is a distributor, then the user obtains the content. If the user is unable to acquire the content, the user waits until another later epoch where one of the neighbors may possess the content. We assume that a fraction f_{dist} of users who possesses the content are willing to distribute it. We will later look at how f_{dist} affects content spreading.

3.2 Preliminary Results

We first show that content spreads very fast in a scale-free network when all users are interested in acquiring the content. This is a well-known result associated with scale-free networks, but we consider it under the scenario that only a very small fraction of users are trying to acquire the content at given epoch. We begin by assuming that one of the hubs possesses content at the outset and is distributing it, and then consider the case when no hubs initially store the content. In the simulation, f_{dist} = 0.3, which means that only about one-third

of all users are willing to share this piece of content. The solid curve in Figure 1 shows how content spreads throughout the network in a very short period of time. Note that it takes less than 3,000 epochs for all of the users to acquire the content.

We now do away with the assumption that at least one of the hubs initially possesses the content, but will continue to assume that all users (hubs included) are interested in acquiring the content being distributed. The dashed curve in Figure 1 shows the result. The only difference from the previous experiment is that content spreading is initially very slow, but once one of the hubs obtains the content, the content spread is rapid because users now readily find what they are looking for. Therefore the same asymptote is reached, i.e., all users eventually obtain the content. There is a small time shift, τ between the curves, which corresponds to the time elapsed until a hub obtains the content. This experiment clearly shows the important role played by hubs in scale-free networks. Content fails to spread effectively until one of the hubs is involved. We shall reinforce this idea with further experimentation, but from the perspective of content owners, one can note that the value of τ must be made large if it is to have an impact on sales.
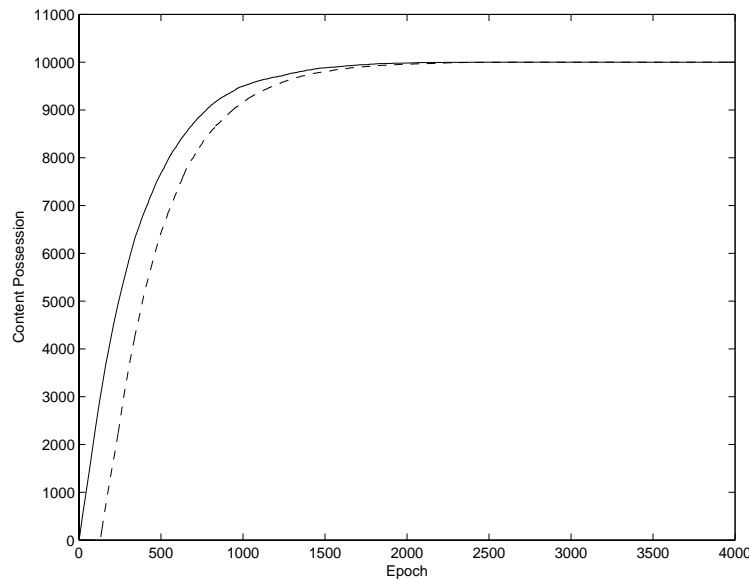
Figure 1. Content possession as a function of time steps, where it is assumed all users are eventually interested in acquiring content, but at each epoch only 0.3% are actually trying to download the content, i.e., $f_{acq} = 0.003$. The solid line corresponds to the case when a hub initially has the content and is distributing it, and the dashed line corresponds to the case when no hubs are initially storing the desired content

3.3 The Importance of Hubs

Let us now consider what happens when some fraction of the hubs are not interested in sharing the content. This situation is more reminiscent of what happens in real P2P file sharing networks. Again, we are assuming that all non-hub nodes are eventually interested in obtaining the content. As a boundary case, consider first the situation when all hubs have the content at the outset. This is the solid line shown in Figure 2. Note that this curve is similar to the solid curve in Figure 1; the only difference being that content is obtained by all users in about half the time. Thus, there is little practical difference between one hub and all hubs possessing the content at the outset, assuming all hubs are allowed to share the content.
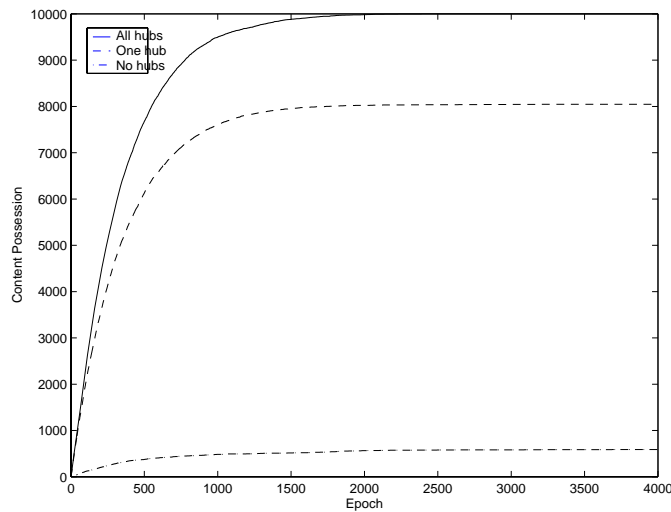
Figure 2. Content spreading when some hubs are restricted from sharing content. The solid curve corresponds to all hubs having the content at the outset. The dashed curve corresponds to the case were only one hub has the content at the outset and no other hubs are allowed to possess it. The dot-dash curve considers the case when no hubs are ever allowed to share the content

If, however, we restrict certain hubs from sharing the content then differences do emerge. Specifically, the dashed curve in Figure 2 shows what happens when only one hub has the content at the outset, and no other hub is allowed to possess it. In this case, for the first time, we reach a situation where the curve asymptotes at a different value. That is, not all users obtain the content, even though they all want it (with the exception of all but one hub). The reduction in this case is about 20%. If this situation could be replicated in practice, we would expect some fraction of these users to instead purchase the content through alternative legal means. Note, however, the severity with which hubs must be restricted before any significant gain is realized. Disabling only a few hubs has little impact on file sharing. Taken to the extreme, consider the case where no hubs share the content, shown by the dot-dash curve in Figure 2. In this case, the content spreads very slowly through the network, reaching only about 500 users after 4,000 epochs. That is, within a reasonable time frame, the piece of content does not reach everybody that wants it. Thus if no hubs are involved in sharing, users cannot find what they are looking for, and would probably begin considering legitimate options for obtaining the content. Given this result, we clearly see why hubs have become the favorite targets for many of the recent legal attacks on P2P file sharing networks. However, in order for a legal attack to be extremely effective, it must bring down (or at least discourage them from sharing) all of the hubs in the network. The difference between the top and bottom curves in Figure 2 is a quantifiable measure of how effective a legal attack aimed at bringing down the hubs can possibly be. That is, it bounds how effective this attack can be, with the important caveat that the difference is substantial only when all hubs are brought down. Nevertheless, since the number of hubs is a small, as compared to the total number of users, we see that these legal attacks offer some possibility of success. A legal attack that targets bringing down some of the hubs while strongly discouraging the remaining hubs from sharing content can be an effective technique against P2P networks. Widely publicizing legal attacks is one way of discouraging nodes or hubs from sharing illegal content. The RIAA as well as some record companies have been using this strategy for some time now.
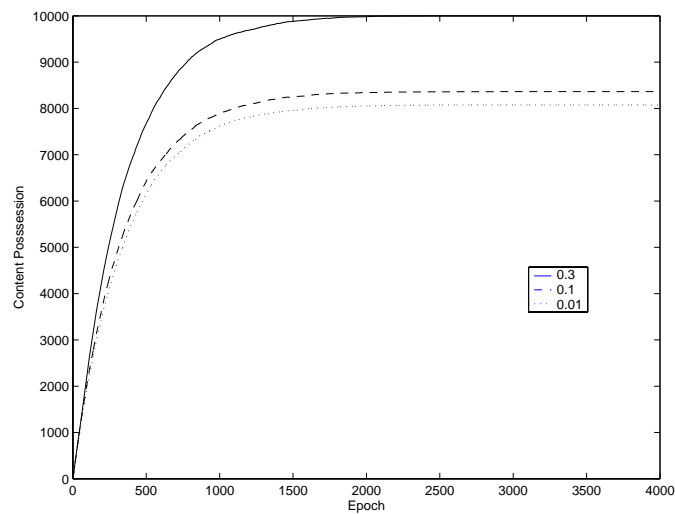
Figure 3. The effect of decreasing the percentage of users willing to distribute content in a P2P network. The curves range from 30% down to 1% of the users willing to distribute a piece of content

3.4 Effect of Sharing Preferences on Content Spreading

We have looked at a number of factors that can affect the fraction of users who are distributors, i.e., f_{dist}. This could result in a change in the rate of content spreading. We might reasonably expect a decrease in f_{dist} to result in more users attempting to acquire the content legally. Thus, let us now consider what happens when f_{dist} is decreased from 0.3 to 0.01. We will, however, assume that at least one hub is distributing the content. The results of these experiments are shown in Figure 3. Notice that the rate of content spreading is decreased some what, and content does not reach all of the users, when only 10% of the users are willing to distribute content versus 30% of the users. It is also clear that a point of diminishing return is reached soon thereafter. That is, when we further and significantly reduce distribution preferences from 10% of the users down to 1% of the users, the rate of content spreading only decreases slightly as shown in Figure 3. This can be accounted for by the fact that the hubs are major force behind the spread of content and as long as they are involved, content spreads. Again, in the case of $f_{dist} = 0.01$, the content does not reach everybody because there are not enough distributors, but the difference between discouraging 90% and 99% of the users from distributing content may be prohibitively expensive.

3.5 The Effectiveness of Flooding the Network with Corrupt Content

We have mentioned in Section 1 that some record companies have attempted to combat piracy by flooding P2P networks with purposefully corrupted content. This can result in an increase in the level of frustration for users of these networks. This approach is really rather ingenious as it directly uses the power of scale-free networks in order to attack illegitimate content sharing. Furthermore, the effort required to mount this attack is significantly less than what is required to mount an effective legal attack. We now describe an experiment designed to look at the effectiveness of this technique.

Suppose there are two versions of a piece of content, a high-quality (good) one and a corrupted (bad) one. We assume that the P2P network is flooded with the corrupt version, and that the high-quality content is also available on the network. We assume for every one hub that shares good content there are n > 1 hubs that are distributing the bad version. We will look at how content spreading changes for different values of n. Also let us assume that a user chooses between the versions of the content obtained as a result of a search with equal probability. Clearly the user is more likely to choose the corrupt version as flooding implies n > 1. If the user obtains a bad version of the content, we assume another attempt is made to obtain a different version of the content. This could again be a good or a bad version. If the user does not obtain good content after a certain number of tries, we assume the level of frustration rises, and the user is more likely to stop attempting to find

the content on the P2P network. The user then might resort to legal options. We model this behavior as follows: After n failed attempts at obtaining good content, a user makes another attempt with probability 1/n and the user stops making any further attempts with probability 1 − 1/n.

As for sharing, we assume again that one-third of all users are willing to share content. Furthermore, these users might themselves end up unknowingly sharing bad content until they obtain good content. Note that users will eventually find good content if they search long enough. Our experiments consider how fast the good content spreads in the P2P network for different values of n. More specifically, we assume in Figure 4 that ratio of hubs sharing bad content to those sharing good content ranges from 2-to-1 all the way up to 10-to-1. We see that good content spreads slowly, particularly as compared to rate of spreading in the previous experiments. Less than half of all the users actually manage to get the good version even when the ratio of "good hubs" versus "bad hubs" is only 2-to-1. The remaining users, frustrated at not being able to find good content, may go on to seek content elsewhere, perhaps through legal means. Hence, flooding the network with corrupted versions of a piece of content is definitely a good strategy for the content owners to pursue. We note, however, that a response on the part of the P2P networks involves the initiation of content rating systems meant to inform perspective content acquires about the quality of the content they are considering downloading. Of course one can easily conceive of additional steps content owners can take to thwart these rating systems, followed by newer countermeasures on the part of the P2P networks, etc., and a resulting "cat-and-mouse" game between these two parties ensues. There are measurement based analyses of the effectiveness of flooding, which indicate that good flooding strategies can be effective (Christin et al, 2005).
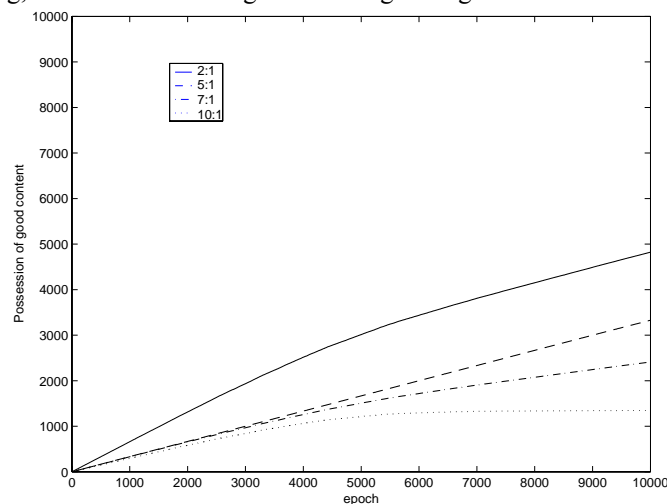
Figure 4. Effect of flooding the network with corrupted content.

4. CONCLUSIONS

We have examined the scale-free topology of P2P networks and how they facilitate the rapid distribution of content. We then examined how user behavior influences the spread of illegal content on P2P networks. The importance of hubs in such scale-free networks was illustrated using different experiments. We then examined the effectiveness of some of the strategies aimed at stopping this illegal sharing of content, finding that in theory, flooding the P2P network with corrupted content is an effective strategy. Of course multiple simultaneous attacks, both from the legal and technological arenas, are often applied by content owners in practice. Future research will consider content protection measures, the questions of how much content hubs are willing to store, and the decay rate for the availability of content as it ages.

REFERENCES

Albert, R, Jeong, H & Barabasi, A. -L, (1999). The diameter of the world wide web. *Nature*, (401):130–131.

Barabasi, A.-L. & Albert, R., (1999). Emergence of scaling in random networks. *Science*, (286):509–512.

Biddle, P, England, P, Peinado, M & Willman, B, (2002). The darknet and the future of content distribution. *Proceedings of the 2002 ACM Workshop on Digital Rights management.*

Blackburn, D., (2004). On-line piracy and recorded music sales. *Harvard University working paper.*

CacheLogic, (nd). *http://www.cachelogic.com.*

Christin, N, Weigend, A & Chuang, J, (2005). Content availability, pollution and poisoning in file sharing peer-to-peer networks. *In EC '05: Proceedings of the 6th ACM conference on Electronic commerce*, New York, USA, pp. 68–77.

Clip 2 Company, (2001). Gnutella: To the bandwidth barrier and beyond. *http://dss.clip2.com/gnutella.html.*

Watts, D.J. & Strogatz, S.H., 1998. Collective dynamics of small-world networks. *Nature*, (393):440–442.

Adar, E. and Huberman, B., (2000). Free riding on gnutella. *Technical report, Xerox PARC.*

Lijeros, F, Edling, C.R., Amaral, L.A.N., & Stanley,H.E., (2001). The web of human sexual contacts. *Nature*, (411):907–908.

Electronic Frontier Foundation, (nd). http://www.eff.org/IP/P2P/MGM_v_Grokster/.

M.Girvan, M & Newman, M.E.J., (2003_. Community structure in social and biological networks. *Proceedings of the National Academy of Science,* USA, (99):8271–8276.

RIAA, (nd). *http://www.riaa.com/news/filings/napster.asp.*

EVALUATION OF WEB DESIGN STRATEGIES FROM A TECHNICAL VIEWPOINT. CASE STUDY: GREEK SITES

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ABSTRACT

This is the second part of a broader study about eCommerce activity in Greece. A number of Greek companies' web sites, all in the ASE (Athens Stock Exchange) from different sectors of the economy and different sizes were evaluated. The sites proved to meet the general standards related to user interface design, but failed when more advanced issues, namely customization, globalization, security and privacy were considered. The lack of adequate financial investment – discussed in the first part - led to the production of attractive but not effective eCommerce solutions, which is most likely the reason behind the failure of the Greek eCommerce market to grow to measurable levels.

KEYWORDS

Internet, evaluation template, Web sites, empirical study

1. INTRODUCTION

Despite the fact that in Greece, high-speed Internet access, e.g. ADSL, was not introduced until very recently (OTE, 2004) up to 16% (2003) of the companies in the country are hosting Web sites (www.ebusinessforum.gr). The question is whether these web sites meet the international standards concerning a site's functionality. A preliminary research of large Greek on- or off-line universities' libraries and governmental web sites revealed only a handful of professional work or academic research in Greece that dealt with this issue.

A critical parameter affecting the way people interact with a Web site is its structure, overall design and layout. A poorly designed Web site might lead to accessibility problems as well as reduced interest to navigate through it causing reluctance to visit the site again. Even though professional firms in the country design many Web sites, there is, still, a substantial amount of work done by people with limited knowledge on how a well-designed Web site should be regardless of the fact these technology experts have the know-how to build any eCommerce solution, from simple to very sophisticated.

2. AIMS AND OBJECTIVES

The aim of this study is to check whether the Greek web sites have the functionality and features that help promote eCommerce transactions to the digital consumers. With this goal in mind we evaluated the Web sites of Greek companies based on certain standards set forth by well-recognized international academic and professional organizations and institutions worldwide. The sites were compared against four different categories of features and functionality, namely stickiness, customization and globalization, accessibility and availability, and Security and Privacy.

A representative sample of 232 Greek medium-large companies and corporations, of the public and private sector, all of the Athens Stock Exchange were selected from 15 different sectors of the countries economy. Two different approaches were followed. Initially, the company with the most assets, the company with the fewer assets and three companies with medium assets were selected from each sector; then, an equal percentage of the rest of the companies was randomly selected to form the sample (Appendix). The main reason for the selection of these medium-large companies was to ensure these companies' online presence.

The work presented in this paper is part of a larger study focusing on those quantitative and qualitative characteristics that shape the Greek information society and monitoring internet usage growth and eCommerce activities.

3. BACKGROUND

In a highly competitive environment such as the Web with billions of sites online and thousands added every day (D-Lib Magazine, 2003) designers/developers consider important that Web sites are attractive and inspire trust to the users so as to cause them to revisit. Four categories of features and functionality are considered key for the successful implementation of an eCommerce strategy: user-interface design, globalization and customization, accessibility, security and privacy.

The term user-interface design includes all those features that affect a site's attractiveness to visitors. Studies have proved the negative effects of scrolling mechanisms, and the positive effects of having hyperlinks easily distinguished from the rest of the content if in the form of a text (Iowa University, 1999) or intuitively identifiable if in the form of icons (California State University, Sacramento, 2002). Others explained the importance of not having hyperlinks leading to a missing or dead object and being relevant with Web site's content (Helm, 2001). This concept is also connected with such mechanisms as site trees or similar diagrams composed of text or icon hyperlinks that show user's current location in the site (Roy *at all,* 2001). Search engines and various communications channels made available, like online surveys, email links, feedback forms, etc. (Berkeley, 2002), could provide additional value to the overall design of web sites. Some studies determined what elements make the sites "appropriate" and "appealing" (Wentzell, 2003) and what others e.g. banners, marquees, graphics, should be considered as annoying and distracting (California State University, Sacramento, 2002). Finally, the importance of accurate and accredited information updated in a timely manner (Berkeley, 2002) so as to avoid consumer's misbelieve of the information presented is acknowledged.

The second feature of a well-designed web site is its identification and connection to the populations in different geographic regions, a feature often referred to as globalization. The reason is people around the globe behave differently on various stimulations triggered by a Web site as a result of variations in culture, religion, language and symbols (Hanrahan and Kwok, 2001) causing positive first impressions to some populations and culture shock (negative) to others. Therefore, the strategy followed in designing the site should address whole populations most likely to be multilingual (Xanthidis and Nicholas, 2004), and incorporate such important elements as color used (Anderson and Fell, 2003), legal framework related to taxation and import/export issues in different regions (Rutherford, 2002) and universal terms like "postal code" instead of local ones like "zip codes" (Housley, 2004) which are meaningless in the majority of the globe's population.

On the other hand the developer must address the issue of personalization/ customization which refers to a Web site's built-in facility to identify a user's content, style, or layout preferences even before any interaction takes place between the user and the site (Svet, 2003). These user profiles can be created using forms, queries, cookies or other techniques and stored in databases. In the case of transaction-oriented sites different payment options i.e. credit cards, money orders, various types of checks, etc., should be listed and described in detailed and currency converters add more value in the site design especially in those cases when there are a variety of consumers residing in different geographic regions (Hanrahan, 2001; Housley, 2004).

A third attribute of every web site is its accessibility on a 24/7 basis at reasonable loading speed, usually less than 10''(California State University, Sacramento, 2002) and availability for a variety of electronic devices such as notebooks, personal computers, PDAs and mobile/cellular phones as displaying a Web site is primarily hardware/ software dependent. Currently, it appears there are no tools available that actually

convert a Web site's layout for different device usage but there are tools that help create accessible code (Bohman, 2003). The recommended way of dealing with the platform diversity is to separate layout design and content by having different layout templates, or "style sheets" for the same content depending on the specific device (International Center…, 2004).

In the accessibility/availability attribute the web site's possible built-in ability to be read by visitors with disabilities could also be included. This could be done either by providing a specific version tailored for such cases (McManis *at all*, 2001) that would utilize such mechanisms and software as screen readers or magnification software or even reader assistance software (Pyatt, 2004) or by avoiding "graphically intense" or with "heavy sound" content (State of Connecticut…, 2004) which could cause problems to individuals with limited vision, hearing or mobility abilities.

Finally, a fourth attribute of a web site is the way it addresses security, privacy and ethical issues on the Net (Cabinet Office, 2002). Currently, the most effective way to tackle this problem is to apply available mechanisms, despite the fact there is no bulletproof mechanism to ensure complete defense against the various types of threats, e.g. spyware, viruses including Trojan horses, etc. (Housley, 2004). Then, it is on the developer's judgment to decide which of the available mechanisms, e.g. Verisign (www.verisign.com) is the best.

Privacy concerns addressed in web sites should also be included in this general category of attributes. Strategies could be from as simple as messages informing the visitors of the use according to the underlying laws of their information keyed in (Fishman, 2004) or as complex as utilizing advanced techniques to mask e-mail addresses and other private and very sensitive information via some type of scripts, forms, buttons, etc. while crawling the Web.

Given all the above our question before this study was only to find if and to what extend the technical knowledge to built a "successful" web site as described previously exists and is applied.

4. METHODOLOGY

The web sites of 232 medium-large companies from 15 sectors of the Greek economy, public and private, either "local" (Greek) or international with subsidiaries in the country, were evaluated (a list of the web sites in appendix). Medium-large companies were selected because they shape the internet environment in Greece by investing the most in the new digital technologies aiming to utilize it in the best possible way; smaller companies should be expected to do more technology-wise. They were found via www.presspoint.gr and from *Greek Financial Directory* which lists companies registered in ASE (Athens Stock Exchange) sorted by sector. Put in simple words one should not expect more technology to be better utilized and in a way more professional in other smaller companies in the country.

It took between 15' and 20' to evaluate each site and the evaluation period started in 11/5/2005 and ended in 30/6/2005. The answers to the evaluation questions were quite straightforward almost binary in nature, a fact that simplified the process.

The evaluation template used consisted of a number of queries divided into four categories:

1. Stickiness: addressed general and specific design issues, namely the use of scrolling mechanisms, the presence of floating hyperlinks, the quality of the graphical user interface, the utilization of site maps, the availability of feedback mechanisms i.e. email links, or user evaluation forms.

2. Customization and Globalization: questioned the web sites' design strategy targeting whole populations and/or individuals both in terms of languages supported and in terms of colors and other graphics used. Also traced if import/export and taxation differences between regions were clarified, payment and shipping/delivery options were adequately described and what was the level and type of customization provided by the site.

3. Accessibility, availability and hard/software: tested whether the web sites were accessible by different platforms, by different users with – perhaps – health problems or other abnormalities, or what the system requirements were both in terms of hardware and in terms of software.

4. Security/privacy: answered to whether the developers considered sensitive issues like security and privacy, if they incorporated security mechanisms for the better protection of the data in the web sites.

5. FINDINGS

5.1 Web Site Design/Stickiness

Initially, concerning web site design issues, the study showed developers in Greece follow the internationally accepted standards of what a nice looking web site should be like. Indeed, the majority of the developers (142/232; 61.21%) tend to avoid the use of scrolling mechanisms which proved to have negative impact in the web site's attractiveness. Also positive were the results on the overall graphical design of the web sites which was appropriate and appealing following contemporary high standards in the 92.67% of the cases (215/232), avoiding such distracting and annoying elements as floating ad banners and the like (212/232; 91.38%).

Then, while evaluating the placement, style and targeting of the hyperlinks - undoubtedly a central part of every web site – they were found to be quite easily accessible in a glance 71.98% of the time (167/232), clearly distinguishing themselves from the rest of the contents either when they were in a text form having font properties (name, size, bold/no bold, color) differentiating from other text (204/232; 87.93%) or when they were in the form of icons in which case they were intuitively identifiable and not misleading (216/232; 93.10%). Also, almost in all cases evaluated (226/232; 97.41%) there were no dead hyperlinks (i.e. leading to nonexistent web pages), or other pointing to irrelevant pages (229/232; 98.71%). Finally, it was positive to see that there were "read more" hyperlinks leading to additional information clarifying possibly broad, unclear or unknown topics to the reader/visitor (134/232; 57.76%) and in almost all cases (227/232; 97.84%) the web pages content was updated regularly.

There were, however, a few rather or quite negative results that need be underlined. It was expected that in all cases email links should be available as they are quite easy to implement and quite useful for communication between the web site visitors and the owners. Much to our surprise only 67.24% of the cases provided such links (156/232). Even worse, floating hyperlinks - which no doubt are very helpful for the visitors - were present in only 34.48% (80/232) of the web sites possibly because it is not a trivial feature to implement. Additionally, despite the international agreement that site map is another central feature for every web site only in 85/232 cases it was present (36.64%) and only in 10 of those cases (4.31%) the mapping mechanism was informative as of the depth of the page the visitor is navigating at every moment in relation to the whole web site. Internal search engines were included in only 88/232 cases (37.93%). In 106/232 cases (45.69%) feedback forms were found but their quality was questionable.

Closing, it was more than obvious that content credibility (signed by a person responsible for updating the content) (32/232; 13.79%), or online surveys available (2/232; 0.86%), or online help available in any form e.g. FAQs (1/232; 0.43%) should better be forgotten by the prospect visitor of the sites.

5.2 Customization and Globalization

It was quite obvious that except the Greek (211/232; 90.95%), the only other language seriously considered and used when developing web sites was the English (178/232; 76.72%). All the rest, i.e. Spanish (7/232; 3.01%), French (7/232; 3.01%), German (8/232; 3.44%) and Chinese (3/232; 1.29%), included into our study, were seldom used mainly in specific cases of companies which probably had some business or other relations to certain populations of the global. In terms of the colors used they were found to be appropriate (231/232; 99.57%) in connection with the populations of visitors targeted (based on the assumption that the language in which the text was written was reflecting the mother tongue and culture of the visitor targeted). However, it was also realized that this last conclusion was not based on enough evidence and it would be very interesting to see how things would change if, say, a large proportion of the targeted population were Chinese speaking people.

As far as globalization issues, only the executives of a handful of companies seem to take things seriously as only in 10/232 cases (4.31%) there was some kind of briefing about import/export and taxation matters, and only in 11/232 web sites information was provided on shipping/delivery options (4.34%). No discussion about providing lists of countries or commodities for which certain imports/exports restrictions apply. These results would not be to our surprise if it was for small companies but these are medium-large private and

public organizations targeting, presumably, populations and businesses not limited to the country many of which are from regions such as Asia (central, or East), Africa, America, etc.

Next, concerning customization features offered by the web sites the study showed 89/232 (38.36%) web sites provide no customization features whatsoever. Furthermore, no web site was found to display information based on previous user interaction and preferences stored in log files or in the form of cookies. A relatively significant (and rather unexpected considering the previous results) number (108/232; 46.55%) displayed information on relevant or competitive commodities/services. A small percentage (32/232; 13.79%) displayed further clarifications on issues not in the sphere of the knowledge of the user. Finally, there were no web sites found to allow changes in the format of the design, i.e. let the user permanently decide the layout of the Web site as it appears in his/her client browser, neither were any found to identify the user's preferences of language and culture based on the IP address of the user's system or on the user's selection of a region/country from a map/list available.

Last, as far as payment and shipping/billing options available, the general picture of the results of the study remained disappointing. Only 21/232 companies' web sites (9.05%) provided a list of available payment options and just 3 of them (1.29%) described in some detail the steps to be followed for each option. Currency converter, a feature often found in many international business oriented web sites, was present only in 3/232 (1.29%). Universal terminology for payment and shipping/delivery, e.g. the universal term "postal code" used instead of the regional term "zip code", appeared in 34/232 cases (14.66%).

5.3 Accessibility, Hard/Software Requirements

The results of the evaluation concerning accessibility and hard/software requirements were radically different. In most cases (162/232; 69.83%) the sites were accessible by the common different platforms, i.e. Windows, Linux. The results were also positive when the time to load the home page was evaluated (less than 10'' was considered a reasonable time) with 214/232 (92.24%) succeeding, as well as the proper display of the page contents without twisting of objects or any other display anomalies under different display resolutions (226/232; 97.41%).

On the negative side, unfortunately as it was expected, only in 1 case the web sites were designed with the people with health abnormalities in mind. Also disappointing was the fact that in case third party tools were needed to run the web pages of a web site only in 15/232 cases (6.47%) the options to download the respective tools were given to the visitors.

5.4 Security, Privacy

The results of evaluating the web sites with security and privacy in mind were completely disappointing. There is nothing much to be said actually. On one hand there should be security concerns tackled but very little was found in this direction. Only 20/232 (8.62%) sites had some kind of authentication process running when a visitor was requesting to get access to the companies'/organizations' intranet. Even less were the sites (16/232; 6.90%) protected by some security protocol like SSL, SET, etc. The cipher strength for the sites protected by such protocols was less than 128 (very low indeed) in 218/232 cases (6.03%). No on-line anti-virus scanner available and no expiration time after a defined amount of idle time (as suggested for security purposes).

On the other hand, concerning the visitors' privacy, the study showed a tendency to avoid tracking/identifying mechanisms, like cookies, spy ware, etc. (231/232 cases; 9.57%) but there is serious doubt this was a conscious decision from the part of the companies' executives or lack of technical expertise required to implement it. Additionally, only 31/232 sites were found (13.36%) with a privacy statement (a dead simple feature to realize), and only 56/232 (24.14%) cases of web sites with masked email addresses through scripts, forms, buttons, etc. for privacy related reasons.

6. CONCLUSIONS/DISCUSSION

A company's web site is the reflection of its executives' strategic decisions concerning eCommerce. It is reasonable to assume three are the actors of every eCommerce transaction, namely the companies' executives making the decisions, the technology experts implementing the solutions requested and the digital consumers reacting in a positive or a negative way to these strategies (figure 1). Whether a web site is successful or not is rather easily traceable by the number and quality of transactions occurring between the consumers and the companies' web sites and stored in the transaction log files.
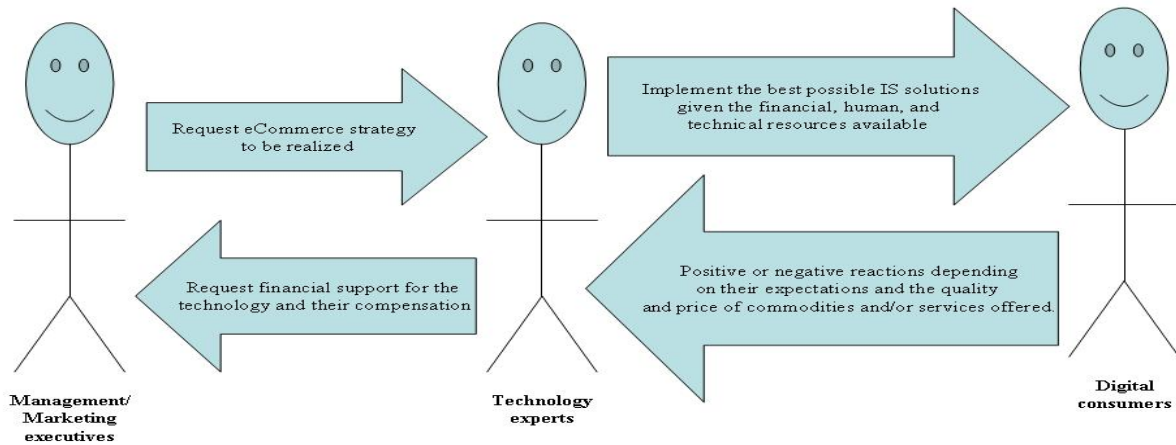
Figure 1. Actors and roles in the e-Commerce chain of activities

A previous study (Xanthidis and Nicholas, 2004) proved that there is really no significant or measurable eCommerce activity in the country which means the digital consumers are very reluctant to make any type of transactions online that would involve some kind of online payment. Although it should be further studied in detail what exactly the digital consumers expect as far as quality and price of the commodities and/or services offered by the Greek web sites, it is quite clear based on the rules of the market that they do not find it in those sites. It also needs to be further studied whether the Greek digital consumers are currently or willing to be in the near future involved in eCommerce transactions with web sites operated and maintained by international businesses.

Evidently, the eCommerce solutions of the Greek companies are weak and unable to provide the services and trust the Greek consumers demand in an attractive way. Indeed, this study has proven that the vast majority, and for what concerns certain features almost all, Greek web sites fail to succeed in following the internationally accepted standards of successful eCommerce sites. The technology, management and/or marketing experts are very well educated and experienced and skilled enough (Xanthidis and Nicholas, 2004) to decide, design and implement the correct solutions; thus they are not to blame for their strategic decisions.

The only piece of the puzzle that remains to be analyzed is the one that calls for financial support to acquire the necessary technology and infrastructure and to compensate the experts' time to successfully implement appropriate and appealing eCommerce solutions. Indeed, we believe that this is the key point missing when building successful web sites in Greece. It is estimated that the vast majority of the web sites of the companies in the country cost around €1,000 and €2,000 despite the fact that all actors of the play (management, marketing, technology experts) strongly believe the investments required are at least double or triple that amount just for a good start. Obviously, with such small investments nobody should expect and plan to develop high quality and standard web sites that can make a boost a real growth in the eCommerce market of the country.

REFERENCES

Anderson, B., Fell, J. M. (US Government Export Portal) (2003), *Taming the Red Dragon: Getting in and Succeeding in China,* http://www.export.gov/comm_svc/pdf/RedDragon.pdf (accessed: 2004)

Berkeley University (2002), *Evaluating Web pages: Techniques to apply and questions to ask*, http://www.lib.berkeley.edu/TeachingLib/Guides/Internet/Evaluate.html (Published 2002; accessed: 2004)

Bohman, P. (2003), *Using Opera to check for accessibility,* http://www.webaim.org/techniques/articles/opera (accessed: 2004)

Cabinet Office (UK Government) (2002), *Privacy and Data sharing. A performance and innovation report* (accessed: 2004)

California State University, Sacramento (2002), *Web Design Principles*,

http://www.csus.edu/uccs/training/online/design/d_principles.htm (accessed: 2004)

D-Lib Magazine (2003), *Trends in the Evolution of the Public Web,* available at

http://www.dlib.org/dlib/april03/lavoie/04lavoie.html (accessed: 2004)

Fishman, S. *Software Development: A legal guide*, Nolo Press, Berkeley, 1994, First Edition

Hanrahan, M., Kwok, Wei-Tai (2001), *A New Connectivity - How Technology is Changing the Marketing World*

http://iaa2001.atalink.co.uk/html/p026.htm (accessed: 2004)

Helm, J. C. (2001), *Web based Application Quality Assurance*,

http://sce.cl.uh.edu/helm/Helm_html/papers/QW2001_PaperJune0101.pdf (accessed: 2004)

Housley, S. (2004), *Web site Globalization*, http://www.onevision.co.uk/xq/ASP/id.1072 (accessed: 2004)

International Center for Disability Resources on the Internet (2004), *Accessibility on the Web*, http://www.icdri.org/WebAccess/accessibility_and_web_JKD.htm (accessed: 2004)

Iowa University (1999), *Designing accessible web sites booklet*,

http://www.uiowa.edu/infotech/WebAccess.htm (accessed: 2004)

McManis, B. L., Ryker, R., Cox, K. C. (2001), "An Examination of Web Usage in a global context", *Industrial Management and Data Systems, 101/9, pp. 470-476*

OTE S.A. (Public Greek Telecommunications Company) (2004), *Activities, Profile,* available at http://www.ote.gr/oteweb/greek/company/st_profile2.htm (accessed: Nov. 2004)

Pyatt, E. J., Pennsylvania State University (2004), *Creating Accessible Web Sites,* (accessed: Dec. 2004)

Roy, M. Christine, Dewit, O., Aubert, B. A. (2001), "The impact of interface usability on trust in Web retailers", *Internet Research: Electronic Networking Applications and Policy,* Vol. 11 No. 5, pp. 388-398

Rutherford, E. (2002), *How to Avoid Global Website Disasters*, http://www.cio.com/research/.../111400_disaster.html (accessed:2004)

State of Connecticut Web site Accessibility Committee (2004), *Universal Web Site Accessibility Policy* for State Web Sites - *Version 4.0,* http://www.cmac.state.ct.us/access/policies/accesspolicy40.html (accessed: 2004)

Svet, B., State University of New York, Buffalo (2003), *Personalization and Customization in eCommerce*,

http://www.cse.buffalo.edu/~sbraynov/seninar2003/presenttations/lecture.pdf (accessed: 2004)

Wentzell, B.(2003), *Characteristics of a quality educational Web site,*

http://catnet.sdacc.org/articles/tech_ID74.pdf (accessed: 2004)

Xanthidis, D., Nicholas D. (2004), "Evaluating internet usage and ecommerce growth in Greece", *Aslib Proceedings,* Vol. 56 No. 6, pp. 356-366

Appendix

The Sample (233 medium-large companies of the ASE used for this study)	
Sector & # of companies	**Companies' names and domain names (www.domain...)**
Food, Beverages and Tobacco Industry (29)	cocacola.gr, chipita.com, katselis.gr, evrofarma.gr, cma-greece.gr, diageo.com, nestle.gr, intercatering.gr, kraftfoods.gr, amstel.gr, allatini.com.gr, vassilioudomaine.gr, xifias.gr, xatzikranioti.gr, delta.gr, dodoni.com.gr, elais.gr, musses.gr, pezaunion.gr, thraki-sa.gr, inowines.gr, stelioskanakis.gr, krikri.gr, domaine-lazaridi.gr, mevgal.gr, megafarm.gr, melissa-kikizas.gr, geniki-trofimon.gr, loulisgroup.com
Chemical Industries (7)	veterin.com, plias.gr, druckfarben.gr, ballis.gr, kerakoll.com, neochimiki-lavrentiadis.gr, famar.gr
Transport, Equipment, Manufacturing (4)	neorion-shipyards.gr, suzuki.gr, petropoulos.com, hyundai.gr/hyundai,
Financial Sector (11)	alpha.gr, progressfund.gr, newmillenniumaeex.gr, diasfund.gr, altius.gr, credit-sec.gr, athenstock.com, euroxx.gr, investor.gr, aspissec.gr, eudynamics.gr
Insurance and Pension Funding Services (12)	ethniki-asfalistiki.gr, agroins.com, phoenix-metrolife.com, aspis.gr, europisti.gr, alico.gr, ing.gr, inlife.gr, megaservice.gr, eurobrokers.gr, interamerican.gr, syneteristiki.gr
IT Services (29)	logicdis.gr, ipirotiki.gr, compucon.gr, logismos.gr, 01p.gr, abc.gr, ace.gr, acom.gr, actis.gr, active.gr, adacom.com, aheadrm.com, algo.com.gr, alphagrissin.gr, alphait.gr, alphyra.gr, altasoft.gr, ace-hellas.gr, anixter.gr, apollo.gr, areianet.gr, arion.gr, mmpi.net, cardisoft.gr, datablue.gr, hipac.gr, infomap.gr, mantis.gr, gnomon.com.gr
Communications and Telecommunications Services (24)	vodafone.gr, forthnet.gr, lannet.gr, intersat.gr, algonet.gr, hellas-sat.net, choruscall.com, com-tonet.gr, cosmoline.com, oteglobe.gr, plural.gr, tim.gr, teledome.gr, telepassport.gr, tellas.gr, unitel.gr, gr.uu.net, vivodi.gr, voiceweb.gr, winet.gr, newsphone.gr,. mediatel.gr, cosmote.gr, myq.gr
Health and Social Services (7)	iaso.gr, euromedica.com.gr, hygeia.gr, mediconsa.com, biorehab.gr, gerolymatos.gr, psychothes.gr
Media and Printing (Newspapers) (29)	dol.gr, kathimerini.gr, lykos.gr, imako.gr, technicalpress.gr/el, alphatv.gr, filathlos.gr, mad.gr, ellinikagrammata.gr, asfalisinet.gr, euro2day.gr, alter.gr, ert.gr, klikfm.gr, opap.gr, megatv.com, alupress.gr, bioshop.gr, compupress.gr, direction.gr, europress.gr, business2005.gr, metohos.com, chip.gr, newspaperdirect.gr, city231.gr, optionpress.gr, smartpress.gr, traveltimes.gr
Metal/machinery manufacturing – Mineral & Cement (17)	elval.gr, rokasgroup.gr, tzirakian.com, fitco.gr, s.andb.gr, naxos-marble.com, fhl.gr, pavlidismg.com, betanet.gr, aget.gr, iktinos.gr, mathios.gr, sidma.gr, metka.gr, grecianmagnesite.com, spidersa.com, mevaco.gr
Education (23)	alba.edu.gr, alexanderinst.gr, andim.gr, btc.com.gr, cems.gr, compact.gr, ds-training.gr, didacta.gr, ecdl.gr, icon.gr, certification.gr, intelearn.gr, itec.edu, nyc.gr, proseed.gr, iek-akmi.gr, acg.edu, xinis.com, sport-tourism.com, aegean.gr, omiros.gr, futurekids.edu.gr, tex.unipi.gr
Retail (22)	atlantic.gr, dutyfreeshops.gr, promota.gr, ascompany.gr, experthellas.gr, glorybook.gr, metro.com.gr, metropolis.gr, modabagno.gr, hatz.gr, plaisio.gr, oriflame.gr, bravo.gr, tupperware.gr, vardas.gr, vassilias.gr, e-h.gr, electroniki.gr, interflora.gr, kotsovolos.gr, marinopoulos.gr, multirama.gr
Tourism (Hotels) (11)	louishotels.com, clubhotelloutraki.gr, chandris.gr, athensparkhotel.gr, rodospark.gr, astir.gr, president.gr, divanis.gr, ionianhe.gr, capsis.gr, portocarras.com
Government (5)	parliament.gr, ekdd.gr, nomarhiapeiraia.gr, ypan.gr, mfa.gr
Business Services (3)	procom.gr, foreverprint.gr, euroconsultants.com.gr

MANAGING CRITICAL SUCCESS FACTORS IN A B2B SETTING

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ABSTRACT

When information systems (IS) are developed and implemented, in any context, a number of success factors determine whether or not the effort will succeed. Attention to success factors helps to avoid some costly mistakes, and speeds up the way change is managed. This paper is focused on how to manage critical success factors (CSF) in organisations involved in standards-based Business-to-Business (B2B), with a focus on organizational CSFs. An existing CSF framework in IS planning is applied theoretically to a B2B setting. Activities in a B2B standards implementation model are compared and matched against the framework. Results show that the framework is suitable for planning B2B implementations, essentially for strategic planning, Future work will consist of further detailing and empirical validation in order to develop practical guidelines for how the framework can be used in planning for B2B standards implementation.

KEYWORDS

Critical Success Factors, Business-to-Business, Framework.

1. INTRODUCTION

In all kinds of information systems (IS) development and implementation situations, there exist a number of success factors for whether or not the effort will succeed. In Business-to-Business (B2B), different types of factors from various origins affect the outcome of technology implementations. Close attention must be paid to what types of factors and issues that may affect organisations, and means to deal with them must be developed and/or adopted. Currently, there is a lack of such means, accentuated by the fact that IS projects fail at an alarming rate. B2B is characterised by numerous interactions in real-time between partners, aiming to provide better service and products to customers. Changes occur on an every day basis. Attention to critical success factors (CSF) may help avoid some costly mistakes, and speed up change management.

CSF in IS development can be divided into three groups: economic, organisational and technological, of which we primarily focus on the organisational ones. The *goal* of this research is to investigate whether or not an existing framework for managing organisational CSF in IS development is applicable in planning for the implementation of B2B standards-based solutions. Little research exists so far that relates CSF to B2B information systems. The investigation is made through a theoretical comparative analysis. Activities in a B2B standards implementation model will be put in relation to an ISD framework, and matches identified. The *main target groups* for the results are people strategic planners, i.e. management levels in organizations. These in turn influence for example project managers and staff educators that prepare staff members for dealing with CSF in their daily work.

The paper is organised as follows: Chapter 2 describes B2B and standards, Chapter 3 introduces CSF and the related framework, Chapter 4 includes the analysis, while Chapter 5 closes with results and future work.

2. SETTING THE SCENE: BUSINESS-TO-BUSINESS (B2B)

The setting of the paper is Business-to-Business (B2B) e-commerce. We use the definition of Thompson and Ranganathan (2004), where B2B is: "*...the use of the Internet and Web-technologies for conducting inter-organizational business transactions*." B2B was selected for analysis since it is highly sensitive to market changes, and heavily dependent on IS. Adopting B2B is not only about choosing technology, but about strategy as well, and relationships must be carefully managed (Thompson and Ranganathan, 2004). B2B is also an enabler for competitiveness (Lee et al, 2003). Organisations may reside near each other geographically, or they may be dispersed. To a great extent, B2B is conducted using standards (Ersala et al, 2002), which simplifies co-operation (Hasselbring, 2000; Ghiladi, 2003). In this paper, the definition of a B2B standard is: *guidelines for how communication and information sent between organisations should be structured and managed* (Söderström, 2004).

Through a combined theoretical and empirical study, Söderström (2004) developed an B2B standards implementation model (figure 1). There are three main phases: preparation, architectural and consolidation. *Preparation* concerns activities for planning and preparing projects and architectural work. *Architectural* work concerns making changes to processes and technology to incorporate the standard into the existing infrastructure. Finally, *consolidation* concerns launching the standard, as well as evaluating and maintaining the system and expanding its use.
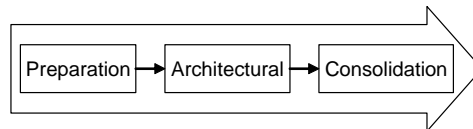
Figure 1. Main implementation process phases

Our focus is on the *preparation* phase, since CSF have the greatest impact here due to its planning and management features. Preparation includes four sub-steps: strategic planning, process analysis, partner alignment, and project planning (figure 2). The order between the steps is not necessarily the same at all times, and some activities may be conducted parallel, which is illustrated by the double-headed arrows in figure 2.
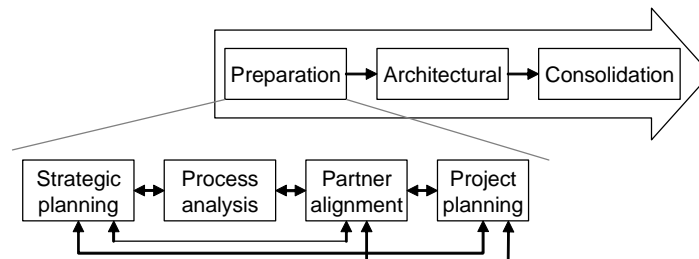
Figure 2. Detailing of the preparation phase

In brief, the four steps contain:
1. *Strategic planning*: Standards and B2B must be part of the business strategy, in order to identify how they can help achieve the business plan (Ramsey, 1998), create new markets, redefine old ones and enable inter-operability (Bolin, 2004). The lack of strategic vision is a major barrier to justifying IT investments (Love and Irani, 2004). Top management commitment is a necessity (Premkumar et al, 1994). Stakeholders from different organizational levels must be involved early to achieve implementation success.
2. *Process analysis*: Business processes must be analysed in order to identify, prioritise and orchestrate which processes to include (Söderström, 2004). This analysis enables a deeper understanding of the organisation and its processes (Kosanke and Nell, 1999), identifies business transaction requirements, and determines if a chosen standard covers these requirements (Rukanova et al, 2003). Hence, business processes help define project scope regarding which processes to support (Ersala et al, 2002), and how and which part(s) of the organisation that will be affected.

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3. *Partner alignment*: B2B partners must identify with whom to trade (Intel, 2003; Söderström, 2004). Partners may have different levels of maturity, and hence varying experience in standards use. Agreements include what, where, how, and scope (webMethods, 2003). Common goals must be set, responsibilities, time span and resources established, and a commitment given by each partner, for example through Trading Partner Agreements (TPA).

4. *Project planning*: Details about required technology, infrastructure, and project conduction are determined (RosettaNet 2001; Söderström, 2004). Results from previous phases are utilized in planning, with implementation goals, milestones and resources. Planning is the key to implementing IT (Ramsey, 1998). Agreements between project participants are important to resolve open issues and prepare execution options.

Söderström's (2004) model was selected as a basis for the upcoming analysis to CSF since it is the most detailed implementation model of its kind for B2B. It is based on an extensive literature survey, as well as on empirical material from standards developers, standards users and creators of standards-based software.

3. THE FRAMEWORK FOR CRITICAL SUCCESS FACTORS IN IS PLANNING

Success factors in ISD can be categorised as emerging from economic, technological or organisational issues (Ewusi-Mensah and Przasnyski; 1994). Planning considerations should focus on important organizational factors, because they influence the other factors. Our research is therefore limited to organisational factors. This chapter will first discuss what critical success factors are, before the framework is elaborated.

3.1 Introducing Critical Success Factors

Critical Success Factors (CSF) are: "*the conditions that need to be met to assure success of the system*" (Poon and Wagner, 2001, p.395). They should consist of a limited number of factors (Rockart, 1979). They should consist of a limited number of factors (Rockart, 1979). The analysis of the factors emerging from organisational issues shows four different CSF (Aggestam, 2004): To learn from failed projects; To define the system's boundary, both for the whole system and for relevant subsystems; To have a well defined and accepted objective that aligns with the business objectives; and To involve, motivate and prepare the "right" stakeholders. The framework does not explicitly need to take *To learn from failed projects* into consideration, it is more of a pre-requisite. Figure 3 summarizes the analysis.
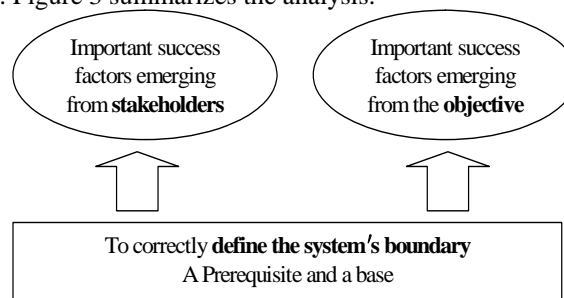
Figure 3. CSF in ISD

The reminder of this chapter will elaborate on each of the three remaining CSF.

3.1.1 The System's Boundary

The systems boundary factor concerns business borders, and not the technical IS border. Knowing what the system is and defining its boundary is a prerequisite for ISD and consequently for addressing all success factors. The system's boundary constrains what needs to be considered and what can be left outside (van Gigch, 1991). Identifying the boundary triggers an active discussion about what the actual system includes, which related systems and subsystems there are, etc. Only if the organisation as a whole is clear about its aim

and works on a principle of shared values can small units be allowed to take responsibility for running themselves (Barlow and Burke, 1999). Consequently, the whole system should ideally be analysed before the subsystems. It is important to stress that related systems may offer resources in exchange for something.

3.1.2 The Stakeholders

Organizational change is risky, but risk can be minimised by having the right kind of persons on your team (Champy 1997), and to identify important stakeholders and discover their requirements (Kotonya and Sommerville 1997). How well an IS will work in an enterprise depends on the user involvement in the development process (Cherry and Macredie, 1999; Pohl, 1998; Sutcliffe, Economou and Markis, 1999; Saiedian and Dale, 2000; Browne and Ramesh, 2002). The success of this involvement depends on how well people work and communicate (Saiedian and Dale 2000), and communication gaps exist. According to Champy (1997) stakeholders across the organization have two needs during organizational change: Confidence in the management and knowledge about the meaning of the change.

Commitment from the top is crucial if the project affects a large part of the organization (Milis and Mercken, 2002). Strong sponsorship is required even before a project is launched to it being initiated and seeded resources (Poon and Wagner, 2000). According to Proccacino et al (2001) a committed sponsor is important, but the confidence in the management is even more important.

3.1.3 The Objective

A successful IS should meet agreed upon business objectives (Ewusi-Mensah and Przasnyski 1994, Milis and Mercken 2002). When the IS strategy reflects organizational objectives, supports business strategies, recognizes external forces and reflects resource constraints, then the organization more likely uses IS strategically (Kearns and Leder 2000). Defining the goal is fundamental (Clavadetcher 1998) and organizational change must begin here (Champy, 1997). A comprehensive project definition gives a common vision, a co-operation base, terms of reference and prevents boundaries from extending beyond intended limits (Milis and Mercken 2002). In developing an IS we make tacit knowledge about the system explicit in a way that everybody involved can understand (Pohl 1998). This is a complex process (Kotonya and Sommerville 1997, Leffingwell and Widrig 2000, Pohl 1998), which requires careful analysis of the organization. An organization should be examined from different perspectives (Pun 2001) which in turn is a prerequisite for defining the goal. We use Bolman and Deal's (1997) four complementary views/frames (table 1), but complement them with a fifth frame, the Neutral Frame in order to capture the neutral perspective of the organization e.g. the Business Plan and objectives, ownership, turnover and number of employees. This Neutral Frame can be thought of as a starting point for the other frames.

Table 1. Overview of the Four-Frame Model, adapted from Bolman and Deal (1997)

	Structural frame	Human resource frame	Political frame	Symbolic frame
Metaphor for organisations	Factory or machine	Family	Jungle	Carnival, temple, theatre
Central concepts	Rules, roles, goals, policies, technology, environment	Needs, skills, relationship	Power, conflict, competition, organisational politics	Culture, meaning, metaphor, ritual, ceremony, stories, heroes
Image of leadership	Social architecture	Empowerment	Advocacy	Inspiration
Basic leadership challenge	Attune structure to task, technology, environment	Align organisational and human needs	Develop agenda and power base	Create faith, beauty, meaning

The way an objective will be defined and formulated depends on the level of inquiry at which it has been considered (van Gigch 1991, Beyer and Holtzblatt 1998, Leffingwell and Widrig 2000). Three levels of inquiry have to be considered (van Gigch, 1991):
- Action or implementation level – "How"
- Diagnostic level – "*What* to do"
- Reflecting level – "*Why*"

Discussions about objectives, and even design of IS, often only take place at the action level and/or what-to-do level, but according to van Gigch (1991) all three levels are necessary. This is in accordance with Bubenko (1993) who claims that the HOW part should be linked to the WHY and WHAT parts.

3.2 The Framework for Managing CSF

A framework is "*... a suggested point of view for an attack on a scientific problem*" (Crick and Koch, 2003, p.119). The building blocks in the CSF framework (figure 4) are not new in themselves, but the combination is. The framework stresses a flexible outset adaptable according to stakeholder type, and it should be used in planning to prepare the organisation for managing CSF in future activities. To the best of our knowledge, no other framework takes this point of view. The framework should also be used iteratively on different levels of abstraction: first to the whole project ("the system") and then to identified critical, parts ("subsystems"). However, we will use a sequential order in this paper for simplicity reasons.

The target organization should define the system's boundary and relevant subsystems. The objective has to be defined next, and relevant stakeholders be identified. The objective should be well defined, analyzed and described in different complementary frames and at different levels of detail. It should always support the business objective, which requires IS- and business strategies to be clearly aligned.
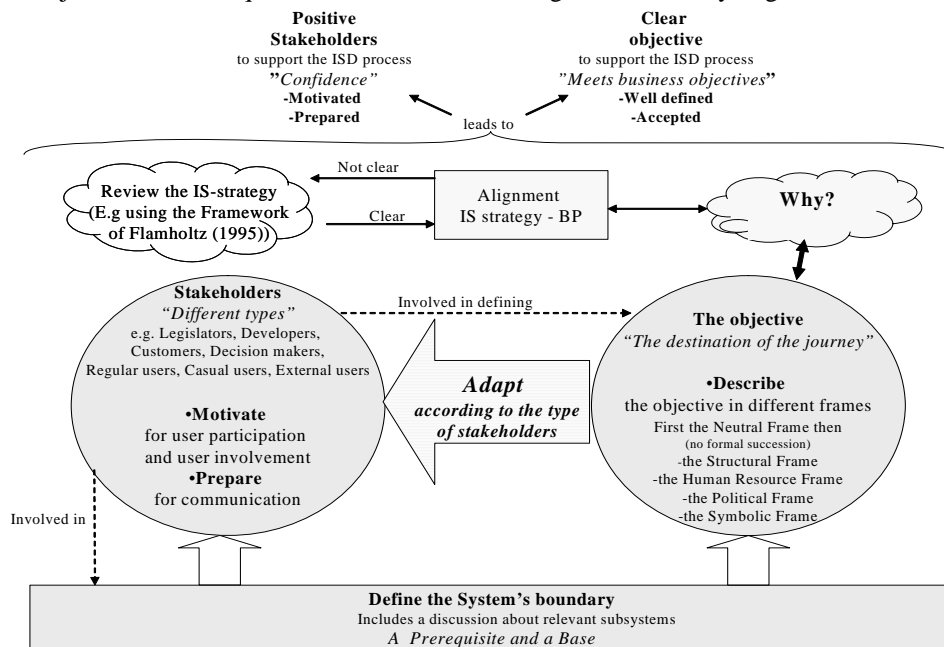
Figure 4. A Framework to support the Information Systems Development process

Relevant stakeholders should be motivated and prepared for future participation and involvement in the ISD process. User participation refers to user activities, while user involvement is more a subjective psychological state of individuals. Stakeholder groups are probably a mix of the two. *Both motivation and preparation must thus be adapted* to the various types of stakeholders.

The motivation process should focus on stakeholder needs of knowledge and confidence. Stakeholders will feel confidence and motivation if the objective's description is adapted to them and explained in a way that they obtain knowledge about how it will affect them and why the project is important. The most suitable stakeholder description should be chosen, which could mean more than one description. User participation and user involvement is a communication process. *The preparation process* should thus focus on educating stakeholders about concepts to make future communication easier and more effective.

These processes aim to meet stakeholder needs about confidence and knowledge about changes. This will contribute to positive, motivated and prepared stakeholders, a prerequisite for user involvement and participation, and consequently for reaching user satisfaction with the system. Using the framework results in a clear, well defined and accepted objective, and in positive, motivated and prepared stakeholders.

4. MAPPING THE CSF FRAMEWORK TO THE B2B SETTING

As mentioned, B2B relies on IS. Enabling B2B organizations to operate and enhance their IS more effectively and with higher quality is therefore important. This chapter will map the CSF framework to the B2B setting in order to determine its appropriateness for use therein.

The analysis originates from the descriptions of the implementation phases with the intention to identify matches between them and the framework for CSF. Since the framework is based on organizational CSF and has a planning and preparing view, the main matches are found in the three sub-steps: strategic planning, process analysis, and partner alignment (see table 2). The leftmost column presents the four implementation phases, the middle column includes a brief description of key points therein, and the rightmost column includes comments of in what way the CSF framework can assist in B2B implementation planning. Starting with *strategic planning*, there are two central issues: the necessity of an updated business strategy, and the inclusion of relevant stakeholders. The strategy determines where the organisation is heading, and the standards-based solution must be duly incorporated. Furthermore, only strategy reveals which operations matter. The CSF framework emphasizes the important *why*-perspective by stressing the necessity of clear and accepted goals. Commitment from top management is another central building block, and this is where strategy is determined and a way to ensure that organizations operate to meet goals. The framework also emphasizes relationships between goals, actors and sub-systems. This includes delimiting the IS by clearly identifying and stating systems boundaries, and to include relevant stakeholders in its preparation. In the implementation model, a cross-functional/cross-organisational, implementation team is suggested. This team should co-operate in order to realize the objective and to conduct B2B implementation.

In *process analysis*, the most essential point is to identify what to include in the B2B effort, in terms of processes, systems and organizational entities. This means, for example, that organizations should analyse their processes to define the scope of projects, and to identify which processes need support. The framework includes boundary identification, in order to set clear goals and delimitations. Furthermore, the tight coupling between goals and boundaries mean that defining the goal helps to define systems boundaries as well. The goals are agreed upon by involved stakeholders. In this process where subsystems/-parts are identified, another positive effect may also be a clarification of which partners and actors there are to include.

Table 2. Relating B2B standards implementation preparation to Aggestam's (2004) framework.

Phases	Description	Framework
Strategic planning	An updated business strategy is essential when implementing B2B standards.	It is essential to have a clear and accepted goal, supporting the why perspective.
	As many relevant stakeholder as possible should be involved early on.	Emphasises relations between goals, included stakeholders, and identified sub-systems.
Process analysis	Identifying what (parts of) business processes and the organisation(s) to include.	The goal and systems boundaries are tightly coupled, and presuppose one another.
		Contributes to identify important sub-systems/parts of the organisation.
Partner alignment	The common goal needs to be agreed on and committed to.	The goal and system boundaries need to be identified.
	Responsibility and resource commitment must be agreed upon.	Contributes to identify relevant issues to resolve between partners.
		Contributes to achieving well accepted goals.
Project planning	Make a detailed plan based on the results from the previous phases.	Is not explicitly managed within the framework, but results from previous phases can be utilized as a basis for project planning.

Partner negotiations (or *partner alignment*) are essential to establish what to do, why, by whom, with what means, and when. Clear responsibilities make better ground for project success. Besides the mentioned focus on goals and system boundaries, using the framework contributes to identify issues that partners need to resolve. The result is agreements on e.g. common and well accepted goals, leading to a higher likelihood of project success.

The *project planning* phase is not directly dealt with in the CSF framework. Previous phases form the basis for the activities in project planning. In particular, preparations made in the three phases aim to facilitate and enable mutual agreements between all project participants. The framework does not deal with

economic or technological issues, but focus on organizational ones. However, since organizational issues affect economic and technological ones, they are implicitly part of the framework. For example, it is important to know which business processes to include to be able to establish needed economic and technological resources.

5. DISCUSSION OF RESULTS

This paper has focused on the problem of managing critical success factors in organizations involved in standards-based B2B. The goal was to investigate whether or not a framework for managing organisational CSF in IS development is applicable in planning for B2B standards implementation. The analysis was conducted by comparing a B2B standards implementation model to a framework aiming to support preparation in IS development in general (Aggestam, 2004). The analysis clearly shows that the framework *is* applicable in B2B planning. In particular, the framework is useful in the three phases: strategic planning, process analysis, and partner alignment. The following advice is given:

- In *strategic planning*, the framework should be used to develop clear and accepted goals in accordance with its *why*-perspective. Goals, stakeholders and sub-systems must be carefully aligned in order to achieve a successful result
- In *process analysis*, the framework should be used to identify boundaries and sub-systems.
- In *partner alignment*, the framework should be used to identify essential issues to resolve.
- The *project planning* phase is not directly managed within the CSF framework.

The framework does not deal with economic or technological issues, but focus on organizational ones. Despite this focus, results show that the framework can be utilized implicitly for managing economic and technological issues as well. However, the framework does not cater enough for these issues, and a complementary tool is therefore needed.

In future work, we will focus on detailing each of the three phases, with the aim to develop practical guidelines for enabling organizations to enhance their preparations for managing CSF. This includes viewing the guidelines from a stakeholder perspective originating from the main identified target groups. The practical guidelines will then be tuned and improved by applying them in real life B2B cases.

REFERENCES

Aggestam, L. (2004) *A Framework for supporting the preparation of ISD*, in Proceedings of the Doctoral Consortium, held in conjunction with the Conference on Advanced Information Systems Engineering (CAiSE'04), 2004

Barlow, H.A. and Burke, M.E. (1999) *The organisation as an informaion system: signpost for new investigations* East European Quarterly, Jan99, Vol.32 Issue 4, p549, 8p

Beyer, H. and Holtzblatt, K. (1998) Contextual Design Defining Customer-Centered Systems Morgan KaufmanPublishers Inc

Bolin, S. (2004), *The Nature and Future of ICT Standardization*, available at: http://www.sun.com/software/standards/natureandfuture_ICT.pdf, as is: June 21, 2004

Bolman, L.G. and Deal, T.E. (1997) *Nya perspektiv på organisation och ledarskap.* Andra upplagan, Studentlitteratur Lund

Browne, G. J. and Ramesh, V. (2002) *Improving information requirements determination: a cognitive perspective* Information and Management 1994 (2002) 1-21

Bubenko jr, J.A. (1993) *Extending the Scope of Information Modelling* 4:th International Workshop on the Deductive Approach of Inforamtion Systems and Databases, Lloret, Costa Brava,(Catalonia), Sept 20-22 1993. Departmentd de Llenguatges i Sistemes Informaticsn Universitat Politecnica de Catalunya, Report de Recerca LSI/93-25, Barcelona (http://www.dsv.su.se/~janis/jbpaper/library/bib.htm)

Champy, J. A. "Preparing for OC": Hesselbein, F., Goldsmith, M. and Beckhard, R. (1997): *The Organiszation of the Future* Jossey-Bass Publisher San Francisco

Cherry, C. and Macredie, R.D. (1999) *The Importance of Context in Information System Design: An assessment of Participatory Design* Requirements Engineering (1999) 4 103-114

Crick, F. and Koch, C. (2003) *A framework for conscious* Nature neuroscience volume 6 no 2 february 2003, 119-126

Ersala, N., Yen, D. and Rajkumar, T. (2002), Enterprise Application Integration in the electronic commerce world, *Computer Standards & Interfaces*, 2189 (2002), pp.1-14

Ewusi-Mensah, K and Przasnyski, Z.H. (1994) *Factors contributing to the abondonment of information systems development projects* Journal of Information Technology (1994), 9, 185-201

Ghiladi, V. (2003), The Importance of International Standards for Globally Operating Businesses, *International Journal of IT Standards & Standardization Research*, Vol.1, No.1, January – June 2003, pp.54-56, Idea Group Publishing

Hasselbring, W. (2000a), Information System Integration, *Communications of the ACM*, June 2000, vol.43, no.6, pp.33-38

Hong, K-K. and Kim, Y-G (2001) *The critical success factors for ERP implementation: an organisational fit perspective* Information & Management 1972 (2001) 1-16

Intel (2003), Collaborative RosettaNet Implementation: Intel and Fujitsu streamline e-Business automation across the supply chain, Intel Information Technology White Paper, October 2003

Kearns, G.S. and Leder, A.L. (2000) *The effect of strategic alignment on the use of IS-based resources for competetive advantage* Journal of Strategic Information Systems 9 (2000) 265-293

Kosanke, K. and Nell, J. (1999), Standardisation in ISO for enterprise engineering and integration, *Computers in Industry*, 40 (1999), pp.311-319

Kotonya, G and Sommerville, I. (1997) *Requirements Engineering* ISBN 0-471-97208, WILEY

Krumbholz, M. and Maiden, N. (2001) *The implementation of enterprise resource planning packages in different organisational and national cultures* Information Systems 26 (2001) 185-204

Lang, S., Masoner, M.and Nicolau, A. (2000) *An empirical examination of the influence of organisational constraints om information systems development* International Journal of Accounting Informaion Systems 2 (2001) 75-102

Lee, S.C., Pak, B.Y. and Lee, H.G. (2003), Business value of B2B electronic commerce: the critical role of inter-firm collaboration, *Electronic Commerce Research and Applications*, 2(2003), pp.350-361

Leffingwell, D. and Widrig, D. (2000) *Managing Software Requirements A unified Approach* Addison Weasley

Love, P. and Irani, Z. (2004), An exploratory study of information technology evaluation and benefits management practices of SMEs in the construction industry, *Information & Management*, In press

Milis, K. and Mercken, R. (2002) *Success factors regarding the implementation of ICT investments projects* (Article in Press) Elsevier Science BV

Pohl, K. (1998) Requirements engineering: An overview *CREWS Report Series CREWS-96-02*

Poon, P, and Wagner, C. (2000) *Critical success factors revisited: success and failure cases of information systems for seniior executives,* Decision Support Systems 30 (2001) 393-418

Premkumar, G., Ramamurthy, K. and Nilakanta, S. (1994), Implementation of Electronic Data Interchange: An Innovation Diffusion Perspective, *Journal of Management Information Systems*, Fall 1994, Vol.11, No.2, pp.157-186

Procaccino, D.J., Verner, J.M., Overnyer, S. P. and Darter M. E. (2001), Case study: factors for early prediction of software development success, *Information and Software technology* 44 (2002) 53-62

Pun, K-F. (2001) *Cultural influences on total quality management adoption in Chinese enterprise: An empirical study* Total Quality Management, May2001, Vol.12 Issue 3, p323, 20p

Ramsey, J. (1998), Developing an IT Strategy, *Computer Bits*, 8 (8), August 1998, available at: http://www.computerbits.com

Rockart, J.F. (1979) *Chief executives define their own data needs* Harvard Business Review, March – April, 1979

RosettaNet (2001), Case Study: Arrow and UTEC replace EDI-based purchase order process with RosettaNet standards, Case study report, as is: February 20, 2004, available at: http://www.rosettanet.org/RosettaNet/Doc/0/D074294MUC4KJD8GF7HQL8RE67/Arrow_case_study.pdf

Rukanova, B., van Slooten, K. and Stegwee, R. (2003), Beyond the Standard Development and the Standard Adoption, In Jakobs, K. (ed.), Proceedings of the 8th Euras Workshop on Standardization, Aachen, July 11-12, 2003, pp. 133-143

Saiedian, H. and Dale, R. *Requirements engineering: making the connection between the software developer and customer* Information and Software Technology 42 (2000) 419-428

Shin, K. and Leem, C.S. (2002), A reference system for internet based inter-enterprise electronic commerce, *The Journal of Systems and Software*, 60 (2002), pp.195-209

Sutcliffe, A.G. and Economou, A. and Markis, P. (1999) Tracing requirements problems in the requirements engineering process *Requirements Engineering (1999) 4* 134-151

Söderström, E. (2004), *B2B Standards Implementation: Issues and Solutions*, PhD Thesis, Department of Computer and Systems Sciences, Stockholm University, Akademitryck, ISBN 91-7265-942-4

Thompson, T. and Ranganathan, C. (2004), Adopters and non-adopters of business-to-business electronic commerce in Singapore, *Information & Management*, Vol.42 (2004), pp.89-102

Van Gigch, J.P. *System Design Modeling and Metamodeling* Plenum Press New York

webMethods (2003), GEAR 6 RosettaNet Implementation Guide: Project Planning Guide, Whitepaper, February 2003

MOVING FROM PRODUCT-BASED BUSINESS TO ONLINE SERVICE BUSINESS

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ABSTRACT

The purpose of this paper is to study how a software product company can expand its business with the Software as a Service (SaaS) model. The differences between the product and service business are considerable and the change of focus from one to the other is not easily done. For example, the scale economies, which are associated with product business, are not easily achieved in service business. However, the SaaS business model has many benefits to offer to both SaaS customers and providers. SaaS services e.g. enable customers to focus on their core competencies, provide easier access to technical expertise, and offer economical access to valuable software applications at anytime and from anywhere. To providers, SaaS offers e.g. lowered production and distribution costs, more predictable cash flows, and shortened sales cycle. In this research study we examine how the SaaS model can be implemented by a software company and conduct a case study on F-Secure and its Personal Express security service. By successfully solving the risks associated with the SaaS model and by fulfilling the customers' demands of customization and at the same time benefiting from economies of scale, scope, and aggregation, F-Secure has leveraged its domain area expertise with its SaaS offering: F-Secure has expanded its operations in a number of countries and increased its customer base both in B2C and SME markets profitably with the help of its partners.

KEYWORDS

Software as a Service, e-commerce, value creation, business model, online service.

1. INTRODUCTION

The differences between the product and service business are considerable and the change of focus in a firm's business model from one to the other is not easy to accomplish (see e.g. Hoch, D. et al. 1999, Nambisan 2001, Cusumano 2003). For example, the scale economies, which are associated with product business (and especially with information goods), are not easily achieved in service business. Furthermore, the economies of scope (e.g. applying domain area how-to knowledge) are harder to take advantage of in the product business as they usually e.g. increase the complexity of the software development (Nambisan 2001). The Software as a Service (SaaS) model tries to bridge the gap between the software product and service business in order for the Independent Software Vendors (ISVs) to provide valuable online services to the customers (SIIA 2001, Hoch, F. et al. 2001, TripleTree 2004, Sääksjärvi et al. 2005). The SaaS business model tries to provide answers on how the software firms can at the same time achieve economies of scale, economies of scope, and fulfill customers' requirements for customization to suit their business needs. Our objective is to study how a software product company can successfully change its product-focused business model to a more service-oriented one and in the process increase the number of its customers, access new markets easily and with very low risk, and more importantly, how to do these things without sacrificing profitability with the SaaS model.

The purpose of this explorative and descriptive research study is to address the above-mentioned issues and propose different ways of how they can be solved. We use a case study, which is centered on one particular domain area (namely the software anti-virus and intrusion prevention) to illustrate how one particular ISV has leveraged its domain area knowledge (which is associated with scope economies), expanded its customer base profitably (enjoying from economies of scale benefits), customized its SaaS

service offering to suit its partners' and customers' needs, and also leveraged the complementary resources of its partners in creating a co-branded security service offering (benefiting from economies of aggregation). The case company that we studied was F-Secure, which has operated in the anti-virus and intrusion prevention (product) business since 1988. In 2001, F-Secure started offering its software products as an online service via its Internet Service Provider (ISP) partners, which has been so successful that it now has 47 partners in 19 countries and SaaS now accounts for 26 per cent of its revenues and continues to grow at a fast pace.

As more and more households and SMEs are accessing the Internet via broadband connection and as at the same time the security risks with Internet usage, such as viruses, spam, spyware, rootkits etc., continue to grow both in number and variety (CERT 2005), the issue of how to deal with these problems is accentuated. While the broadband access is gaining more and more popularity amongst the households and SMEs the security risks associated with Internet usage have become commonplace and need to be dealt with on a daily basis. In order to cope with these problems, it has become a necessity to use anti-virus, anti-spyware, and firewall software. The ISPs have noted this and are recommending that their customers not only install anti-virus and intrusion prevention software on their PCs but also to keep updating them regularly. The above-mentioned matters combined with the fact that anti-virus software is (unfortunately) already outdated when it is taken out of its shrink-wrapped package because new viruses, their variants, and various other malicious software applications appear almost every day on the Internet (CERT 2005) mean that in order to take full advantage of these security applications they need to be updated (preferably) often via network. The above-mentioned aspects together make this particular domain area of anti-virus and intrusion prevention software business especially suitable for the SaaS model.

1.1 Organization of this Paper

The paper is organized as follows. The next section introduces the theoretical framework used in this study. In section three the case study's research methodology is reviewed and in section four the overview of the case company is presented. In section five the findings from the case study are analyzed. The final section is for discussion of the results and also our conclusions and suggestions for future research are presented.

2. THEORETICAL FRAMEWORK

The theoretical framework of this study consists of the Software as a Service model (Cherry Tree 2000, SIIA 2001, Hoch, F. et al. 2001, Sääksjärvi et al 2005) and the value driver model of Amit and Zott (2001). These models are the building blocks that form the theoretical background of this paper and are used as the lenses via which the case study's findings are analyzed.

2.1 Software as a Service Business Model

The Software as a Service is a rather new concept although the origins of the SaaS model can be traced back to the time-sharing services (Kern et al. 2002, Walsh 2003). The SaaS model moves the focus from owning the software to using the software as it examines the service aspect of the software business and ways for the ISVs to offer software as a service to their customers (SIIA 2001, Hoch, F. et al. 2001, TripleTree 2004, Sääksjärvi et al. 2005). Some of the proposed SaaS benefits for the customers include that SaaS enables them to focus on their core competencies, offers easier access to technical expertise, frequent and free upgrades, and economic access to valuable software applications at anytime and from anyplace (Cherry Tree 2000, SIIA 2001, Hoch, F. et al. 2001, Ekanayaka 2002, Kern et al. 2002, Walsh 2003). For the ISVs, the proposed benefits of offering SaaS services includes e.g. scale economies in both production and distribution costs, expansion of the potential customer base, more predictable cash flows, and shortened sales cycle (Cherry Tree 2000, SIIA 2001, Kern et al. 2002, Walsh 2003). We have summarized the SaaS model's benefits and risks from the service providers' viewpoint in Table 1. For a more thorough discussion of these benefits and risks see e.g. Sääksjärvi et al. (2005).

A white paper of the SIIA introduced the term "Software as a Service" (SIIA 2001, Hoch, F. et al. 2001). SIIA's aim was to change the perspective from outsourcing to that of network-based services by exploring

and identifying important issues and challenges for the ISVs seeking to introduce new online services. Among the important issues that SIIA reviewed were the new skills and resources needed by the software companies in order to be able to "SaaS enable" their existing products. This could e.g. mean building new versions of their software products and/or forming partnerships in order to create their SaaS offering. SIIA (2001) and others (Cherry Tree 2000, Ekanayaka 2003, Walsh 2003, Sääksjärvi et al. 2005) have emphasized that the ability to manage partnerships will be important amongst the new set of skills needed by SaaS providers because even the largest companies will have difficulties in providing and managing all of the components needed in creating SaaS solutions.

Table 1. The benefits and risks of the SaaS model for the provider (adapted from Sääksjärvi et al. 2005)

Benefits for the SaaS provider	Risks for the SaaS provider
1. SaaS enables economies of scale in production and distribution (one-to many offering)	1. It is difficult to manage the complex network of suppliers, which is required for integrating the product and service businesses
2. The cash flows from SaaS are more predictable than in traditional software sales (recurring revenue)	2. Moving to the SaaS model initially reduces the turnover as the revenue comes from service fees instead of license sales
3. SaaS expands the potential customer base	3. Performance and scalability issues are to be expected, depending on the technical solution used
4. The sales cycle of SaaS services is shorter than that of traditional software sales	4. High initial investment in starting the SaaS business (building and maintaining the required IT infrastructure and costs of buying 3rd party software)
5. SaaS lowers version management and maintenance costs	5. The customization of the SaaS applications typically incurs extra costs
6. By successfully integrating products and services into a SaaS offering, provider creates barriers to entry for competitors	6. Requires commitment to a more frequent release/upgrade cycle

We propose that instead of the limited outsourcing perspective, the SaaS business model should be understood as a one-to-many e-commerce arrangement dealing with digital products (see e.g. Shapiro and Varian 1999 for a more thorough discussion on digital products). We define the SaaS as follows: "Software as a Service is time and location independent online access to a remotely managed server application, that permits concurrent utilization of the same application installation by a large number of independent users (customers), offers an attractive payment logic compared to the customer value received, and makes a continuous flow of new and innovative software possible" (Sääksjärvi et al. 2005).

SaaS services, which are also called on-demand solutions or services, are said to be the next generation of Application Service Provision (ASP) services (Cherry Tree 2000, SIIA 2001, TripleTree 2004). The most important differences between the SaaS and the "old" ASP model are that: 1) SaaS applies an e-commerce point-of-view instead of the ASP model's outsourcing view, 2) the SaaS model emphasizes the capability and need to (mass) customize customer solutions, and 3) SaaS is a business model concerned with value creation and value appropriation whereas ASP is more of an technical definition.

The SaaS model is a significant departure from the "development and release" business model familiar to the ISVs and their customers. According to SIIA (2001), from the vendor's point-of-view there are three primary benefits in moving to the SaaS model: 1) it reduces the substantial costs of code delivery to the customer (also updates can be provided faster and more often), 2) recurring-revenue models such as those enjoyed by the ISPs are extremely appealing to software developers (Nambisan 2001, Cusumano 2003), and 3) online service model greatly expands the potential customer base of the ISV. Other reasons for moving to a software service model are e.g. that firms may want to change their "traditional" business model to a more Internet focused approach, offer better online services and information to customers, limit the costs of implementing and configuring software for customers, and/or attract new customers, partners, and investors (Cherry Tree 2000, SIIA 2001, TripleTree 2004). Among the strongest proponents of the Software as a Service concept have been many of the largest, most influential enterprise software publishers such as Oracle and SAP (Cherry Tree 2000, SIIA 2001, TripleTree 2004).

More and more ISVs are implementing the SaaS model and slowly changing their focus from product-based business (where the customer owns the application software and delivery infrastructure) to providing software services (where the customer "rents" the application and the SaaS provider manages the delivery

infrastructure). There are many examples of this in the literature and in the marketplace that software firms have included SaaS services in their service portfolio (Cherry Tree 2000, SIIA 2001, Kern et al. 2002, Susarla et al. 2002, Walsh 2003, IDC 2004, TripleTree 2004). However, creating a successful SaaS offering will require more concrete models of e.g. how the issues related to networking are managed (Gulati et al. 2000, Dyer et al. 2002), how the necessary scale economies are reached (performance and scalability issues of applications need to be resolved while meeting the clients' customizing requirements see e.g. Cherry Tree 2000, Hoch, F. et al. 2001, Susarla et al. 2003, Walsh 2003), and how the continuous flow of product innovations i.e. novelty for the customers (Amit and Zott 2001, Utterbach 1994) could be arranged. All in all, these observations make the SaaS model very challenging; some of the literature have probably underestimated the difficulties and risks (SIIA 2001, Walsh 2003, TripleTree 2004) caused by the SaaS model's requirement for the firms to be able to transform their software product business into online service business (Nambisan 2001, Cusumano 2003, Sääksjärvi et al. 2005). However, it has to be noted that for some ISVs, the SaaS model is more of a new sale or distribution channel and does not require a complete renewal of the company's strategy. For an ISV with an existing customer base, the key questions revolve around bringing software services to market with a minimum of disruption to current sales and distribution channels and achieving a maximum additive effect on sales. Key to this success will be partnerships and their management (Cherry Tree 2000, SIIA 2001, TripleTree 2004).

2.2 Value Diver Model

The network-based value perspective of Amit and Zott's (2001) value creation model provides a good background to explore and explain what are the driving forces behind the SaaS providers' reasons for partnering and the factors that affect these partnerships. Amit and Zott's model is based on the virtual markets "in which business transactions are conducted via open networks based on the fixed and wireless Internet infrastructure". According to Amit and Zott, several characteristics of the virtual markets, such as the ease of extending one's product or service range to include complementary products, improved access to complementary resources and capabilities, and new forms of collaboration among firms, have an enormous effect on how value can be created. Value creation opportunities in virtual markets may arise e.g. from new ways to combine information goods, physical products and services, and integration of resources and capabilities among partners.

The value creation model is based on the value chain framework (Porter 1985), the theory of creative destruction (Schumpeter 1942), the resource-based view (Barney 1991), strategic network theory (e.g. Dyer and Singh 2001, Gulati et al. 2000) and transaction cost economics (Williamson 1975). Amit and Zott's model enables an evaluation of the value creation potential of different business models through four value drivers: efficiency, complementaries, lock-in, and novelty. In this paper, Amit and Zott's model's four value drivers are used to review and analyze the case firm's actions in forming its SaaS service offering.

Amit and Zott (2001) emphasize the distinction between a business model and a revenue model: the business model primarily refers to value creation whereas the revenue model is centered on value appropriation. By the term "value" Amit and Zott refer to the total value created for all parties involved in the network that the firm's business model compasses. The four value drivers help in assessing the total value that can be appropriated by the participants of a particular firm's business model i.e. the ISV and its partners/complementors, and their customers.

In Amit and Zott's model the most important value driver is efficiency. Efficiency enhancements include e.g. reduction of transaction costs, achievement of scale and scope economies, reduction of search costs etc. Another source of value creation are complementaries, which are present whenever having a bundle of goods together provides more value than the total value of having each of the goods separately (for a more thorough discussion on bundling and economies of aggregation see e.g. Bakos and Brynjolfsson 1999 and 2000). Business models can also create value by capitalizing on complementaries among activities e.g. when firms co-operate and create a SaaS offering together. The virtual markets open new value creation possibilities since new relational capabilities, skills, and assets (i.e. shared resources) between firms can be exploited e.g. between online and offline capabilities in order to create sustainable advantage.

According to Amit and Zott (2001), the value-creating potential of a business model depends also on the extent of which it is able to engage customers to repeat transactions and this value driver is called the lock-in. Lock-in usually refers to the switching costs faced by clients who consider alternative services or products

from other firms. Lock-in includes e.g. customer loyalty programs, customization, and branding. The fourth value driver, novelty, consists of new ways of conducting transactions, new product or service innovations, or new ways of combining products and services (such as creating an online security service offering). Usually the four value drivers and their effects are interrelated with one another.

3. THE CASE STUDY

This explorative research study follows the interpretive approach to qualitative research as we conduct a case study and analyze the findings using hermeneutics as our mode of analysis (Myers 1997). We use the Klein and Myers's proposed set of principles for interpretive field research (Klein and Myers 1999) in conducting our research. In this section the case study's research design is examined with the help of research design method outlined by Yin (2003).

According to Yin (2003), the case study's research design components are: a case study's questions, propositions, unit of analysis, the logic linking the data to the propositions, and the criteria for interpreting the findings. In this case study we wish to explore how a software company can take advantage of the SaaS model's benefits while overcoming or avoiding the risk associated with the model. Therefore we use the four value drivers of Amit and Zott's (2001) model in order to find answers to the following questions: 1) how an ISV can achieve returns from scale 2) while holding on to scope economies, 3) benefit from its partners complementary skills and assets, and 4) at the same time fulfill customers' customization requirements with its SaaS offering. Our propositions were reviewed earlier in section 2 were the theoretical framework was presented. The case study's unit of analysis is the F-Secure's SaaS business model, which we think provides useful insights on how to create a SaaS offering. The logic linking of the data to the propositions is done in the following sections where the case study's findings are reviewed using the theoretical framework. As the criteria for interpreting the findings, the theoretical models are used as the framework with which the case study's findings are analyzed.

For this case study information was gathered via interviews and discussions with the F-Secure's personnel in product management, research and development, and senior management. In addition, information was also gathered from newspapers and trade journals, web-based news services, and from the company's own communication materials such as annual and quarterly reports, press releases, product descriptions, and from the F-Secure's web pages.

4. F-SECURE AND ITS SAAS OFFERING

4.1 Overview

F-Secure (formerly known as Data Fellows) was founded in 1988 and has been listed on the Helsinki Stock Exchange since 1999. It has its headquarters in Helsinki, Finland and offices in France, Germany, Japan, Sweden, the United Kingdom, and the USA. F-Secure's annual revenue in 2004 was 47.3 million euro (39 million in 2003), EBIT was 6.8 million (1.5m) and it had 306 (283) employees (F-Secure 2005a). The revenue was divided as follows: the corporate segment 28.6 million euro (representing 69 per cent of the anti-virus and intrusion prevention business), service provider segment 8.5m (21%), consumer segment 4.1m (10%), and wireless segment less than 0.4m (1%). Geographical breakdown of the revenues was as follows: Nordic countries 34% (33% in 2003), rest of Europe 47% (35%), North America 10% (21%), and rest of the world 9% (11%).

Currently the F-Secure's SaaS business has 47 partners in 19 countries. In the first quarter of 2005 the SaaS business segment revenue had grown 102% from the first quarter of 2004, constituting 26 per cent of F-Secure's revenues. All in all, F-Secure's SaaS business has been very successful since it has grown in just four years (from 2001) to account for 3.2 million euro in the first quarter of 2005, which translates to over 100% growth rate in every consecutive year of its existence (F-Secure 2005b).

The F-Secure's software application is based on multiple scanning engines, that detect and remove malicious pieces of software from the user's PC, and updates that can be downloaded over the Internet,

which contain information about new viruses and other threats and how to disable them safely. F-Secure's anti-virus and intrusion prevention suite consists of the following components: anti-virus, anti-spyware, firewall, parental control, and spam control. F-Secure's software supports 16 languages and runs on multiple operating systems, including Linux, Symbian OS 60 and 80, and Microsoft Windows from version 95 through XP. F-Secure sells its software through VARs and distributors in 50 countries, its own web store, and as a service via its ISP partners. The main competitors of F-Secure are McAfee, Symantec, and Trend Micro.

F-Secure keeps a 24/7 watch for new virus threats in order to be able to quickly analyze and respond to them. F-Secure has also been reported by independent test laboratories to have the fastest response time to virus outbreaks and the highest number of updates in a month (F-Secure 2005c). Furthermore, F-Secure has received many awards from a number of tests and evaluations (F-Secure 2005d).

4.2 F-Secure's Security as a Service Offering

F-Secure has been in the anti-virus and intrusion prevention business for over a decade and until few years ago sold its software only as shrink-wrapped products. From the year 2001 onwards, F-Secure has offered its anti-virus software as a service via its ISP partners. In Figure 1. we present an overview of the F-Secure's SaaS business model.

F-Secure's SaaS service offering (which is called the F-Secure Personal Express for service providers) consists of the following components: anti-virus (which stops viruses, worms, trojans etc. in real-time), anti-spyware (removes secretly installed spying software or ad-ware), firewall (intrusion prevention), parental control (provides access control to Internet content), spam control (controls inbound email messages), and automatic update feature (which consists of virus definition database and software updates). F-Secure offers to ISPs a co-branded, customized security service, which consist of the F-Secure's anti-virus suite and its components, customization services (configuration, localization and co-branding, which are done via the built-in customization features), open interfaces to the ISPs' user databases, and of a service expiration control mechanism, which together ensure easy and fast service deployment. For a small monthly subscription fee, the ISPs' customers (B2C or SME) can subscribe to the security service, which consists of the anti-virus suite, automatic updates, and local customer support services. The monthly fee is usually only from 1/15 to 1/20 of the actual, packaged F-Secure security suite application's license price. The revenue model is simple and straightforward: F-Secure and the ISP share the revenues received from the customers' monthly payments.
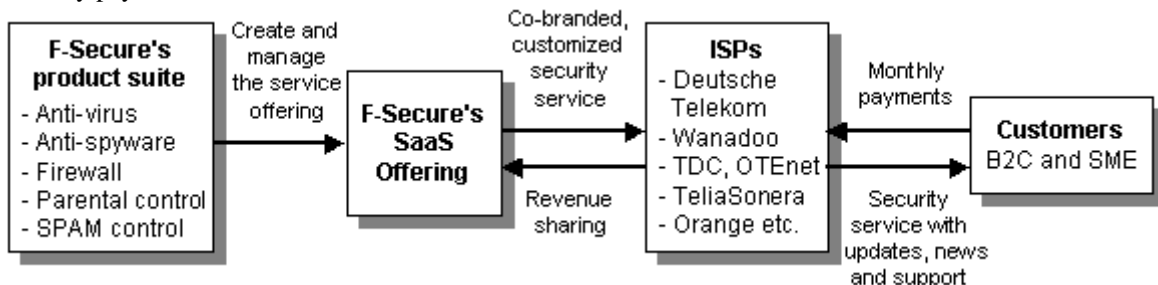
Figure 1. F-Secure's partner network and SaaS offering

5. ANALYSIS OF THE CASE STUDY FINDINGS

For F-Secure, its SaaS service has been a success story from the beginning: it has been able to increase its sales, international operations, and customer base profitably without having to make huge investments e.g. in different countries' sales and support personnel. The case study's findings in light of Amit and Zott's (2001) value creation model are summarized in Table 2.

Furthermore, F-Secure has been able to capture all of the previously listed benefits of the SaaS model (see Table 1.). For example, F-Secure has taken advantage of its domain area how-to knowledge and managed to offer its product suite as a service to the wider customer base of the ISPs via its one-to-many SaaS offering.

In essence, F-Secure has managed to reach economies of scale while taking advantage of economies of scope (i.e. its anti-virus and intrusion prevention knowledge is used by a larger number of customers), and at the same time managed to achieve e.g. lower customer support costs (ISPs handle support). This has been made possible by F-Secure, which has successfully combined its own product-based business with the ISPs' service business related skills and network assets. By partnering with the ISPs F-Secure has also lowered its costs associated with sales, distribution, and marketing and also started receiving recurring revenue.

Table 2. Sources of value creation in the F-Secure's SaaS offering

Efficiency	Complementaries	Lock-in	Novelty
1. Scale economies: lower distribution and marketing costs of SW, lower customer support and billing costs	1. Bundling offers economies of aggregation: enables brand leveraging of both the F-Secure and ISPs	1. Co-branded, tailored offering to suit the ISPs' and their customers' needs and requirements	1. Security as a service offering via ISPs' sales and delivery channels
2. Scope economies: F-Secure provides anti-virus how-to knowledge to a larger audience	2. ISPs broadband access and associated security risks are overcome by F-Secure's suite: one-stop shopping	2. High-volume repeat transactions: recurring revenue from ISPs' and their customers	2. F-Secure benefits from the first mover advantage and positive feedback effects
3. Provides an easy, low cost, and low risk access to new markets	3. Reduced search (efficiency related offering): ISPs act as the sales and distribution channel	3. Efficiency features and complementary service offering both attracts and retains customers	3. Fast and effective distribution (of virus definition updates etc.) channel through ISP partners' networks
4. F-Secure and the ISPs can focus on their own core competencies			

In addition, the risks associated with the SaaS model have also been successfully dealt with: F-Secure has selected partners that complement its own skills and resources in creating and enabling the SaaS offering. Also the effect of reduced turnover due to decreased license sales (some customers now pay smaller monthly service fees) have been offset by the fact that F-Secure has increased its customer base in a number of countries while lowering the costs (by sharing them with its partners) usually associated with increased sales and internationalization (such as marketing, personnel, billing, support etc. costs).

As mentioned earlier, this particular application domain area of anti-virus and intrusion prevention software seems especially suitable for the SaaS model e.g. because the required infrastructure, which was also needed in F-Secure's earlier product-based business, can be exploited in its SaaS service business. Also the necessary commitment to frequent update cycle was of great importance in product-based anti-virus and intrusion prevention business: by increasing its number of customers F-Secure is now able to reap even larger returns of scale (by spreading the costs over larger number of customers). Last but not least, the architecture of the F-Secure's software suite, which basically consists of the multiple scanning engines and security threat definition database, makes it possible that the application is run on the customers' computers and only the necessary updates are distributed in a centralized fashion via the ISPs' network infrastructure.

In a summary, F-secure has successfully taken advantage of the SaaS model's benefits and managed to downplay the associated risks. F-Secure's SaaS service has provided the firm a relatively easy and low risk access to new markets because the ISPs have e.g. an existing customer base, (distribution) network infrastructure, and the necessary customer care and billing systems in place. The ISPs have benefited from increased revenue stream by offering the co-branded, value-adding security service to their B2C and SME customers. This means that both F-Secure and its partners have benefited from their complementary skills and assets and also from bundling together their online and offline assets.

However, we have to note that there are some issues that might prove to be problematic for F-Secure in the future: the issue of who owns the end-customer and how to increase the lock-in (e.g. is F-Secure's brand strong enough) on the ISPs in case F-Secure's competitors begin to compete more aggressively with their own SaaS offerings are still open. However, so far F-Secure has not lost a single SaaS customer to its competitors.

Although this case study concentrated on only one company and its SaaS offering, the results of this case study can be said to be generalizable on the analytical level (which is level-1 inference, Yin 2003). This is commonplace with case studies as they rely on analytical generalization (Yin 2003). According to Lee and

Baskerville's generalizability framework, this research study's findings would fall into the category of generalizing from data to description (Lee and Baskerville 2003).

6. DISCUSSION AND CONCLUSIONS

The purpose of this paper was to study how a software product company can expand its business with the Software as a Service business model. We conducted a case study of F-Secure and its SaaS offering to study how by taking advantage of the proposed benefits of the SaaS model (such as expanding the customer base and by lowering the distribution costs) and by managing to solve or avoid the associated risks (e.g. by successfully managing the partnerships, making the customization quick and easy to implement, and by avoiding the high initial investment costs), a software firm can increase its sales, number of customers, and profitability at the same time. By managing to reach the necessary economies of scale while taking advantage of scope economies, F-Secure also managed to customize its SaaS offering to suit its ISP partners' and their customers' needs. Furthermore, both F-Secure and its partners benefited from economies of aggregation. Therefore we can say that F-Secure was successful in changing the focus of its product-based business since it was able to overcome the difficulties and risks caused by the SaaS model's requirements for a firm to be able to transform software product business into online service business. All in all, it needs to be said that despite of all of the above-mentioned things, for F-Secure its SaaS service offering is still more of a new sale or distribution channel and not a complete renewal of the company's strategy. In addition, on the basis of our analysis using the value driver model, we think that instead of just concentrating on efficiency improvements, the sustainable way to generate value using the SaaS model should be easy and low-cost access to innovative and useful software applications, based on a broader set of value sources i.e. complementaries, novelty, and lock-in.

On the basis of this study, we can say that as a part of a medium-sized software firm's (in this case F-Secure's) growth strategy the SaaS business model can be very beneficial. However, it needs to be said that this particular application domain area of anti-virus and intrusion prevention has features, such as the need for frequent updates and an efficient channel for their distribution, that make it especially suitable for the SaaS model. In conclusion, since this paper concentrated only on exploring one particular software application domain area and on the F-Secure's SaaS offering, the generalizability and transferability of our findings are somewhat limited. In order to gain more extensive and detailed understanding of the SaaS model and its implications to the ISVs in general, also other software companies and their SaaS offerings in different application domain areas should be investigated. Therefore we suggest that further empirical studies are conducted in order to reach a better understanding of the SaaS model and its implications to the ISVs.

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REFERENCES

Amit, R. and Zott, C., 2001. Value Creation in E-business. *Strategic Management Journal*, Vol. 22, No. 6/7, pp. 493-520.

Bakos, Y. and Brynjolfsson, E., 1999. Bundling Information Goods: Pricing, Profits, and Efficiency. *Management Science*, Vol. 45, No. 12, pp. 1613-1630.

Bakos, Y. and Brynjolfsson, E., 2000. Bundling and Competition on the Internet. *Marketing Science*, Vol. 19, No. 1, pp. 63-82.

Barney, J., 1991. Firm Resources and Sustained Competitive Advantage. *Journal of Management*, Vol. 17, No. 1, pp. 99-120.

CERT, 2005. *The 2005 E-Crime Watch Survey: Summary of Findings*. CERT Coordination Center, Pittsburgh, PA. (www.cert.org)

Cherry Tree, 2000. Framing the IT Services Industry: 2nd Generation ASPs. *Spotlight Report*, Cherry Tree & Co., September 2000. (www.cherrytreeco.com)

Cusumano, M., 2003. Finding Your Balance in the Products and Service Debate. *Communications of the ACM*, Vol. 46, No. 3, pp. 15-17.

Dyer, J. and Singh, H., 2001. The Relational View Cooperative Strategy and Sources of Interorganizational Competitive Advantage. *Academy of Management Review*, Vol. 23, pp. 660-679.

Dyer, J. et al., 2003. How to Make Strategic Alliances Work. *Sloan Management Review*, Summer 2001, pp. 37-43.

Ekanayaka, Y. et al., 2003. Evaluating Application Service Providers. *Benchmarking*, Vol. 10, No. 4, pp. 343-354.

F-Secure, 2005a. *F-Secure's Annual Report 2004*. F-Secure, Helsinki, Finland. (www.f-secure.com)

F-Secure, 2005b. *F-Secure's Interim Report Q1 2005*. F-Secure, Helsinki, Finland. (www.f-secure.com)

F-Secure, 2005c. *Antivirus Update Reaction Times of Major Antivirus Vendors*. F-Secure, Helsinki, Finland. (www.f-secure.com/news/response/f-secure_speed_of_response.pdf)

F-Secure, 2005d. *F-Secure's Awards and Reviews*. F-Secure, Helsinki, Finland. (www.f-secure.com/news/awards/)

Gulati, R. et al., 2000. Strategic Networks. *Strategic Management Journal*, Vol. 21, pp. 203-215.

Hoch, D. et al., 2000. *Secrets of Software Success*. Harvard Business School Press, Boston, MA.

Hoch, F. et al., 2001. *Software as a Service: "A to Z" for ISVs*. Software & Information Industry Association (SIIA). Washington, DC, www.siia.net.

Kern, T. et al., 2002. Exploring ASP as Sourcing Strategy: Theoretical Perspectives, Propositions for Practice. *Journal of Strategic Information Systems*, Vol. 11, pp. 153-177.

Klein, H. and Myers, M., 1999. A Set of Principles for Conducting and Evaluating Interpretive Field Studies in Information Systems. *MIS Quarterly*, Vol. 23, No. 1, pp. 67-94.

Lee, A. and Baskerville, R., 2003. Generalizing Generalizability in Information Systems Research. *Information Systems Research*, Vol. 14, No. 3, pp. 221-243.

IDC, 2004. U.S. Software as a Service 2004-2008 Forecast by Delivery Model. *IDC - Industry Developments and Models,* IDC Bulletin No. 31267.

Myers, M., 1997. Qualitative Research in Information Systems, *MIS Quarterly*, Vol. 21, No. 2, pp. 241-242. MISQ Discovery, updated version, April 2005. (www.misq.org/discovery/MISQD_isworld/)

Nambisan, S., 2001. Why Service Business are not Product Businesses. *MIT Sloan Management Review*, Vol. 42, No. 4, pp. 72-81.

Porter, M., 1985. *Competitive Advantage: Creating and Sustaining Superior Performance*. Free Press, New York, NY.

Schumpeter, J., 1942. *Capitalism, Socialism and Democracy*. Harper, New York, NY.

Shapiro, C. and Varian, H., 1999. *Information Rules: a Strategic Guide to the Network Economy*. Harvard Business School Press, Boston, MA.

SIIA, 2001. *Software as a Service: Strategic Backgrounder*. Software & Information Industry Association (SIIA), Washington, D.C. (www.siia.net)

Susarla, A. et al., 2003. Understanding the Service Component of Application Service Provision: An Empirical Analysis of Satisfaction with ASP Services. *MIS Quarterly*, Vol. 27, No. 1, pp. 91-123.

Sääksjärvi, M. et al., 2005. Evaluating the Software as a Service Business Model: From CPU Time-Sharing to Online Innovation Sharing. *Proceedings of the IADIS International Conference e-Society 2005*, Qawra, Malta, pp. 177-186.

TripleTree, 2004. Software as a Service: Changing the Paradigm in the Software Industry. *SIIA and TripleTree Industry Analysis Series*, Washington, DC. (www.siia.net)

Utterback, J., 1994. *Mastering the Dynamics of Innovation*. Harvard Business School Press, Boston, MA.

Walsh, K., 2003. Analyzing the Application ASP Concept: Technologies, Economies, and Strategies. *Communications of the ACM*, Vol. 46, No. 8, pp. 103-107.

Williamson, O., 1975. *Markets and Hierarchies, Analysis and Antitrust Implications: A Study in the Economics of International Organization*. Free Press, New York, NY.

Yin, R., 2003. *Case Study Research: Design and Methods*. Sage Publications, Thousand Oaks, CA.

RE-INVENTING SMART CARDS FOR COMPETITIVE B2B E-COMMERCE

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ABSTRACT

This research study aims to develop a new dynamic web-based B2B E-commerce solution for Eppco Petroleum Company. It also re-invents "Eppco Select Card" as a state-of–the-art application providing new benefits for both customers and company. The resulting portal features on-line card ordering, account tracking, invoice presentment, payment, and personalization depending upon the customer profile. It aims to place the company in the lead among competitors in the customer focus and service delivery.

KEYWORDS

B2B, SMP, EIPP, CVS, E-Commerce.

1. INTRODUCTION

Eppco is known as the premier petroleum drilling and refining company in the Middle East with a respectable role in the international market. Eppco entered retailing business in 1988 and today is considered as one of the leaders with excellence in fuel retailing sector within UAE. Their well-designed, modern filling stations offer comprehensive services. As part of the drive for innovation, Eppco has introduced Select Cards for corporate clients with limitless credit facility for 45 days. These magnetic strip cards based on credit voucher system (CVS) are used by corporate nominees for purchase of any auto related stores/ and item purchases at C-Stores or auto related services available. Select Cards are sold on order basis; mostly for one year. Currently there are more than 175 "multiple-card" corporate customers. These corporations opened their accounts with Eppco after making an initial payment and completion of guarantee procedures. Each organization has a person who is authorized to enter correspondence, sign the documents, to make payments and to receive the cards on behalf of his company. This person is called 'Contact' in our application.

All transactions are uploaded to the central database at the end of every month and invoices are issued at the end of the month. Invoices are sent by mail and payments expected within 45 days. Growth strategy of the company is built around the core values of speed, convenience, and value.

Within UAE, Eppco has two significant competitors, Adnoc and Emarat in the line. Their web sites were studied carefully. They have the following main features:-

1. Adnoc (http://www.adnoc-dist.co.ae)

   Adnoc uses a card similar to Eppco's Select card called RAHAL. RAHAL is used to pay for refueling, products and services at all Adnoc service stations across UAE. RAHAL carries many benefits for the customers like discounts and exciting offers at shops, hostels and commercial establishments all over the country. Adnoc has a web site that offers invoice presentment functionality for its corporate customers. Customers can view their monthly invoices on the net but have no e-payment option.

2. Emarat (http://www.emarat.co.ae)
   Emarat has launched a similar facility Safeer Card in 1996 specially tailored to meet requirements of its commercial fleet owners. This card does away with any need for vouchers, coupons, cash or expense claims and allows the vehicle driver to use any of the products and services available at the network.

2. PROBLEM DEFINITION

Effective customer care and on-line invoice presentment / payment can serve myriad purposes like attracting new customers, reduce end user complaints, effective switchover to new customers, providing points of differentiation, promote a positive corporate image, reduce customer service costs and increase profits. This indicated the need for devising high-tech and innovative system that will make Eppco Select Cards a better option for customer service. This service upgrading has to be comprehensive to improve the interface with customer corporations as important clients. The Strategic Management Proposal (SMP) is to put forth a dynamic web based e-commerce solution that will align, communicate and position Eppco as the leading organization in its customer focus and service delivery. As Ken Hobday (Richter, 2000) Vice President of the CheckFree (invoice providers) notes that the first benefit in e-invoicing to both the invoice producing company and the customer is a much higher bandwidth of interaction.

3. EPPCO EIPP MODEL

With a view to provide comprehensive on-line customer services, Eppco can venture into e-commerce with Electronic Invoice Presentment and Payment (EIPP) tool. The proposed Sellers Direct Model with Eppco will establish an electronic invoicing capability on its own web site and provide its customers with invoicing information and the capability to effect invoice payments directly from the site. E-invoicing application will be created to handle complete invoicing process from creating, amending and authorizing an invoice to the customer (Figure 1). Email notifications will be issued to all customers about new invoices raised that can be viewed on-line. Eppco banks with one particular bank and payments are normally received by adjustment in respective bank accounts. It needs to be appreciated that getting real value out of B2B invoicing requires integration. Hence, the e-invoicing system will accept payments transaction from the customer's bank, validate the transaction and alert the application through e-mails of the payments effected. Customers will be provided personalized services.
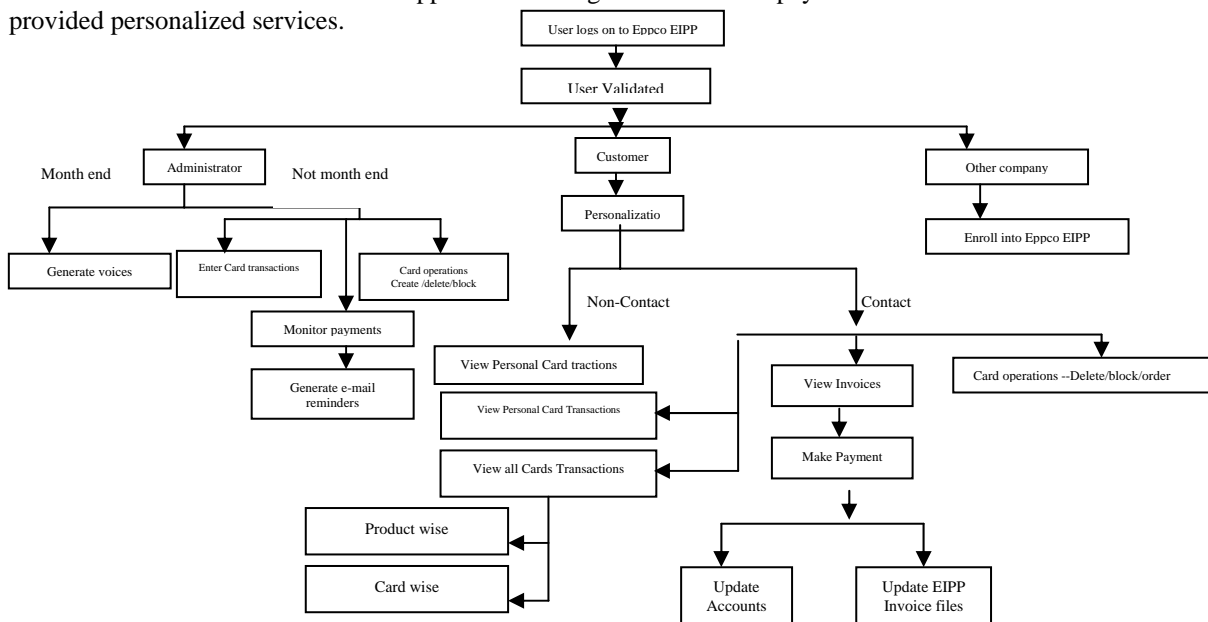
Figure 1. Structure chart of the EIPP

4. PERSONALIZATION

Whereas web sites store a lot of information for people, the people on their part are demand-rich and time-poor; they need an arrangement whereby specific information they need becomes available with ease without having to sift through the entire web site. One such technology is Personalization.This technology is employed to whisk users quickly to particular pages of a site so that they can get precisely what they are looking for. The fastest growing personalization technology in the corporate business environment today is in the area of corporate portals.

4.1 Personalization Approaches

Portal products use a variety of different approaches to personalize the content that business users view and access via a portals web interface. Nemes (2001) explained one method of personalization that consists of recommendation engines, one broad category, uses data-mining analytic, algorithms and other forms of artificial intelligence to analyze company's or individual's behavior patterns based on existing information from multiple data sources. Those sources include transactional information and click stream data showing individual movements on the site and registered profile data. After analyzing the combined data, site operators can present specific areas of their site that are more likely to interest the user.

4.2 Eppco's Personalization Approach

This application will use search engines to personalize its web application. These search engines will analyze the already stored data, identify the user and accordingly display the information pertaining to that one user specifically. One problem with this personalization is the customer's concern over privacy of the information collected through the web site. In this regard it is the "industry sanctioned standards" carefully designed and strictly followed that will balance the needs of businesses in wake of their rising concern for privacy of the personally identifiable information. According to Martin (2001), a new ally and a valuable tool to use the ethical behavior as a distinct competitive advantage is the Personalized Consortium, (http://www.personalization.org/)a 61-member group founded in April 2000 to promote the responsible use of technology for personalizing consumer and business relationships. The consortium has established a set of integrated privacy principles that could be the key to higher sales volumes and enhanced customer retention.

5. SYSTEMS DEVELOPMENT APPROACHES

Four popular methodologies such as Traditional Systems Development Life Cycle (SDLC), Structured Systems Analysis and Design (SSAD), Rapid Application Development (RAD), and Object -Oriented Analysis and Designing (OOAD) are studied to determine their suitability advantages and disadvantages. A comparison indicates that both OOAD and RAD have strong focus on business situation. Using object-oriented techniques is key for building large, scalable and evolvable applications. OOAD methodology will therefore chosen to help Eppco launch e-commerce in an efficient, faster and cheaper way. Also, OOAD was accepted as a better choice because, it allows easier communication between the analysts, users and programmers. It results in increased internal consistency across analysis, design, and programming activities to build a robust system.

The standard tool for OOAD is Unified Modeling language (UML), a language for specifying, visualizing and constructing the artifacts of software systems as for business modeling. Object –oriented Hypermedia Design Model (OOHDM) is an extension of UML. In OOHDM the conceptual model is specified using the UML notation. The OOHDM (Schwabe & Rossi, 1998) is a model-based approach for building large hypermedia applications. It has been extensively used to design web sites and Information Systems.

Eppco E-commerce solution can be described as a hybrid between a hypermedia and an information system. In any such application, the information navigation and presentation is of great importance. UML does not suit Eppco e-commerce application for reasons given hereafter:-

- Due to the hybrid nature, the development of web application must cope with a number of applicative requirements such as the support of exploratory access through navigational interfaces and the customization and possibly dynamic adaptation of content structure, navigation primitives and presentation styles. UML does not contain useful abstractions capable of easing the task of specifying applications that embody the hypertext metaphor. It does not provide any notion of linking and very little is said about how to incorporate hypertext into the interface. The Eppco application is a hypermedia application. It is important to build a healthy navigational structure in a hypermedia application (Rossi, *et al.*).

- UML does not provide primitives for specifying navigation. UML fails to consider navigation as a design problem (Schwabe & Rossi).

Thus OOHDM has been chosen as the analysis and designing tool for Eppco application.

6. EIPP APPLICATION STRUCTURE

There was a need to partition application functionality or responsibility between distributed processing contexts best in order to optimize the usage of components and resources involved. After comparing several ways of doing this, the best way concluded would be to partition the application functionality into three tiers distribution architecture: Front-end clients, Application servers and Database server. Figure 2 shows the tiering strategy of Eppco.

6.1 Presentation Service Tier

This is the graphical user interface layer. The interface to the user is through the browser. Eppco's e-commerce application supports the Browser-Enhanced Model layer strategy that uses a combination of HTML, DHTML and Scripting. This functionality will use ASP that will reside on the IIS server as the interface between the web pages and the business service layer.
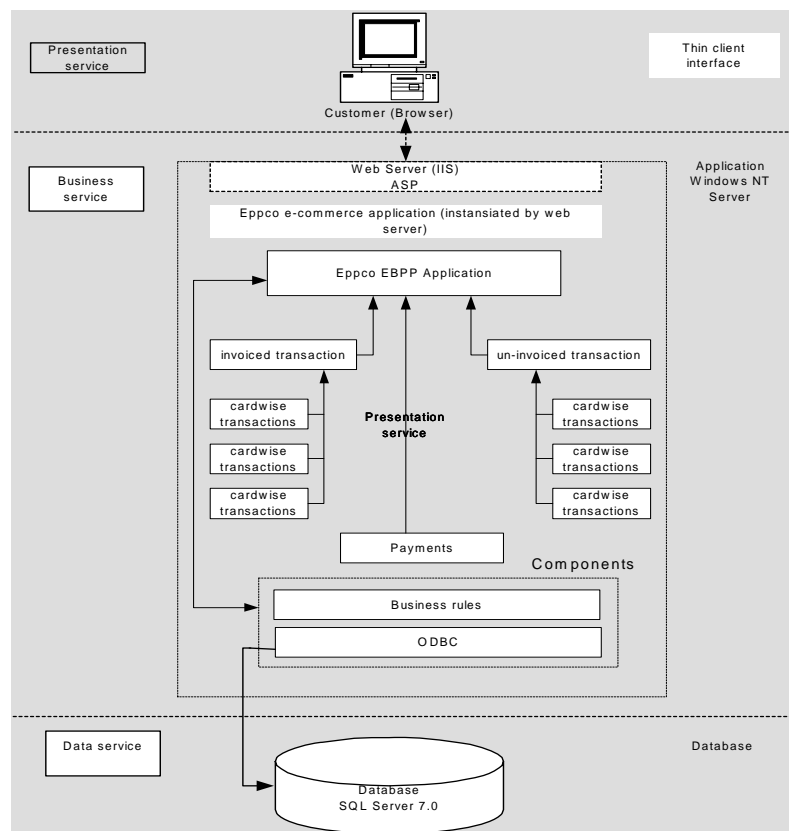
Figure 2: Eppco E-Commerce Application Three Teir Architecture

A customer's requests for invoices, orders and payments are initiated on the client side through a web browser interface. Web page will be served up by the web Server. The web Server IIS, resides on the Windows NT machine. The web server will also take in a request, for an ASP page, which will in turn request the service of components. ASP acts as a surrogate between the browser and the components. Simple texts as well as the full invoice details are obtained through the ASP page interface. Here client-side scripting is used for validations of the user input data.

6.2 Business Service Tier

The Business Service tier is the most dynamic of all the tiers. It consists of the Web Server and the application server. The application server tier holds the shared parts of application and business logic. This tier needs services like transactions, concurrency control and security. Most of the information requested by the applications is accessed via this layer; data intensive computing operations will be executed here. This tier will contain Component Object Model (COM) objects. These components have been created in Visual Basic from Active X DLL project type and are called Eppco.DLL. By keeping the business logic in central component will help in easy maintainability and a coherent updating for all the Eppco business customers whenever the business logic needs to be updated. Internet Information Server (IIS) web server loads this application. This application in turn loads Eppco COM objects. These Eppco components are registered in MTS (Microsoft Transaction server). MTS will manage the component instances and monitor the transactions. MTS uses a pool to hold component instances by handing them out whenever the application requires one. The Eppco's deployment strategy is shown in Figure 3.

The application also manages all the customers' access to the features and functions of the system. This application will remember the customer's status. Client requests to enter the card details, view the invoices, view the card details or make the payment. The ASP pages which will be a combination of static HTML formatted pages and dynamic scripted pages pass the customer's request to Eppco.DLL on the web server that converts the invoice details to an HTML-based message. Another component passes the HTML data into a SQL structured query and queries the search parameters against the database of existing invoice details. The results of this query are returned as an HTML document to the browser. Once the requested page has been delivered to the customer, the connection between the browser and the web server will be broken. This server processing will update business state of the server apart from delivering the requested page to the browser. Customer can make the payments on-line. Bank transfer can do the payment. If the customer has requested to make the payment, then the application will be integrated with the bank application by passing certain parameters as CGI script to the bank server. The bank application will validate the customer by its account number and the Personal Identification Number (PIN). If the transaction is successful, a 'successful transaction' message will be sent to the EIPP, which will set a trigger in this application, which in turn updates the database automatically.
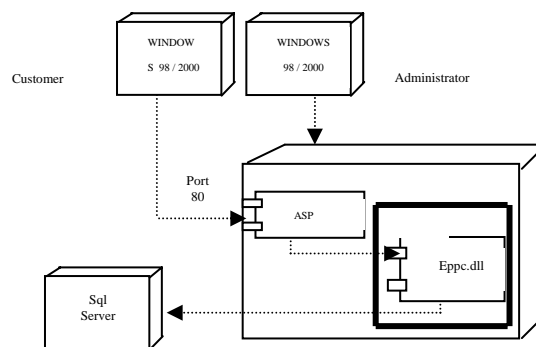
Figure 3. Developed System Components

Compiled components such as ActiveX DLL are used in the application to provide some of the user interface functionality.

Session objects have been used in the application to facilitate personalization.

To prevent any person from going directly to a page without proper authentication, session objects have been used to validate and store identification before allowing access to the page.

Personalization

Users are required to enter their username and password. After analyzing the user profile, data-mining algorithms, a form of artificial intelligence is used to display the information based on his/her profile. Here an algorithm has been given only for one type of personalization for illustrative purpose.

- Free Car Washes displayed On-line based on the amount Spent. The algorithm is to display free car washes, based on the total amount spent by the customer on any Eppco product.

```
Algorithm
Set the session variable equal to the on-line user-id.
If Promotion is on
  Store promotion details
  Set invoice amount equal to sum of all the amounts
  Set award equal to invoice amount divided by the required amount
  If any previous award
    Set award-id equal to maximum (award-id)
    Increment award-id by one
  Else
    Set award-id equal to 800
  Endif
  If more car washes
    Store details in promotion award
    Display the number of free car washes.
  Endif
Endif
```

- Segmenting corporate customers into different groups based on their profile and Eppco resources usage. Card holder employees will be interested only in pages that display the account status of their cards, whereas Contact will be interested in pages used for invoice payments, ordering cards, checking for price updates, promotions etc. too.
- Storing user's name and password using cookies helps the user to login next time without typing in the details.

6.3 Data Service Tier

This tier consists of the database server and the data. It provides three types of services.
- Data translation: Any logical request for the information service will be converted into SQL because Eppco is using SQL data repository.
- The second service deals with the execution of the request by ActiveX Data Objects using Object Data Base Connectivity.
- The third service is the database technology, which in this application is the Microsoft SQL Server.

The system relies on Microsoft SQL Server 7.0 to maintain separate clustered databases for customers, customer service contacts, invoice data and payment data. The Invoice database and the customer personal information database are updated on the first of every month. The transaction data is updated daily. In addition, the Web server stores the payment details

7. CONCURRENT DATA ACCESS

The Eppco database is a shared resource. Multiple users may attempt to access and manipulate the same data at the same time. Several users attempting to update the data without concurrency control may result in conflicts with each other. A concurrency control needs to be implemented to the database. This is achieved by using locking mechanisms in EIPP. With locking mechanisms, any data that is retrieved by a user for updating must be locked to other users until the update is complete or aborted.

SQL Server supports three types of locking mechanisms: auto commit, explicit, and implicit. SQL Server connections operate in auto commit mode by default. Each SQL statement executes automatically as a distinct transaction and commits upon completion in auto commit mode.

An implicit transaction is started whenever an INSERT, UPDATE, DELETE or any other data manipulation function is performed. If there is an open transaction, no new transaction is started unless the previous one is released.

If the implicit locks were used in the Eppco application, and bank transactions i.e., transferring the money from the customer account to the Eppco account is not successful or COMMIT statements are forgotten, it may lead to open transactions and open locks preventing other customers from accessing the data they need. If this situation repeats itself, more and more open locks are created and, at some point, the database becomes unusable.

Eppco application uses explicit transaction instead.Explicit (user-defined) transactions contain one or more individual SQL statements that SQL Server treats as a single logical unit of work.

This code segment creates an explicit transaction to update the customer's invoices.

```
Public Function CreditToMyAccount(CustAccNo, Amount, orgno) As String
    Dim SQL As String
    CreditToMyAccount = ""
    On Error GoTo ErrCreditToMyAccount
    Conn.Open
    Conn.BeginTrans
     SQL = "update bank_account set amount_bal = amount_bal - " & Amount & "
where account_no = '" & CustAccNo & "'"
     Set RS = Conn.Execute(SQL)
    CreditToMyAccount = SQL
    SQL = "update invoice set total_amount = total_amount- " & Amount & " where
org_id = " & orgno
    Set RS = Conn.Execute(SQL)
    Conn.CommitTrans
      Exit Function
ErrCreditToMyAccount:
    Conn.RollbackTrans
    CreditToMyAccount = Err.Description & " - CreditToMyAccount"
End Function
```

The "Begin Transaction" statement defines the start of the transaction. This transaction will remain active until it is ended with either a "Commit" or "Rollback Transaction" statement.

If the "Commit Transaction" statement has been issued, all locked resources held by the transaction are released. The "Rollback Transaction" statement cancels all data changes made since the start of the transaction. It returns the data, referenced in the transaction, to the logically consistent state present at the beginning of the transaction. A transaction cannot be rolled back after it has been committed. The "Rollback" statement also releases all locked resources held by the transaction.

8. SECURITY

To obtain a secure web site for the e-commerce transactions Eppco has taken measures to make sure that the access to the site is controlled and the information communicated by the customers like their user-ids and password are not seen by unwanted user. These measure include

File Access control List, Digest Authentication, Secured Socket Layers (SSL) and by creating security firewalls.
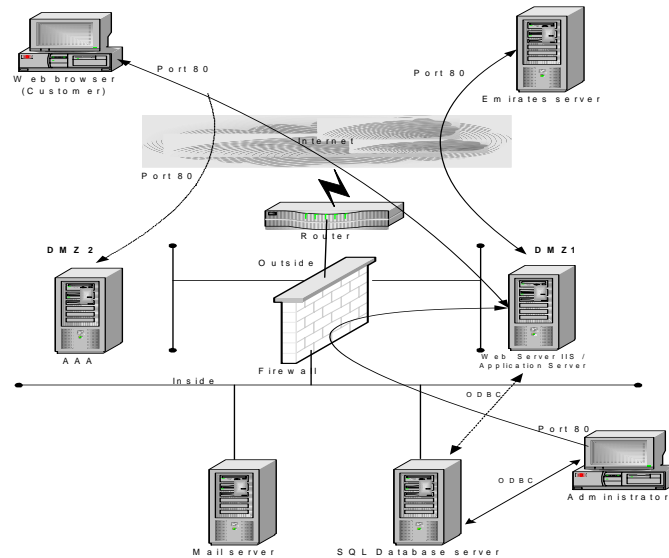
Figure 4: Eppco E-Commerce Application Network Setup

As shown in Figure 4, two de-militarized zones DMZ1 and DMZ2 have been created. Any customer accessing through the internet port 80 will first have to go through the Firewall. The purpose of the Firewall is to setup a secure network zone so that no outsider can access the Eppco servers. Firewall will check if the customer has been defined or not. If it is so, then it'll check if the customer has connected through Port 80 or not. Valid customers will then be sending to DMZ1, where it accesses the AAA (Authentication, Authorization and Accountability) server. Here Customer will be authenticated by matching his username and password. If authenticated, server will check which application, machine is this customer authorized for. Having done so, this server will keep an account of everything this customer does. Having authenticated and authorized then this customer will be sent to DMZ2, where access to the application server is given. This application will access Database server, which is SQL server, which is in the most secure zone, through ODBC. In case of customer making payments, integration with Emirates bank application and Comptrust application running on Eppco server will also use Port 80. Emirates bank uses digital certificates for authentication using a private key.

MTS provides extra security by maintaining the list of users and the privileges list for the use of components.

Cookies based authentication is also used for accessing every Eppco application web page.

9.   IMPLEMENTATION ISSUES

Looking at available alternatives ASP was found to be the best option. Some of the reasons for choosing ASP for the implementation are simplicity, part of IIS, browser independent, free of cost and security against hacking as it is NEVER seen by the browser.

Since it is compatible with XML this application could later be turned from HTML to XML, which is becoming the industry, standard for the exchange of information.

By registering Eppco components in MTS, application will be more scalable because MTS uses a pool to hold component instances, which means that fewer component instances will be created overall, which means a lower burden on the resources. MTS uses a multi-thread feature to achieve it. Thus, the application resources will be able to serve a greater number of users.

10. FUTURE ENHANCEMENTS

The various system limitations in strategy include privilege provided to selected customers only, dealing with a selected bank only, scope restricted to integration with accounts receivable system only, implementing language and the technology used are identified and enhancement solutions provided to overcome these limitations. Application expansion to allow the customers to control, the handling of invoices and credit notes in their organizations, integration with customer's accounts payable, system boundary stretch, JSP as the appropriate implementing environment, integration and increased reliability through clustered database server and XML technology for data transmission to represent data in an application independent way, and to create client-side disconnected record sets, are suggested for the future enhancement.

11. CONCLUSIONS AND DISCUSSION

Eppco, in quest for an upgraded IT solution to provide enhanced customer services at lower costs and real-time delivery lead to the proposed EIPP solution. This solution provides a differentiated personalized service to the customers. To create an invoicing and personalized solution, the Seller's Direct Invoicing Model was preferred where Eppco deploys its web site requiring its customers to log on to view and redeem their invoices. To select and develop the hypermedia application, it was observed that the traditional methodologies were not appropriate here because these do not contain useful abstractions capable of easing the task of specifying applications embodying the hypertext metaphor. Object Oriented Hypermedia Modeling became the natural choice. Decisions about the concurrency issue were taken. Eppco application required a dynamic, scalable and robust web site that could access the database to display invoices and would have the ability to respond to the customer's payment input. ASP was accepted as the best choice for particularly in view of its compatibility with XML. Microsoft Inter Dev 6.0 was used to create the code, a long process that included creating components and ASP pages for the creation, presentment of the invoice, providing payment options for users and creating algorithms for a personalized web site. For any web application, handling money transactions and personal information exchange, security of the information is a prime concern. Security measures include use of file access control lists, Secure Hash standards for user password encryption SSL encryption, cookie based authentication and Firewall technology to create de-militarized zones. Three-tier logical architecture has been used to separate all business logic from the database server and the client thus making the system scalable and easy to change. The integrated e-commerce solution designed for business-to-business invoicing allows Eppco to share invoicing information over the web. It will speed up the invoicing process, allow customers to transmit payment details online and improve management controls. Since it has low bandwidth requirements, access to invoice information is fast. EIPP system presents the invoices to the customers within standard web browsers. Customers are equipped with ability to set preferences for the payment dates, payment modes and amounts. The system integrates with Bank application to handle payment processing and accounts receivable system at Eppco.

Eppco has been used only as model in this research study. This framework can be applied to any industry using similar technologies. In order to maintain the company confidentiality, the figures may not reflect the actuals. This study was done three years back when Eppco had just a static web site. Its competitors like Emarat did not offer any invoice display facility to its customers nor was there any option of personalization in the site. The computerized Safeer Card transaction statements were sent to its corporate customers by post every month. Till this date, both competitors do not provide any payment options on-line, as has been recommended in this study for Eppco. Many other features have been added to it. However this project also recommends additional features like payment option and personalization which could be add-ons.

REFERENCES

1. Martin, S., (2001). "Integrating Ethics into Marketing Strategy", *B to B*, Chicago, Vol. 86, Issue 5, ,March 5, pp. 16.
2. Nemes, J., (2001)."B-to-B sites get persona*l*", *B to B*; Chicago, March, pp. 15- 16.
3. Richter, R., (2000). "E-utilities via the Web", *The new economy Supplement to Penn Well Publications*, pp. 33.
4. Rossi, G., Schwabe, D., Lyardet, F.," Web Application Models are more than Conceptual models", LIFIA, Department0 de Informatica, UNLP, Argentina.
5. Schwabe, D., Rossi, G., (1998). "An Object-Oriented Approach to Web-based Application.

MODEL-BASED PRICING OF E-LEARNING

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ABSTRACT

As colleges and universities use the internet as a new channel for education, questions arise how to cover development costs and how to set up revenue models for e-learning. Pricing mechanisms and flexible e-learning systems are needed to offer learners differentiated e-learning services and to charge for their usage. In this paper, we propose a graphical price modeling language that can be used for setting up tariffs for e-learning. Furthermore, a portal architecture with workflow support is presented that can be used to integrate a learning provider's existing systems like e-learning, pricing, and grading systems into individualized web applications (portals) for learners, tutors, and administrators.

1. INTRODUCTION

In order to reduce development costs for e-learning and to react towards market demand, learning providers need to integrate learning objects and services from different learning providers. Pricing mechanisms for learning objects and services need to be established that help to raise revenues and thus to justify investments made for the adoption of traditional learning material for e-learning, for development and setup of learning management systems, etc. In order to implement pricing in e-learning, technical requirements need to be fulfilled that allow for the integration of pricing aspects into the existing e-learning systems. We propose a portal architecture that meets these requirements by providing workflow-support to orchestrate pricing and e-learning processes. Thus, a learning provider can succeed in implementing usage-related accounting and pricing mechanisms for different customers and for learning objects as well as e-learning processes of varying complexity. As a means for defining price models a price modeling language will be presented.

In the following section, the pricing of e-learning will be considered from a conceptual view. Therefore, we differentiate between three conceptual models for the description of customers, products / services and pricing schemes. The third section presents a graphical and formal modeling language for *price models* that can be used for flexible pricing of e-learning. Afterwards, in section 4, we suggest extensions to existing Web Services-based e-learning systems architectures by adding portlet functionality. Thereby, individualization of e-learning systems for different users and user groups, as well as inter-process communication between parts of e-learning systems that are encapsulated in Web Services can be simplified. In section 5, Petri nets for workflow-based pricing of e-learning are presented. Section 6 concludes with a brief summary and an outlook on future research issues and developments.

2. CUSTOMER-FOCUSED PRICING OF E-LEARNING

2.1 Learning Objects and e-learning Processes

For products in e-learning, the term *learning object* has been coined (Vossen & Jaeschke 2003). Learning objects such as course lectures form input and output of activities in e-learning processes. *E-learning processes* can be divided into teaching, learning, and administration processes (Gruene et al. 2004). Besides the traditional process of "learning", learning processes include the information exchange between teachers and learners. Pricing mechanisms in e-learning can be linked to both learning processes and learning objects. When an e-learning provider chooses to use a cost-plus pricing strategy, he should also consider costs for support processes and administrative processes during calculation.

2.2 A Conceptual View on Pricing

Besides costs and the price levels of competitors, a customer-focused pricing of e-learning services and products needs to consider the learners' requirements with regard to quality and quantities (Nagle & Holden 1995). Our approach concentrates on the operative aspects of pricing e-learning. We do not take into account the development of strategic objectives and goals, like the definition of business cases, the setup of revenue models, or analyzing the effects of different price levels on the consumer behavior as described in (Monroe 2003). Instead, we try to ease the design of price models on a conceptual level. By help of price models, pricing mechanisms can be implemented in e-learning systems. Price models for e-learning can be set up similar to price models for services in other domains like mobile communication, application service providing, or internet access. We think that price models in e-learning will develop from rather simple flat-fee price models to more differentiated price models like the price model applied by Penn State World Campus (www.worldcampus.psu.edu). For price models for services the term *tariff* has been established. Tariffs, according to (Diller 2000), link prices to certain, distinguished usage behaviors and conditions. In e-learning, e.g., the learner's usage behavior over a pre-defined period of time can be taken as the basis for pricing. Tariffs may also define usage-independent prices, such as subscription fees, setup charges, or license fees for the use of e-books.

Fig. 1 gives an overview of the conceptual models that are needed to implement a pricing mechanism in e-learning. *Price models* define rules for the pricing of products and processes by introducing prices. Besides the description of prices and price structures in price models, an e-learning provider needs to describe in detail "what is sold" to the customer. Product and service offerings for learners, resellers, learning providers, and institutional customers must be described in *product* and *services models* (product models for short). Besides the content description of learning objects and the definition of the e-learning processes, product and services models in e-learning can define service levels to be met by the learning provider. Guaranteeing service levels is of major concern when a learning provider licenses learning objects and services from other learning providers, e.g., to enrich her own e-learning offers. Primal concepts for product models can be found in the Sharable Content Object Reference Model standard (SCORM; www.adlnet.org). The SCORM standard provides metadata schemes that can be used for describing the content of learning objects. Furthermore, so called "sequencing" in SCORM allows for a definition of learning paths that guide the learner through learning objects being contained in a SCORM package. An overview of SCORM and similar standards is given in (Collier & Robson 2002). As SCORM is focused on the exchange of learning objects in content packages, it is suitable as a product model for buyer-seller relationships in an institutional environment. For individual learners the description of learning products and processes, e.g., course systems for undergraduate students is generally given in textual form. From the learning provider's and the individual learner's point of view a formal and graphical and precise product description by appropriate models would further the understanding of learning programs and simplify their adaptation to individual needs. Thus, the increased flexibility of product models makes it possible to "respond to the growing diversity of students in terms of motives, talents, and job perspectives. (Teichler 2003)" A learning provider in higher education should also define rules and requirements for a certification of learners' academic achievements in her product models. An in-depth analysis and development of formal and graphical product models for e-learning

is still missing. Comparable approaches may be found in software engineering, e.g., in the fields of requirements engineering and versioning of software products.

Customer group models allow for the definition of various customer profiles, e.g., regular student, part-time student, institutional customer, reseller, etc. Customer groups form the basis for customer-based price differentiation and granting access rights to learning products and processes. Rules for the definition of discounts and additional charges should not be defined in customer group models, as they are part of price models. Access rights for customer group models in e-learning systems can, e.g., be implemented with reference monitors (Schneider 2003).
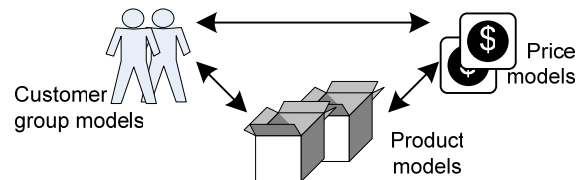
Figure 1. Conceptual orientation towards pricing

To enable the development of pricing mechanisms in e-learning, the above mentioned models need to be connected to each other. A user will be granted prices according to his group membership. Thus group membership limits the number of applicable price models for the user. Price models may be designed for specific product and services models, e.g., to implement a usage-oriented charging of e-learning processes. And product models should be designed according to the customers' needs and valuations.

3. PRIMOL – A PRICE MODELING LANGUAGE

3.1 Price and Price Models

According to (Monroe 2003), price can be defined as "(…) the amount of money we must sacrifice to acquire something we desire. That is, we consider price as a formal ratio indicating the quantities of money (…) needed to acquire a given quantity of goods and services (…)." Monroe emphasizes the link between price models, which describe the numerator, and product models, which describe the denominator. Often, the numerator itself can be calculated as a function of the denominator, e.g., the price for a unit may decrease with the number of consumed units. A price model itself can be composed of different price components. It is used for calculating a price for given time frames, e.g., every month. During price calculation, price components will be evaluated and aggregated to determine an invoice value. A price model thus needs to provide means for defining functional and logical operations on its components. A price model could codify, for instance, that a monthly download of 20 learning objects is included in a user's tariff whereas all downloads that exceed this amount shall be priced with € 1.99.

3.2 Price Model Components

Our proposed description language for price models distinguishes between three components: simple price, complex price, and aggregation rule.

3.2.1 Simple Prices

Examples for so called *simple prices* in e-learning are one-time charges that apply for booking of a course or learning module, or license fees for e-books that are paid only once. Enrollment fees that are charged each trimester or semester are another example for simple prices. Simple prices are connected to events, i.e., an amount will be charged for a simple price, if the adhering event occurs. Events can be triggered by user interaction with the e-learning system or by time constraints. Simple prices are ideal for charging additional, individual services that are offered to the learner, for instance late registration for courses or support requests for setting up a learning environment.

3.2.2 Complex Prices

Complex prices, in general, allow for the calculation of prices from different property dimensions. In e-learning, the price for a learning object could depend on the number of semesters, the learner has been inscribed for courses, the home location of the learner, and the quality of the learning object. Complex prices can be modeled in two ways: Firstly, the user of the price modeler can define arithmetic and logical operations over the property dimensions in complex prices to determine a price value. A formula for an e-learning object (LO) could then be given as: $p = f(semesters) \oplus g(location) \oplus h(complexityOfLObject)$, where p is the price to be calculated, f, g, and h provide functional rules for the respective dimension, and $\oplus$ stands for operators that are used for aggregating the dimensions' valuations. Given the dimensions in Table 1 and defining $\oplus$ as multiplication operator, the price for an e-learning object can be calculated by multiplying the functional results for each dimension. A US-American learner in the second semester of her studies will be charged for "consuming" a learning object of low complexity as follows:

$$p = f(2) * g('USA') * h('low') = 1.50 * 0.096 * 0.90 = 0.1296$$

For the definition of operations in complex prices, we rely on MathML (Mathematical Markup Language). MathML (W3C 2003) provides an extensive XML vocabulary for arithmetic and logical expressions. It is supported by leading software producers, such as Design Science, Wolfram Research, and Mathsoft.

Table 1. Property dimensions for the functional determination of a complex price

Location	Europe	USA	Africa	
	1.00	0.90	0.80	
Complexity of LO	low	medium	high	
	0.096	0.12	0.138	
No. of semesters	1	2	3	…
	1.00	1.50	2.00	…

Secondly, calculating a complex price can be established by providing an array of price values for the price's dimensions. Thus, the determination of a price can be reduced to reading the field value in a multidimensional array, where the dimension values indicate the position, at which the price is located in the array. According to the depicted complex price with three dimensions in Fig. 2, a US-American learner in the second semester of her studies will be charged € 0.13 for consuming a learning object of low complexity. The respective array field follows from the property dimensions' values, the array field index. In our case, the array field index is given as [location='USA', complexityOfLObject='medium', semesters=2]. The modeling language supports the definition of an arbitrary number of dimensions for a complex price array; it is not restricted to three-dimensional arrays. If a course is "reused" from a third party, such as an external instructor with a high reputation in a certain teaching domain, e.g., agreed upon usage terms between a learning provider and the instructor can be (partially) modeled as dimensions. Thus, it is possible to differentiate between high-priced and regular courses on the level of complex prices and dimensions.
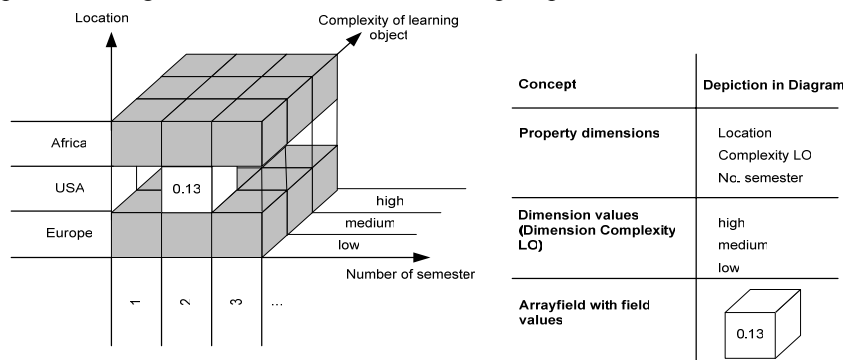
Figure 2. Multidimensional array for the determination of a complex price

3.2.3 Aggregation Rules

Price models include numerous simple prices and complex prices. To allow, e.g., for billing, *aggregation rules* must be defined that provide mechanisms for compressing the price data that are generated when simple prices and complex prices are applied to the production data of the e-learning system. In Fig. 3, a complex price is applied for charging the consumption of learning objects. As a result, for each learning object, a tuple is generated that indicates the monetary amount to be paid and the user who will be charged the referring amount. After that, an aggregation rule is applied to the tuples which counts their number and the amount payable as a sum over all tuples. The results of the aggregation rule can be used as an invoice item for billing purposes. Aggregation rules may reference and process an arbitrary number of price components.
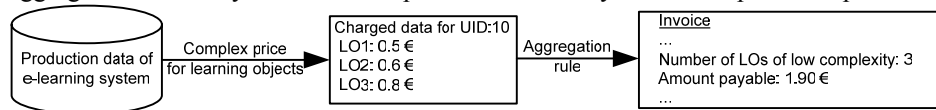
Figure 3. Applying aggregation rules for invoice generation

3.3 Structure of Price Models

Fig. 4 summarizes the structure of a price model. A price model can contain several layers. Except for the root layer, i.e., layer 0 in the diagram, which may comprise only one aggregation rule, each layer can contain multiple aggregation rules (AR), simple prices (SP), and complex prices (CP).
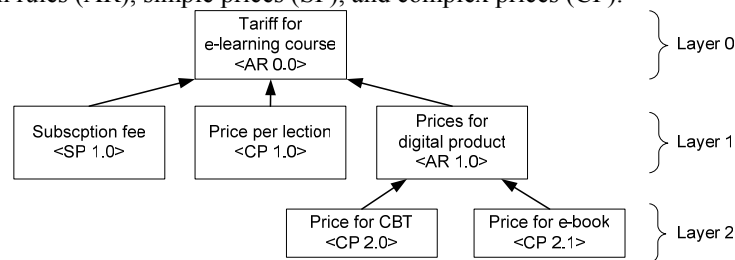
Figure 4. Structure of a price model for e-learning

A single aggregation rule can contain references to an arbitrary number of aggregation rules, simple, and complex prices in the next model layer. In the example, the aggregation rule AR 1.0 on layer 1, which aggregates prices for digital products, references the complex prices CP 2.0 and CP 2.1. All price models are evaluated from bottom to top. During the instantiation of the depicted price model, in a first step, complex prices CP 2.0 and CP 2.1 are being evaluated. As indicated in the previous paragraph, AR 1.0 can then be used to compress and manipulate the results, e.g., by providing only a single price as a sum over all prices for the consumed products. Adding subscription fees (SP 1.0) and prices for the passed lessons (CP 1.0) to the prices for digital products (AR 1.0) by applying AR 0.0 finishes the calculation of the fees that will be charged for the learner's participation in an e-learning course, e.g., during a semester.

3.4 Graphical Description of Price Models

To simplify setup and analysis of price models, we introduce graphical symbols for the price model components. Graphical artifacts are given for aggregation rules, simple prices, and complex prices. Fig. 5 also depicts the referred elements of the metamodel for the price modeling language.

Besides the identification of its type, e.g., SP for simple price, each price component in a price model contains one or more attributes. We implemented a prototype which supports the graphical definition of price models. In the first phases of an iterative design of a price model, all attributes can be hidden to avoid information overloading. Graphical artifacts are linked to each other by directed edges (hierarchical links), which arrange the artifacts in a hierarchical structure.

4. A PORTAL ARCHITECTURE FOR E-LEARNING SYSTEMS

4.1 Web Services and Portlets

Numerous authors have worked on the integration of Semantic Web technologies (Web Services, ontologies, XML) and e-learning. (Vossen & Westerkamp 2003) and (Liu, El Saddik & Georganas 2003) describe, how to construct e-learning systems by integrating distributed Web Services. (Reklaitis, Baniulis & Okamoto 2003) suggest providing Web Services for e-learning in peer-to-peer systems as 'Grid Services'. (König-Ries & Klein 2002) extend this view to mobile devices. For orchestration of Web Services, workflow-management systems (WfMS) can be used (Cesarini, Monga & Tedesco 2004; Gruene et al. 2004). A standard for the orchestration of Web Services called Business Process Execution Language for Web Services (BPEL4WS, ftp://www6.software.ibm.com/software/developer/library/ws-bpel.pdf) has been established. The combination of Web Services with BPEL4WS will in future ease the communication and the integration of new components into e-learning systems.

Unfortunately, Web Services do not provide graphical elements for displaying their data. A Web Services-based e-learning system thus needs to provide its own graphical layer. A graphical layer should offer user interfaces for different roles (administrator, learner, tutor, etc.). The portlets standard that builds on Web Services addresses these issues. Portal servers extend application servers for the execution of Web Services by supporting the portlet specifications WSRP and JSR 168 (Abdelnur & Hepper 2003; OASIS 2003). Portlets are self-contained mini applications that can be integrated into Web-based information systems (portals) (Clarke 2004). Portlets add functionality by offering communication over J2EE session contexts (cf. Java 2 Platform Enterprise Edition; http://java.sun.com/j2ee/) and support single sign-on mechanisms (Díaz & Paz 2005).
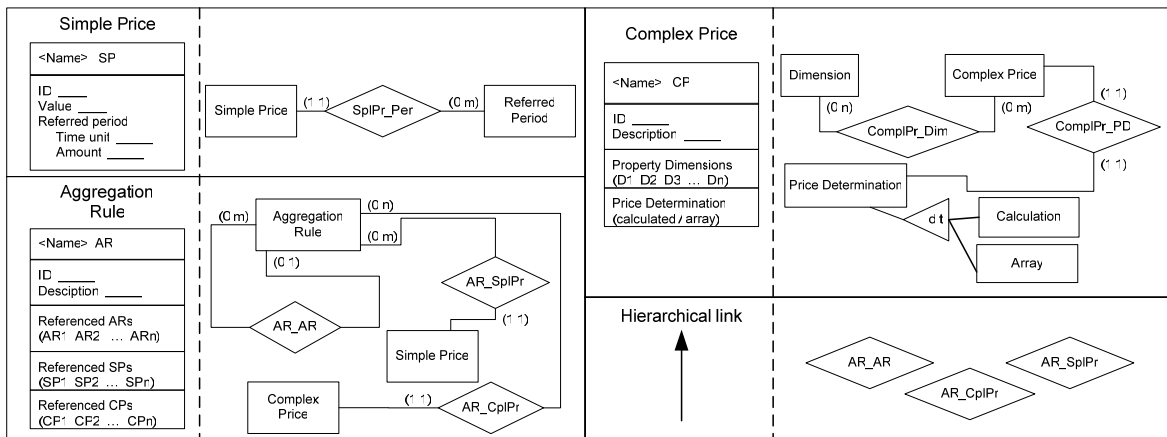
Figure 5. Graphical artifacts for price model components

4.2 An Architecture for e-learning Portals

For the design of flexible e-learning systems, we propose a portal architecture as depicted in Fig. 6. Portals are provided for learners (learning system) and tutors (learning management system). Portlets by third-party providers can be integrated into portals by proxies.[1] For instance, Web Services WS1 and WS2 as well as their graphical layout are hosted on remote servers. Learners-tutor communication is supported on the Web Services and workflow layers of the portal architecture. When a tutor sends an e-mail over her portal, the contents of the mail are processed by WS4 and delivered to WS5. Thereupon, WS 5 as part of a portlet

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[1] A proxy ensures communication via SOAP messages with WSRP-conformant portlets on remote servers and loads the referring instructions for rendering the portlet content.

displays the new mail to the learner. Web Services as parts of portlets as well as Web Services for background tasks may connect to the underlying databases for e-learning content, for price models, etc. When a tutor designs new course content, the referring e-learning objects will be packaged and written to a database by a "course generation service". The packages will be interpreted by a "SCORM runtime Web Service" and delivered to the user by the portlet that includes WS 6.
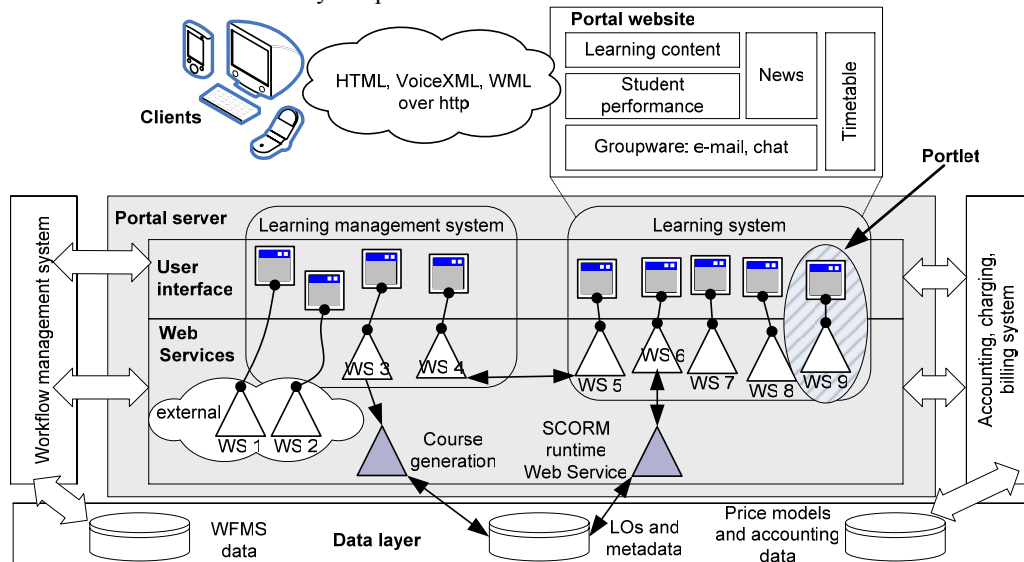
Figure 6. Portal architecture of an e-learning system

The execution and modeling of e-learning processes and processes for pricing are supported by a WfMS (Gruene et al. 2004; Vossen, Jaeschke & Oberweis 2002). In the learner's and administrator's portal pages, the pricing functionality can then be integrated as portlets, e.g., a price model and pricing process design view for administrators or the actual amounts due on the learner's pages.

5. PROCESS-BASED PRICING OF E-LEARNING

As important as the support for workflow execution of e-learning and pricing processes is the modeling of the respective workflows, i.e., the formal representation of real-world processes with a notation that is easy to understand and unambiguous. The precise process descriptions can serve as the basis for a systematic analysis and simulation of the processes. Petri nets (Reisig & Rozenberg 1998) as process description language combine the advantages of a graphical representation of processes with a formal definition. They consist of static components (places, depicted by circles) and dynamic components (transitions, depicted by rectangles) that are connected by edges.

Fig. 7 shows a simple, informal Petri net that describes a process for participating in an e-learning course as well as an accounting, charging, and billing processes that are used for pricing and billing a learner's resource usage. At first, after having booked a course, a learner has to attend an assessment. Depending on his knowledge level, the learner needs to pass different course lectures that are each followed by a test which is composed of several tasks. After the last test, a certificate is generated that gives a detailed lineup of the learner's performance.

The generation of accounting data by so called *pricing aspects* is illustrated by flashes in the e-learning process. Flashes define *join points* from an aspect-oriented view where special pricing events are triggered. Join points can be identified by a referring query on the process scheme. A typical query could be: "find all points where a transition that is labeled 'lecture' starts". Each join point leads to an action, e.g., the generation of accounting or logging data that can be used by another process. In the exemplary process, the events "start of a lecture" and "end of a test" are thus being logged and written to the accounting database. Also, if a learner views third-party streaming media within a lecture, an accounting token will be generated. In Fig. 7, an accounting, charging, and billing process is defined for automated, e.g., monthly generation of invoices.

Invoices can then be delivered to the learner via an individual portlet in the learning system as described above. We intend to introduce join points and aspects for processes in further research. Currently, aspect-oriented techniques are mainly applied in programming, e.g., for adding security to existing software systems (Wand 2004). First research has been done on aspect-oriented modeling by (Jeff et al. 2003; Li, Houmb & Kvale 2004).
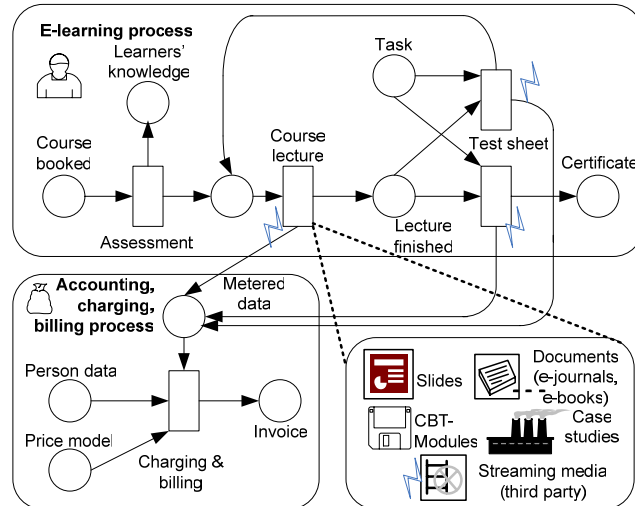
Figure 7. E-learning and accounting, charging, and billing process as Petri net

6. CONCLUSION

In current e-learning systems the adaptation to user-specific needs is usually limited to the generation of courses for different levels of study. In a fast changing learning environment it is crucial to reuse and integrate learning objects from diverse sources and to provide them to learners according to their actual needs. In a pure online environment, the learning provider should offer his customers access to all relevant information like learning content, grades, invoices, e-mails, examination regulations, etc., over virtual channels, e.g., the Web. In this context, portals and BPEL4WS as evolving standards can ease the integration.

For the formal definition of learning processes and for the pricing of e-learning, we make use of XML nets (Lenz and Oberweis 2003). Process schemes that are defined with Petri nets can be analyzed and processed by workflow management systems.

To enable the pricing of e-learning, we have developed a graphical language that supports the definition of price models as well as an XML representation of this language. Furthermore, an editor for the graphical construction of price models has been implemented as a prototype. In a next step, we will integrate an existing e-learning system at the University of Frankfurt and our pricing software prototype by applying the proposed portal architecture.

Once price mechanisms can be implemented in e-learning, new topics will emerge for future work. E.g., how can e-learning providers like universities use price information for controlling their portfolios of courses (price adjustment of course fees, removing courses from the schedule, make-or-buy decision, etc.) Furthermore, in a competitive market, techniques from marketing research, such as conjoint analysis and other types of market analysis, need to be applied in order to determine the customers' valuations for different learning products and services. From a managerial perspective, additional tool-support is needed for measuring the performance of different courses, for monitoring the students' success and duration of studies, etc. Extensive research efforts on performance indicators for e-learning are currently undertaken at the University of Karlsruhe (Keferstein et al. 2005).

REFERENCES

Abdelnur, A. and Hepper, S., 2003, *JSR 168: JavaTM Portlet Specification - Version 1.0, Final Release*, viewed 2005-07-06 <http://www.jcp.org/en/jsr/detail?id=168>.

Cesarini, M. et al., 2004. Carrying on the e-learning process with a workflow management engine. in *Proceedings of the 2004 ACM Symposium on Applied computing*. ACM Press. Nicosia, Cyprus.

Clarke, S., 2004. Standards for Second-Generation Portals. *IEEE Internet Computing*, Vol. March/April 2004, pp. 54-60.

Collier, G. and Robson, R., 2002, *E-Learning Interoperability Standards*, SUN Microsystems, viewed 2004-06-10 <http://www.sun.com/products-n-solutions/edu/whitepapers/pdf/eLearning_Interoperability_Standards_ wp.pdf>.

Díaz, O. and Paz, I., 2005. Turning Web Applications into Portlets: Raising the Issues. in *Proceedings of the 2005 Symposium on Applications and the Internet (SAINT'05)*. IEEE Press.

Diller, H., 2000. *Preispolitik*. W. Kohlhammer. Stuttgart et al., Germany.

Gruene, M. et al., 2004. Individualization of E-Learning Processes by Workflow-Based Learning-Object Management. in W. Abramowicz (ed.), *Proceedings of 7th Int'l Conf. on Business Information Systems*. Vol. 1. Akademia Ekonomiczna w Poznaniu. Poznan, Poland, pp. 214-226.

Jeff, G., B. Ted et al. (2003). An approach for supporting aspect-oriented domain modeling. Proceedings of the second international conference on Generative programming and component engineering. Erfurt, Germany, Springer-Verlag New York, Inc.

Keferstein, K. et al., 2005. Management of E-Learning Processes with High-level Petri Nets. in V. Uskov (ed.), *Proceedings of Computers and Advanced Technology in Education (CATE 2005)*. Oranjested, Aruba. ACTA Press, Calgary, Canada.

König-Ries, B. and Klein, M., 2002. Information Services to Support E-Learning in Ad-hoc Networks. in *Proceedings of the 1st Int'l Workshop in Wireless Information Systems (WIS2002)*. Ciudad Real, Spain.

Lenz, K. and Oberweis, A., 2003. Interorganizational Business Process Management with XML Nets. in H. Ehrig, W. Reisig, G. Rozenberg, H. Weber (eds.), *Petri Net Technology for Communication Based Systems*. LNCS 2472, Springer-Verlag. Berlin et al., Germany.

Li, J. et al., 2004. A Process to Combine AOM and AOP: A Proposal Based on a Case Study. in *5th Aspect-Oriented Workshop (In conjunction with UML 2004)*. Lisbon, Portugal.

Liu, X. et al., 2003. An implementable architecture of e-learnings system. in *Proceedings of the Canadian Conf. on Electrical and Computer Engineering (CCECE 2003)*. Montréal, Quebec, Canada.

Monroe, K.B., 2003. *Pricing - Making Profitable Decisions*. McGraw-Hill Irwin. Boston et al.

Nagle, T.T. and Holden, R.K., 1995. *The strategy and tactics of pricing: a guide to profitable decision making*. Prentice Hall. Englewood Cliffs, NJ.

OASIS. (2003). "Web Services for Remote Portlets Specification." OASIS Standard Retrieved 2005-10-05 <http://www.oasis-open.org/committees/wsrp>.

Reisig, W. and Rozenberg, G., 1998. *Lectures on Petri Nets I: Basic Models*. Springer-Verlag, Berlin.

Reklaitis, V. et al., 2003. Shaping e-Learning applications for a service oriented GriD. in *Proceedings of the 2nd Intl. LeGE-WG Workshop on e-Learning and Grid Technologies*. British Computer Society. Paris, France.

Schneider, F.B., 2003. Least Privilege and More. *IEEE Security and Privacy*, No. Sept./Oct. 2003, pp. 55-59.

Teichler, U., 2003. The Future of Higher Education and the Future of Higher Education Research. *Tertiary Education and Management*, Vol. 9, pp. 171-185.

Vossen, G. and Jaeschke, P., 2003. Learning Objects as a Uniform Foundation for E-Learning Platforms. in *Proceedings of the 7th IEEE International Conference on Database Engineering and Applications*. IEEE. Hong Kong, China, pp. 278-287.

Vossen, G. et al., 2002. Flexible Workflow Management as a Central E-Learning Support Paradigm. in *Proceedings of the 1st European Conference an e-Learning*. Uxbridge. UK, pp. 253-267.

Vossen, G. and Westerkamp, P., 2003. E-Learning as a Web Service. in *Proceedings 7th IEEE Int'l Conference on Database Engineering and Applications*. IEEE Computer Society Press. Hong Kong, China, pp. 242-249.

W3C, 2003, *Mathematical Markup Language (MathML) Version 2.0 (Second Edition) - W3C Recommendation*, MIT, ERCIM, Keio, viewed 2005-10-05 <http://www.w3.org/TR/MathML2/>.

Wand, M., 2004. A Semantics for Advice and Dynamic Join Points in Aspect-Oriented Programming. *ACM Transactions on Programming Languages and Systems*, Vol. 26, No. 5, pp. 890-910.

PRIVACY AND SECURITY ISSUES AND PRACTICES AMONG eCOMMERCE CONSUMERS

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ABSTRACT

Two of the main issues in electronic commerce are the assurance of privacy and security of on-line transactions. Consumer protection legislation of online transactions has been proposed from various entities, and some bills have passed the legislative process. In order to investigate consumer practices compared to consumer advice, this study was designed to identify the degree of awareness and practices of consumers engaged in electronic commerce.

KEYWORDS

Electronic commerce, privacy, security, consumer protection, legislation.

1. INTRODUCTION

On-line shopping has increased dramatically during the past decade. Along with the advantages brought by electronic commerce for consumers, several concerns have been identified. Two of the main issues are related to the assurance of privacy and security of on-line transactions (Briones, 1998; Caudill & Murphy, 2000; Miyazaki & Fernández, 2001). Particularly, the increased use of spyware, software intended to collect users private information, has raised public concern. The Federal Trade Commission (FTC) conducted a study in 1998 where 1,402 commercial web sites were analyzed to determine whether self regulation is an effective means of protecting consumer privacy on the Internet. They found that a tremendous amount of personal information is collected from consumers even though the majority of this information is not necessary to complete on-line transactions. Some of the unnecessary information Social Security number, gender, education, occupation, income, hobbies, interests, and the type of hardware and software used by on-line consumers. In addition, all information collected may also be released to, or accessed by, third parties compromising not only privacy, but also security including identity theft (Linnhoff & Langenderfer, 2004; Milne, Rohm & Bahl, 2004). Furthermore, the FTC found that only a small number of the websites surveyed offer either a Privacy Policy Notice or an Information Practice Statement where consumers are informed about the use of the information they provide.

(http://www.ftc.gov/reports/privacy3/survey). An update to the Federal Trade Commission's (FTC) 2003 Identity Theft Survey Report by Javelin Strategy & Research and the Better Business Bureau found that even though identity theft is more commonly related to offline transactions, online commerce is not immune to this crime (http://www.javelinstrategy.com/reports/2005IdentityFraudSurveyReport.html). More recently, Consumer Reports (September, 2005) identified viruses, spyware, and phishing as rising threads translated in multibillion dollar damages for consumers.

Consumer protection legislation of online transactions has been proposed and some bills have passed the legislative process (http://www.cdt.org/legislation/; Sovern, 2004). In response, Web developers and on-line business through entities such as the On-Line Privacy Alliance and the Platform for Privacy Preferences or P3P, argued against additional legislation and provided self regulation alternatives in the form of third party seals of approval and voluntary Private Policy Statements (http://www7.software.ibm.com/vad.nsf/Data). Some of the privacy and security related third parties seals of approval include the Better Business Bureau, CPA Web Trust, TRUSTe, VeriSign, and Web Assurance Bureau (Miyazaki & Fernández, 2001). The Federal Trade Commission, The Privacy Leadership Initiative; the National Consumer League and Consumers Union representing the public and private sectors of the U. S. society as well as academic researchers have conducted surveys to demonstrate the magnitude of the problem and the lack of consumer awareness of the problem and the means for self protection. All of them identify the need for consumer education as the most important security and privacy protection against identity theft. They have developed educational campaigns and materials to educate the public.

However, despite private and public efforts to provide guidelines and to educate consumers, a recent survey by Consumers Union found that despite industry's efforts, on-line threats were worse than they had been a year ago, largely because of government inertia and consumers imprudent practices (Consumer Reports, 2005). In order to investigate consumer practices compared to consumer advice, this study was designed to identify degree of awareness and practices engaged in by selected consumer groups. More specifically, this study intended to answer the following research questions:

1. Are consumers aware of privacy and security technology available to them as it is assumed?
2. Do consumers follow practices that protect privacy and security?
3. What are other variables that determine the use of recommended protective practices of consumers engaging in electronic commerce?

A questionnaire with items assessing participant's on-line behavior, familiarity with e-commerce, and awareness of privacy and security and Internet technologies was developed and administered to two groups of participants during Spring 2005. This questionnaire was based on the Center for Democracy in Technology (CDT) ten specific tips for consumers to protect their privacy when involved in e-commerce. The instrument consisted of three parts. The first part collected demographic information such as age and gender. This part also included questions about credit cards and hours spend on line per week. The second part included 11 "yes-no" questions about Internet usage and technologies and the self assessment of participants as an informed consumer and / or computer literate. The third part was intended to measure consumer behavior using a 13 item 7 points Likert type scale (1= very strongly disagree; 7= very strongly agree) responding to the following statements:

- I always look for and read privacy policies on the Web
- In addition to my work/university e-mail, I have a separate account for my personal e-mail
- I consider it important for children to get their parents' permission before giving out information online (question for students sample)(I talk with my children about getting my permission before giving out information online – question for the professionals sample)
- I clear my computer's memory cache after browsing
- I make sure that online forms are secure before filling out information
- I set up my browser to reject unnecessary cookies and/or spyware
- I use anonymous remailers
- I encrypt my e-mail
- I use anonymizers while browsing
- When giving the chance, I opt-out of third party information sharing

- I always refuse to give information to a Web site
- I always ask a Web site to remove my name and address from any lists used for marketing purposes
- I always ask a Web site not to share my name or personal information with other companies

2. BODY OF PAPER

Rather than using a random sample of consumers, the researchers were interested in surveying individuals with high probability of being Internet users for e-commerce purposes and to be educated consumers. A total of 357 individuals participated in this study. They provided 299 useful and correctly completed questionnaires. From this sample two groups of participants were identified. The first group included students at a public Mid-Western University enrolled in either Family and Consumer Sciences (84) or Technology (135) related majors (n = 219). Participating students were chosen because of their uniform background in either computer technology related areas or consumer related areas. The instrument was administered during class time with the participation of all students present at the time.

The second group of participants was chosen from a list of educators registered by the Illinois State Board of Education. The list included individuals whose primary assignment was to teach Consumer Education or related areas such as Economics Education, Accounting and Book Keeping, and Business Administration and Management in the State of Illinois between 2003 and 2004. A total of 380 questionnaires were mailed to consumer educators throughout the state of Illinois. A total of 80 consumer educators responded and participated in the study, for a return rate of 21%.

Findings

A total of 167 participants in this study were females and 132 were male. There were 84 Family and Consumer Sciences (FCS) and 135 Technology (TEC) majors respectively and 80 consumer educators. The mean age of the student participants was 23.5 years whereas the mean age for consumer educators was 42.5 respectively. Students have on average 6.44 credit cards (with a median of 2) and spent 16.13 hours on-line per week, whereas their consumer educator counterparts own 4.5 credit cards and spend 8.18 hours per week on-line. As listed in Table 1 below, 91% of the respondents had Internet access. Ninety percent of the sample considered themselves computer literate and 93% self identified as informed consumers. In the three months prior to the survey, approximately 77% made a purchase on line, 89% provided e-mail address to the web site, and 75% registered on web sites. 32% of the sample either have been a victim of identity theft or know someone who has been a victim. In terms of protective software available in their computers, 51% had encrypting software, 19% used anonymizers, and 15% used anonymous remailers. Analysis of Variance (ANOVA) and Pearson R bivariate correlations were used to analyze the appropriate data.

Table 1. Consumer and on-line Practices

	Yes	**No**	**No response**
Internet Access	271	18	10
Purchase in Last 3 Months	231	68	
Provided e-mail to website in past 3 months	265	34	
Registered on web site in past 3 months	225	74	
Ever been Victim	96	203	
Encrypting software	153	135	11
Anonymizers on Computer	58	225	16
Anonymous Remailers	46	243	10
Computer/Internet literate	269	26	4
Informed Consumer	277	22	
More information	219	78	2

Determinants of on-line practices

Gender: When looking at the entire sample, female participants were more likely than their male counterparts to look for and read privacy policies on the web. Female participants were also more likely to

encrypt their e-mail. When investigating only the student cohorts, statistically significant differences were even more compelling. In addition to the previous two differences the researchers found that females were more likely to consider it important for children to get their parents' permission before giving out information online, and to always refuse to give information to a Web site. Male students were more likely to clear their computer's memory cache after browsing.

Gender seems to be one explanatory variable when engaging in electronic transactions. Female on-line consumers seem to be more cautious than their male counterparts. This is also confirmed when we compared Family and Consumer Science students (mainly female) to Technology students (mainly male). A total of 135 students identified their major as technology whereas 84 students were enrolled in a consumer sciences related major. This comparison identified three statistically significant differences. While family and consumer sciences students were more likely to look for and read privacy policies on the web, technology students were more likely to clear their computer's memory cache after browsing and tended to make sure that online forms were secure before filling out information.

Speculations about possible reasons for this finding are beyond the scope of this study. However, given the implications for education and marketing purposes, further research on this issue is recommended. Furthermore, the fact that on-line behavior seems to differ between students' major is also not surprising. Thus, one may infer that education does indeed have some impact on on-line behavior. As FCS students tend to learn and know more about commerce and related policies and Technology students tend to learn more about setting up computers with more precaution.

Age: The older the participant the more likely she or he would be to engage in recommended practices. There were positive, statistically significant correlations between age and the following five behavioral items:

- I always look for and read privacy policies on the Web (0.145*)
- I make sure that online forms are secure before filling out information (0.208*)
- I encrypt my e-mail (0.118*)
- When giving the chance, I opt-out of third party information sharing (0.244**)
- I always refuse to give information to a Web site (0.258**).

Thus, age seems to be another major contributor to on-line behavior. This is confirmed not only by the age variable but also when students (average age 23.5) and professionals (average age 42.5) are compared. There were statistically significant differences for three items: 'I always look for and read privacy policies on the Web';, 'When giving the chance, I opt-out of third party information sharing', and 'I make sure that online forms are secure before filling out information were all rated more favorably by professional participants. There was also a statistically significant difference for the item 'I consider it important for children to get their parent's permission before giving out information online'. However, this question was posted as 'I talk with my children about getting my permission before giving out information online' on the questionnaire sent out to the professional consumer educators. Nevertheless, students rated this item higher than consumer educators. Older, more experienced consumers tend to behave more cautiously and to be more informed than their younger counterparts.

Nevertheless, it seems reasonable to recognize that experience is not only related to age, but also to the usage of the Internet. There was a positive statistically significant correlation between 'Hours spent on the web per week' and the following four items:

- I clear my computer's memory cache after browsing (0.135*)
- I set up my browser to reject unnecessary cookies and/or spyware (0.118*).
- I always ask a Web site to remove my name and address from any lists used for marketing purposes (0.172**).
- I always ask a Web site not to share my name or personal information with other companies (0.187**).

The data support that familiarity with the Internet, when measured by the number of hours spent on-line, can be associated with positive e-commerce practices.

Consumer education: Several statistically significant differences were found between individuals that considered themselves educated consumers and those that did not. The items 'I always look for and read privacy policies on the Web', 'I make sure that online forms are secure before filing out information', 'When given a chance, I opt-out of third party information sharing' and 'I always ask a Web site not to share my name or personal information with other companies' were rated more favorably by informed consumers. Although by design the majority of the sample considered themselves informed consumers, only a small

number of participants (7%) did not identify themselves as such. One may argue that an informed consumer makes purchasing decisions on-line differently than their uninformed counterpart. However, it might merit further investigation to obtain information from larger samples of lesser informed consumers to corroborate this finding.

Years of employment among consumer educators: Of the 80 respondents, the average number of years employed in the field was 11.5 years. Years employed in the field of consumer education revealed some positive correlations. Individuals with more work experience were more likely to look for and read privacy polices on the web (0.444*), to opt out of third party information sharing (0.230*), and to refuse to give information to a Web site (0.244*). One can assert that more experienced individuals are more cautious online consumers.

Number of credit cards: The number of credit cards also revealed statistically significant differences. The more credit cards an individual holds the less likely the person is to have a separate account for personal e-mails (-0.117*). Furthermore, such individuals are less likely to opt-out of third party information sharing (-0.154**). These individuals are also less likely to ask a Web site to remove the name and address from any lists used for marketing purposes (-0.139*) and less likely to ask a Web site not to share name and other personal information with other companies (-0.129*). The number of credit cards owned by an individual therefore seems to be a good predictor of on-line behavior. It can be argued that individuals with a larger number of credit cards are either at higher risk or are more willing to engage in higher risk consumer behavior. Those individual may be more likely to also exhibit careless behavior on their on-line transactions.

Use of protective software: Among the recommended privacy protective practices, participants were more likely to use encrypting software as opposed to lesser known practices such as anonymizers and anonymous remailers. Users of these practices tend to follow other protective practices more often compared to non-users of these technology options.

A total of 153 participants indicated that they did have encrypting software on their computers, versus 136 participants that did not. Ten students did not identify if they were using encrypting software or not. These ten students were excluded from this portion of the analysis. Statistically significant results were found on 7 variables. Individuals that did have encrypting software on their computers rated the following seven items more favorably:

- I make sure that online forms are secure before filling out information
- I set up my browser to reject unnecessary cookies and/or spyware
- I use anonymous remailers
- I encrypt my email
- I use anonymizers when browsing
- I always ask the web site to remove my name and address from any lists used for marketing purposes
- I always ask a web site not to share my name or personal information with other companies

As indicated earlier, participants overall were less likely to use anonymizers (58 vs 225). Sixteen individuals did not respond to this item. Participants were also less likely to use anonymous remailers (46 vs 243). Ten individuals did not respond to this item. However, statistically significant differences were identified between those students that did have anonymizers on their computers and those that did not.

Participants who used anonymizers rated the following items more favorably than participants that did not use such anonymizers:

- I set up my browser to reject unnecessary cookies and/or spyware
- I use anonymous remailers
- I encrypt my email
- I use anonymizers when browsing
- I always refuse to give information to a Web site
- I always ask the web site to remove my name and address from any lists used for marketing purposes
- I always ask a web site not to share my name or personal information with other companies

Furthermore, participants who used anonymous remailers rated the items 'I use anonymous remailers', 'I encrypt my email', and 'I use anonymizers when browsing', more favorably than their counterparts.

3. CONCLUSION

There are numerous predictive variables that help understand on-line consumer practices. Based on the findings of this study, an older female professional with many years of work experience in a consumer related area that owns only few credit cards and uses protective software will be a more cautions participant in on-line commerce than a younger male that is not educated about consumer related issues, owns many credit cards and does not use protective software. One may infer that consumer education creates an increased awareness of on-line privacy and security issues. One may also infer that a higher level of computer literacy as measured by the use of and understanding of tools such as encrypting software, a workable knowledge of browsers, anonymizers, and anonymous remailers, may lead to a safer participation in electronic commerce. Apart from consumer education and an increased level of computer literacy, years of experience as a consumer, age and gender seem to be variables that help identify and predict safe on-line purchasing behaviors.

In conclusion, consumer education and a higher degree of computer literacy are indeed important strategies in familiarizing e-commerce users with not only the tools and technology available for their own protection, but also with the undesirable practices they should avoid as on-line consumers. Consumer education campaigns and curricula should take into account differences in behavior among e-commerce users based on such variables as gender, age, exposure, and experience.

Further research with a larger representative sample of consumers can provide additional information about the impact of the variables identified in this study. This information will potentially lead to better public and private policies that combined with educational efforts will assure privacy and security for e-commerce.

REFERENCES

Briones, M. G. (1998). Internet innovations-and privacy issues- remain marketing's biggest story. *Marketing News*, 32(December7), pp 1-16.

Cadwell, K. (1999). Privacy legislation introduced in Congress. *The Public Policy Report,* Vol 1 No 5, (available online: http://www.cdt.org/privacy/fedprivacystutus.shtml)

Caudill, E. M. & Murphy, P.E. (2000). Consumer online privacy: Legal and ethical issues. *Journal of Public Policy and Marketing*, Vol 19(spring), pp 7-19.

Center for Democracy in Technology (CDT) (http://www.cdt.org/privacy/guide/basic/topten.html)

CommerceNet (http://www.commerce.net/research/stats/wwwpop.html)

Consumer Reports (2005). Net threat rising: Crime abounds, but you can fight back. Vol. 70, No.9, pp 12 – 18.

De Ruyter, K., Wetzels, M. & Kleijnen (2001). Costumer adoption of e-service: An experimental study. *International Journal of Service Industry Management*, Vol 12, No 2, pp 184-207.

Federal Trade Commission Survey of Commercial Web Sites (available online http://www.ftc.gov/reports/privacy3/survey)

Forrester Online Research Index http://www.forrester.com/ER/Press/Release/0,1769,621,00.html

Malaga, R.A. (2001). Consumer cost in electronic commerce: An empirical examination of electronic versus traditional markets. *Journal of Organizational Computing and Electronic Commerce*, Vol 11, No 1, pp 47-58.

Miles, G.E., Howes, A. & Davis, A. (2000) A framework for understanding human factors in web-based electronic commerce. *International Journal Human -Computer Studies*, Vol 52, pp 131-163 (available online at http://www.idealibrary.com)

Milne,G.R., Rohm,A.J. & Bahl, S. (2004) Consumer protection of online privacy and identity. *The Journal of Consumer Affairs*, Vol 38, No 2, pp 217-232.

Miyazaki, A.D. & Fernández, A. (2001). Consumer perceptions of privacy and security risks for on line shopping. *The Journal of Consumer Affairs*, Vol 35, No 1, pp 27 - 44.

Net threat rising: Crime abounds, but you can fight back (September, 2005) *Consumer Reports*, Vol 70, No 9, pp 12-18.

Sovern, J. (2000). Helping consumers protect their personal information. *Advancing the Consumer Interest* , Vol 12, No 2, pp 23-29

Soven, J. (2004). Stopping identity theft. *The Journal of Consumer Affairs*, Vol 38, No 2, pp 233-243.

Sheehan, K.B. & Grubbs Hoy, M. (2000) Dimensions of privacy concern among online consumers. *Journal of Public Policy and Marketing*, Vol 19(spring) pp 62-73.

Subirana, B. & Carvajal, P. (2000). Transaction streams: Theory and examples related to confidence in internet-based electronic commerce. *Journal of Information Technology,* Vol 15, pp 3-16.

WHAT CONSTITUTES THE 'ASSIST' IN E-ASSISTANTS: THE CUSTOMER VIEWPOINT

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ABSTRACT

Customer relationship building is difficult to achieve in online situations where interaction is limited to keyboard and mouse clicks. For online customers, the presence of an Embodied Conversational Agent (ECA) representing an 'e-assistant' on computer screens could engage users in interactions with greater resemblance to face-to-face communication. Through their life-like behaviours, customer interactions with e-assistants could be smoother and take on a more familiar style. However, research indicates several potential disadvantages concerning extra effort, distraction and difficulties with appropriate design. The literature so far has mostly concentrated on short-term, often experimental, interactions with ECAs. The longitudinal study of 'naturalistic' ECA use has received little attention. Since relationships are built over time, it seems important to study whether relationships do evolve and whether the reality lives up to the potential of e-assistants to affect purchasing behaviour.

This paper reports on a qualitative study of respondent opinions, beliefs and emotions after several months of at least weekly use of one of three ECAs. We explore whether respondents desired the help or even the presence of ECAs and what advantages and disadvantages they perceive. We conclude that a) 40% of respondents reject ECA use in the present form and b) failing to match customer expectations of service quality or interaction style poses a significant challenge for the design and acceptance of ECAs on retail websites c) substantial investment in research and programming is needed to ensure interactions support user needs appropriately. There are also some ethical considerations posed by the use of ECAs.

Nonetheless, with careful and better design, there is potential to differentiate retail websites and online services through customer recall and recognition of brand identity; providing a friendlier environment; facilitating alternative methods of information search; contributing to an error correction service; acting as a navigation aid and help through process; providing for stimulation needs; and contributing to emotional support for product decisions.

1. INTRODUCTION

Intuitively, customer relationship building is difficult to achieve in online situations where interaction is limited to keyboard and mouse clicks. Embodied Conversational Agents (ECAs) appear on the screen and "exhibit various types of life-like behaviours, such as speech, emotions, and movement" (Dehn and van Mulken, 2000). For online companies, use of an ECA representing a 'spokesperson' or 'spokescharacter' on computer screens could engage users in interactions with greater resemblance to face to face communication, thus invoking established social rules and dynamics from other interactions and influencing future behaviour (Fogg, 1998). There are two advantages a) through using established 'rules' of communication, these

characters would offer a smoother and more familiar style of interaction; b) their life-like behaviours could make a website more engaging and motivating (Koda and Maes, 1996).

Notwithstanding, there are potential difficulties with the use of ECAs. Firstly, the appropriate representation of an ECA is important for user perceptions and acceptability but appropriateness judgements may be complex (Koda. and Maes, 1996; Keeling, Beatty, McGoldrick and Macaulay, 2004), contain paradoxes (Cassell 2000) and even be potentially damaging (Riegelsberger, Sasse and McCarthy, 2003; Keeling et al., 2004).

Secondly, Dehn and van Mulken (2000) note the failure of ECAs to show many benefits to users beyond being likeable and engaging (Koda and Maes 1996). In part, this may be due to relatively undeveloped programming but other explanations may point to difficulties that are more intractable. Cassell (2000) concludes that processing of interfaces with ECAs requires more effort than those without. Social interaction relies on smooth synchronization, difficult to achieve while 'speech' is text. Further, ECA presence may lead users to expect the system to be as flexible and intelligent as a human assistant (Dehn and van Mulken, 2000; Witkowski, Neville, and Pitt, 2003).

Consequently, it is dangerous to presume that the use of ECAs on the interface will help engage customers and off-set the (presumed) impersonal nature of the website experience. ECA use, according to Dehn and van Mulken (2000), *"can only be expected to improve human-computer interaction if it shows some behavior that is functional with regard to the system's aim."*

The literature so far has mostly concentrated on short-term, often experimental, interactions with ECAs. The information presented has typically described behaviors that were performed at different times and in different situations. The longitudinal study of 'naturalistic' ECA use has received little attention. Since relationships are built over time and research involving temporally or causally related sequences of actions may take on additional complexity, it seems important to study whether relationships do evolve and whether the reality lives up to the potential of ECAs to affect purchasing behaviour.

This paper reports on a qualitative study of respondent opinions, beliefs and emotions after several months of at least weekly use of one of three ECAs. We explore whether online shoppers desire the help or even the presence of such ECAs, what advantages and disadvantages they perceive and identify some ethical issues.

2. CONDUCT OF RESEARCH

There were several requirements for the selection of ECAs to be used in this study. Suitability for a 'family audience' ruled out a number of ECAs but, after some searching, three were found that satisfied that requirement, as well as a range of 'personification'; capability for real-time dialogue between the ECA and the respondent with a substantial interaction repertoire; and interaction content with some task fulfilment content. No ECA fulfilling these criteria was found on a e-retailing website at the time of the study.

The longitudinal study consisted of respondents completing a series of tasks and questionnaires. One task was to write opinions of the positive and negative aspects of ECA use in the light of a) their use over 3-6 months of three existing ECAs representing low to high 'personification'; and b) their use of ECAs on specially constructed retail websites representing different product groups.

Although not specifically in a retailing context, we believe the extended use of ECAs makes this group almost uniquely qualified to contribute to understanding the prospective customer viewpoint on features of ECA functionality and interaction content acceptable and appropriate to website users.

Of the 57 people recruited for the longitudinal research, 49 completed the task reported on in this paper: 18 were male and 31 female, the age range was between 18 and 65; 50% were between 18-35 years old and 50% above 35 years old. There was no systematic relationship between gender and age.

2.1 Template Analysis

The analytical approach was template analysis (Crabtree and Miller, 1999; Silverman, 1994) a specific method of thematically analysing almost any form of textual data (King, 1998), including, as in this case, open-ended responses on a written questionnaire. Analysis started with *a priori* identification of constructs or

themes pertinent to the study. A sub-section of the data was analysed both for data relevant to these initial themes and for evidence of any new themes. As allowed in the method, the original themes were modified in line with themes emerging from the data (Crabtree and Miller, 1999) to form an initial template used in the analysis of the complete data set. Hierarchical coding is usual and used here, with broad themes containing progressively specific constructs (King. 1998).

2.2 Conceptual Framework for Analysis

The communication between customers and ECAs as e-assistants on company websites is comparable to the customer-salesperson communication. Sheth (1976) provides a framework for the study of the customer-salesperson interaction process. This distinguishes between the primary dimensions of interaction style and interaction content, postulating that the outcome of a salesperson-customer interaction is a function of both dimensions. The value of the content of communication is judged on a number of utilities; functional, social-organisational, situational, emotional and curiousity. Sheth (1976) argues that buyers will have expectations about a product/service on all these utilities and that incompatibility between those expectations and what is offered will have a negative impact.

Although some studies find task-specific behaviours have a stronger impact than adaptive behaviours (Blackshear and Plank, 1994), the majority of research indicates that communication styles that balance an appropriate level of social orientation, e.g., 'immediacy' (friendliness, respect for customer) with task-orientated responsiveness and credibility are most effective (e.g., Brown, Boya, Humphreys, and Widing, 1993; Darian, Tucci and Wiman, 2001). Customer preferences may be based on two needs, namely task completion and social interaction.

The conceptualisation in the Sheth (1976) framework is that of expectations of the product or service utilities in "*interpersonal (face-to-face), written or even telecommunication*" salesperson-customer interactions. This study extends that framework to respondent reactions and attitudes resulting from interaction with ECAs.

A further perspective is provided by the work of Argyle (1992) on the importance of social 'rules' during interactions. Argyle argues that most relationships have implicit social 'rules' that allow them to function; some of these 'rules' are common to almost all relationships, others help define the type of relationship. Confirming or breaking such 'rules' will lead to the interaction being judged as rewarding or not rewarding and consequently, the wish for further communication or the rejection of further communication. Briefly, the 'rules' with most relevance here are: 'should respect others' privacy'; 'should not discuss what is said in confidence'; 'should be emotionally supportive'; 'should not take up too much of others' time'; 'should strive to be fair in relations with one another'(Argyle, p. 162) .

3. RESULTS

Respondents felt considerable ambiguity about ECA use on websites: 40% of these respondents explicitly stated that they would prefer to not to use an ECA. However, that group was not completely negative about ECA use and the other 60% who would consider using one were not completely positive in their evaluations. For example, whilst the majority of respondents could find some positive comment most of them also found some shortcoming. Positive remarks were associated with being younger, and negative remarks with being 35+ (chi-sq = 10.95; p = .004).

3.1 What makes an ECA Welcome on a Website?

ECAs are thought beneficial if they add value to the website visit; conversely, they are particularly poorly received when they hinder performance or no clear purpose is perceived.

Respondents thought an ECA could add value in two ways, through performance enhancement and through emotional enhancement. Performance enhancement can be likened to the Sheth (1976) concept of 'functional utility'; emotional enhancement contained aspects of emotional, situational and curiousity utilities.

3.1.1 Performance Enhancement

Many respondents made comments suggesting that using an ECA could lead to performance enhancement; one group (25% of respondents) reported that they had found their experiences useful (see table 1). In addition, many of those who reported they would prefer not to use an ECA felt that other groups might find an ECA useful.

An ECA was thought to be particularly helpful as 1) a navigation aid through complex websites, 2) to give help through the purchase process, (especially for new users) or 3) to find information.

An interesting perspective on the latter are comments that an ECA is valuable when it offers help similar to the way that people, when asking a shop assistant for information, enter into a two-way dialogue that helps narrow down or give extra choice to the customer.

However, a proportion of respondents agreed with the conclusions of Cassell (2000) that the ECA is more of a hindrance than a help, whether trying to find information or making a purchase (see table 1). In this case, the ECA actually lowers functional utility as it detracts from the customer experience of efficient functioning of the website.

3.1.2 Emotional Enhancement

Comments about emotional enhancement were also evident. Nearly 30% mentioned curiousity or diversion needs (see table 1). These respondents felt that retail websites are more fun or more exciting with an ECA.

Situational utility was recognised by a quarter (25%) of respondents who felt the presence of the ECA makes the Internet experience less solitary, friendlier and less impersonal,

> *"They personalise the shopping experience, they add a less technical 'emotional' quality to the shopping experience, almost making it more human".*

> *"At [their] best, they can produce a far more gentle introduction to the shopping experience".*

> *"some... characters add something special to a website and give you a welcoming feeling".*

There was also an implication of activation of the social schema concerning offline service personnel,

> *"it was nice to see a friendly face as it gave the illusion of not having to complete the online form on my own. These characters can also take some of the stress out of online shopping as regards them watching over you as you shop".*

This suggests that, in addition to the support role for search and purchase activities mentioned by many respondents, there is an intervention role for an ECA. For example, if larger than average quantities of a product are ordered, the ECA could check with the customer in a friendly way that this is correct and show them how to make any corrections needed.

Table 1. Percentages of positive and negative comments

Positive Comments	%	Negative Comments	%
Performance Enhancement Value		**Inappropriate 'Behaviour'**	
Useful	25	Irritating and distracting	60
Navigation aid and help through process – especially for new users	31	Find it more of a hindrance	21
Different, interactive approach to communicating and getting information	11		
Emotional Value		**Inappropriate 'Interaction'**	
Fun and more exciting	29	Limited dialogue/boring	21
Makes interaction more friendly/gentle introduction/less solitary	25	Lack of control and choice	21
Felt some affinity	11	Question motives/ marketing gimmick, spyware	13
		Patronizing/arrogant	8

3.1.3 Some Evidence for User-ECA Parasocial Relationships

There is some evidence for user-ECA parasocial relationships: some respondents realised, perhaps to their surprise, that they felt some affinity to the ECA (see table 1):

> "I was quite impressed about how after a while I started to think of it as a kind of guide and even a friend"

> "I found it easy to interact with and fun to use. I also became more trusting of it as a character."

> "I was surprised to find that I began to relate to the characters and invest them with some personality! Perhaps that is why my overall reactions are negative".

The last comment again illustrates the ambiguity felt towards the characters that perhaps lies in failure of the ECA to live up to the 'emotional' promise. 21% of respondents commented around the theme that the dialogue currently available through ECAs is limited and quickly becomes boring. This is further evidence of a deficit in emotional and functional utility found with prolonged use.

3.2 What Makes an ECA Inappropriate on a Website?

Negative comments about ECA use centred on inappropriate interaction style and behaviour as well as inappropriate interaction content.

3.2.1 Inappropriate Style and Behaviour

By far the most common negative comments about the experience of using ECAs concerned inappropriate behaviour. Nearly two-thirds (60%) of respondents felt that ECA presence can be irritating or distracting: they may simply hide part of the computer screen or their movements may interfere with visual attention to another task.

> "....insisted on telling me obscure things that I just did not want to know. It was often in the way."

> "I found mine to be irritating, took up lots of memory and made my machine run slowly".

Complaints were much stronger when ECAs were a) perceived to interrupt respondents whilst working, b) to be patronizing and arrogant or c) to be trying to sell rather than help. Characters felt to display any of these features (or even worse, more than one) were the subject of particularly hostile reactions,

> "most characters are invasive, annoying and downright stupid".

> "characters that constantly prompt you to spend more money are particularly annoying".

> "mostly annoying – sticking their nose in when not wanted and generally getting in the way."

> "seemed more interested in my paying for an upgrade than anything I was doing".

> "makes me want to scream".

> "...is the most annoying program I have ever installed on my computer! Ugly, annoying, not funny, not helpful".

Some respondents found the style and content of ECA communication patronizing and arrogant (see table 1).

> "I didn't need help but the character thought it knew better"

There was also some evidence of a lack of social-organisational utility with one respondent clearly linking a certain group of ECAs with a 'not me' group,

> "screen 'buddies' are strictly for the under 15s. I felt unprofessional having it on my machine".

Comments link respondent irritation to a wish for control and choice (21% of respondents)
> "I found the characters incredibly irritating and I'd like to be able to switch them off if they were present on any site that I was purchasing from".

Lack of emotional utility was also evident in the comments by 21% of respondents that the dialogue currently available through ECAs is limited and quickly becomes boring.

13% of respondents made some comment that could be interpreted as questioning the motives of the software providers. Such comments denoted that, without a clear purpose, customers may start to supply their own explanations: ECAs risk being thought a marketing gimmick or camouflage for the introduction of spyware. This may initiate negative assumptions and feelings related to the customer's more general opinions of the retailer as evidenced in the following comments,

> *"[I am] not happy if they are used as 'marketing tools' to try to get the customer to spend more or buy goods they didn't necessarily want in the first place".*

> *"some characters pose security risks, i.e., compromise personal details or place spyware or adware on pc systems".*

Questioning motives is associated with younger age group, all those mentioning that concern were under 35 (Chi-sq = 8.09; p = .004).

4. DISCUSSION

There is a stream of research that concludes that people can and do react to computers as social actors and not just as functional hardware and software (e.g., Reeves and Nass, 1996). Our results support this and extend this propensity specifically to reactions to the use of e-assistants on company websites. Our data show that the ability to interact with ECAs introduces perceptions of, at least, the potential for functional and relational benefits usually associated with offline salesperson-customer interactions.

Respondents clearly perceived the potential for 'relational benefits' (e.g., Gwinner, 2003), in the confidence and social utility from reduced anxiety and personal reassurance, as well as the emotional enhancement of the website experience. Problem solving and labour substitution can be recognised in the comments regarding the functional utilities inherent in performance enhancement. Further, with some surprise, some respondents observed some elements of emotional attachment.

Reactions were favourable where functional and/or relational benefits were perceived: performance and emotional enhancement both seem important. Customer preferences may be based on two needs, one to complete the task and one for social interaction. Offline salesperson-customer encounters are thought to be most effective where friendly communication styles balance with task-orientated responsiveness. The results of the present study seem to point to the same conclusion for online ECA 'sales assistant'- computer user interactions. We feel this is support for the argument that customers are bringing off-line expectancies into the online situation.

Unfortunately, the introduction of off-line expectancies brings liabilities as well as advantages; our respondents also show the 'dichotomy of opinion' about the acceptability of ECAs as found by Witkowski, Neville and Pitt (2003). Echoing the results of Dehn and Mulken (2000), some respondents felt ECAs were a hindrance to their task completion.

However, although irritation is undoubtedly present and prevalent, the results of this study indicate that simple measures may go far in alleviating user irritation, e.g., ability to easily 'switch off' or careful placement on the screen. Further, effort in processing may be of less relevance to those with little experience of website interaction. In that case, the presence of an ECA may help new users feel more at ease and the opportunity to interact through a more familiar question and answer session may be more natural and useful for them rather than more effortful.

More seriously, the longitudinal study reveals that the abilities and programming of many present ECAs cannot sustain, develop or support interaction that is considered valuable beyond a short initial period where they are found likeable and engaging (Koda and Maes 1996). Often, the characters used by our respondents were quickly found restricted in their usefulness and dialogue, and so judged, ultimately, to be of limited use and/or boring. These concerns are capable of remedy with the introduction of more sophisticated designs. However, such advances are likely to be costly and might add to download and interaction times.

Activation of off-line schema and 'rules' for interactions (e.g., Argyle, p. 162) makes it all the more imperative that care is taken in matching ECA interaction style and content to the goals and motivations of potential customers of a website. Although some respondents did perceive that an ECA could be 'emotionally

supportive', other respondents evidently thought particular ECAs lacking in 'respect for others' privacy'; 'not taking up too much of others' time' or in 'striving to be fair in relations with one another'(Argyle, p. 162). The ECAs perceived to break such interaction 'rules' were the subject of the strongest criticism. Our respondents often expressed the desire to turn them off altogether. Further, some participants were led to question the motivation of the companies 'behind' the ECA; comments were made about security risks and manipulation.

4.1 Implications for e-retailers

We must conclude that a) a substantial number of respondents would rather not use these ECAs in their present form; b) failing to match customer expectations of service quality or interaction style poses a significant challenge for the design and acceptance of ECAs on retail websites; c) substantial investment in research and programming is needed to ensure interactions support user needs appropriately.

Further, perceptions of 'gimmickry' or a lack of perceived purpose and usefulness can be damaging beyond perceptions of limited value. If their use initiates negative assumptions and feelings, this could be generalized to offline opinions of the retailer and damage brand image and customer relations.

Our results support conclusions from earlier work that on retail websites the match-up with brand perceptions is of the greatest importance and cartoon characters may be more acceptable than 'humans' in some cases (Keeling et al., 2004). Nevertheless, we would make a cautionary comment that some respondents felt that cartoon characters may be taken less seriously and must be used with care.

On a positive note, we also found indications supporting the offline conclusions of Crosby, Evans and Cowles (1990) regarding an important direct effect of relationship quality on future sales opportunities:

> "They [ECAs] don't necessarily encourage you to buy more but I find that I remember the site more and would therefore return to it at a later stage".

Thus, their ultimate worth may be through their potential to differentiate retail websites and online services through: a) through greater customer recall and in helping build online brands; b) in aiding recognition of offline brand identity by online customers; c) providing a friendlier environment, especially for new users; d) facilitating an alternative method for information search for those that find the present facilities unhelpful; e) contributing to an error correction service for customers; f) acting as a navigation aid and help through process (place-holder, focus for navigation); g) providing for stimulation needs; h) contributing to emotional support for product decisions.

4.2 Ethical Implications

There is considerable evidence that positively evaluated communicators are more influential than those evaluated less positively, and that the extent to which onscreen characters exhibit life-like behaviours increases motivational impact (Fogg, 1998). In e-retailing, the formation of positive relationships with onscreen characters could increase susceptibility to persuasion through increasing attachment and perceived credibility of the message source, as well as changing the accessibility of product/service attributes. Alternatively, the presence of an onscreen character could increase customer awareness of surveillance, causing them to become more sensitive to privacy issues. The results of the present study indicate that both outcomes could be possible: some respondents were conscious of influence attempts and yet others felt some affiliation with the ECA and the potential for 'relational benefits'. For all respondents there are ethically questionable implications of interacting with an ECA, e.g., loss of time through poor design or intrusion on other activities. This is heightened if any attachment is created; inappropriate persuasion could lead to loss of money, privacy, trust, and personal information.

4.3 Further Research and Limitations

Before implementation of onscreen characters for relationship building in online retailing there are several issues that need to be addressed in a retailing context. These include the appropriateness and ethics of such relationship building attempts, the nature and depth of these 'virtual' relationships and the influence of specific screen design characteristics on purchase persuasion when combined with interaction content and framing through interaction structure. A further concern is unintended yet negative effects on user

impressions of surveillance and loss of privacy.

These findings come from a group of experienced and critical Internet shoppers who were aware of the focus of the research on ECAs although not the detailed hypotheses of the research. The ECAs in the longitudinal study were not on e-retailing websites. As such, any results may be limited to this group and need to be replicated with other groups of users and for e-retailing websites. However, the correspondence with the offline sales literature suggests support for generalization to the wider Internet user population and the foundation for future experimental work.

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REFERENCES

Argyle, M. (1992). *The Social Psychology Of Everyday Life*, London: Routledge.

Blackshear, T. and Plank, R. E. (1994). The Impact Of Adaptive Selling On Sales Effectiveness Within The Pharmaceutical Industry. *Journal of Marketing*, Vol. 2(3), pp. 106-125.

Brown, G., Boya, U., Humphreys, N., and Widing, R. (1993). Attributes and behaviors of salespeople preferred by buyers: High socializing vs. low socializing industrial buyers. *Journal of Personal Selling and Sales Management,* Vol. 13, pp. 25-33.

Cassell, J. (2000). Embodied Conversational Interface Agents. *Communications of the ACM*, Vol. 43(4), p. 70.

Crabtree, B. and Miller, W. (1999). *Doing Qualitative Research* (2nd edition). London: Sage.

Crosby, L. A., Evans, K. R. and Cowles, D. (1990). Relationship Quality in Services Selling: An interpersonal influence perspective. *Journal of Marketing*, Vol. 54 (July), pp. 68-81.

Darian, J. C., Tucci, L. A., and Wiman, A. R. (2001). Perceived salesperson service attributes and retail patronage intentions. *International Journal of Retail and Distribution Management,* Vol. 29(4/5), pp. 205-214.

Dehn, D. M., and van Mulken, S. (2000). The impact of animated interface agents: A review of empirical research. *International Journal of Human-Computer Studies*, Vol. 52, pp. 1-22.

Fogg, B.J. (1998). Persuasive Computers: Perspectives and research directions. *Proceedings of the CH1'98. Conference of the ACM/SIGCHI,* New York: ACM Press. pp. 225-232.

Gwinner, K. P. (2003). Internet retail customer loyalty: the mediating role of relational benefits. *International Journal of Service Industry Management*, Vol.14 (5), pp. 483-501.

Keeling, K., Beatty, S., McGoldrick, P. J., Macaulay, L. (2004). Face Value? Customer views of appropriate formats for embodied conversational agents in online retailing. *International Conference on System Sciences,* Hawaii, pp. 1-10.

King, N. (1998) 'Template analysis', in G.Symon and C.Cassell (eds.) *Qualitative Methods and Analysis in Organizational Research.* London: Sage

Koda, T. and Maes, P. (1996). Agents with faces: the effect of personification. *Proceedings of the 5th IEEE International Workshop on Robot and Human Communication* (RO-MAN'96), Tsukuba, Japan, pp. 189-194.

McBreen, H. M., Shade, P., Jack, M. A., and Wyard, P. (2000). Experimental Assessment of Effectiveness of Synthetic Personae for Multi-Modal E-Retail Applications. In *Proceedings of the 4th International Conference on Autonomous Agents*, pp. 39-45

Reeves, B., and Nass, C. (1996). *The Media Equation: How People Treat Computers, Television, and New Media Like Real People and Places*. New York: Cambridge University Press.

Riegelsberger, J. Sasse, M. A., and McCarthy, J. (2003). Shiny happy people building trust? photos on e-commerce websites and consumer trust**.** *Human Factors in Computing Systems: CHI 03 Conference Proceedings.* Fort Lauderdale, Florida, ACM Press, pp. 121-128.

Sheth, J. M. (1976). Buyer–seller interaction: a conceptual framework. In: *Proceedings of the Association for Consumer Research*, Association for Consumer Research, Cincinnati, pp. 382–386.

Silverman, D. (1994). *Interpreting Qualitative Data*, London, Sage.

Witkowski, M., Neville, B., and Pitt, J. (2003). Agent mediated retailing in the connected local community. *Interacting with Computers*, Vol. 28, pp. 5-32.

CUSTOMER LOYALTY IN THE VIRTUAL WORLD: AN EXAMINATION BASED ON EVALUATION OF WEB OFFERINGS IN THE INDIAN CONTEXT

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ABSTRACT

The use of Internet by organizations is growing rapidly. On-line shopping offers the retailers not only the opportunity to gain customers but also to improve customer loyalty. It offers new ways of analyzing the customer's buying patterns and thus improving the services they offer to them. The Internet and the communications technologies has ushered in an era closer to the economists concept of perfect competition. This has resulted in intense competition and lower margins (Peterson, 97). Customer's access to perfect information has been a challenge for the e-retailers. To compete successfully the e-retailers will have to develop and maintain e-loyalty. An investigation of the three Indian sites, based upon the concept of 8C's (Srinivasan et al), indicates that the customers have very less loyalty towards the web sites. They are spending lot of time and effort in searching for the alternatives and are also, on an average, not willing to pay more on the sites. One positive outcome of the study has been that they are exhibiting positive word of mouth behavior.

KEYWORDS

E-Commerce, B2C, Loyalty, Customer, Internet, Dot Com.

1. INTRODUCTION

The use of Internet by organizations is growing rapidly. A major growth in the electronic commerce (e-commerce) is by the organizations that wish to interact with their customers directly (B2C). On-line shopping offers the retailers not only the opportunity to gain customers but also to improve customer loyalty. It offers new ways of analyzing the customer's buying patterns and thus improving the services they offer to them. The rapid growth in e retailing reflects the compelling advantages that it offers over conventional Brick and Mortar stores, including greater flexibility, enhanced market out reach, lower cost structures, faster transactions, broader product lines, greater convenience and customization (Seth &Rendall, 99). However, despite advantages e- retailing comes out with its own set of challenges. Competing businesses in the world of e-commerce are only a few mouse clicks away. As a result consumers are able to compare and contrast competing products and services with minimal expenditure of personal time and effort. The Internet offers a nearly perfect market because information is instantaneous and the buyers can compare offerings of seller's worldwide. The result is fierce price competition and vanishing brand loyalty (Kuttner, 98). From a seller's perspective customer loyalty and trust has been important for profitability. It is only when the cost of serving a loyal customer falls, do relationships generate profits. Otherwise, in the initial stages of acquiring customers the cost is so high that many relationships are unprofitable (Reicheld & Sasser, 1990).

In the Internet market space, where million of web sites compete with each other, the customer loyalty shifts with the 'click of a mouse'. Acquiring and retaining customers is posing a serious challenge for the web-based businesses. It is becoming increasingly important for businesses to understand as to what impacts e-loyalty and what has been the nature of the impact. The present study thus examines the factors that effect e-loyalty. It also makes a comparative study of the perceived loyalty across three web sites operating in India.

2. E- LOYALTY- FRAMEWORK OF STUDY

Brand loyalty is perceived as a favorable attitude towards a brand resulting in consistent purchase of brand over a period of time (Assarel, 1992). Loyalty is present when favorable attitude for brand are manifested in repeat buying behavior (Keller, 93). Brand loyalty can also be defined as " the preferential, attitudinal and behavioral response towards one or more brands in a product category that is expressed over a period of time by the consumer" (Engel & Blackwell, 82; Gremler, 95). The e-loyalty, thus, for the purpose of the research can be premised on eight e-business factors referred to as 8C's (Srinivasan, Anderson, Ponnavolu, 2002) i.e. Customization, content Interactivity, cultivation, Care, Community, Choice, convenience and Character.

Customization - is the ability of e-business to tailor product and services to the individual customers. In fact the whole shopping experience should be tailored to the customer's need. The e-businesses have entered the phase wherein its value proposition is as dependent upon its ability to customize, as it is upon the variety of content it offers (Scharge, 99). The customization increases the probability that the customers will find something to buy. If the company is able to accurately tailor or narrow choices for individual customers, it can minimize the time spent by customers in browsing through an entire product assessment exercise to find precisely what they want. These advantages of customization make it appealing for customers to visit site again in future.

Contact Interactivity – lack of interactivity is a problem with majority of web sites. These are hard to navigate, provide inadequate product information and answer queries via email after delays of a day or two. Interactivity is also the extent to which two-way communication with the customers is facilitated and the tools available for that. For example, in an on-line book store a customer can not only read the cover of a book but also read reviews, opinions of the other customers, recommendations regarding other books bought by people with similar tastes and preferences. Therefore, interactivity is positively related to e-loyalty (Alba et. al., 97). The on line shopping process facilitated by interactivity increases the freedom of choice and level of control the customer experiences in the on-line environment (Hoffman & Novak, 96)

The extent, to which an e-business provides relevant information and incentives to its customers, in order to extend the breadth and depth of their purchases over time, is determined by *cultivation*. As an example, Amazon offers its customers books based upon their past purchases. Some on line retailers update their customers by email whenever there is a discount sale on similar items purchased by them earlier. This kind of interaction by the sellers, lessen the customer's incentive to defect to other seller who will have to build such knowledge from scratch. This also reduces in a proactive manner, the likelihood of additional searches by customers.

Several studies have established the negative impact of breakdowns in service on customer's repeat purchase behavior (Bitner, Booms & Tetreault 90). Customer *care* is reflected in both the attention the e-retailer pays to detail in order to ensure that there is no breakdown in service and the concern that it shows in resolving any breakdowns that do occur. It is thus expected that the level of care that a company exercises to minimize disruptions in customer service will lead to higher loyalty.

The virtual *community* represents one of the most interesting developments in the information age. It is an online social entity comprising of existing and prospective customers that are organized and maintained by an e-retailer to facilitate the exchange of opinions and information regarding offered products and services. Communities are highly effective in facilitating word of mouth (Hagel and Armstrong, 97) and enable individual customers to identify with larger group. As a result, the customers who identify with a retailer or a brand with a larger context of community can develop strong lasting bonds with those entities (Mael & Ashforth, 92). In a mall, 25% of all interactions could be called as social interactions (Feinberg, Sheffer, Meoli, Rummel, 89). By facilitating the information exchange among customers, for advice on product experiences through the e-community, the retailer can increase e-loyalty among its customers.

Many customers do not want to deal with multiple vendors when shopping (Bergen, Dutta and Shugan, 96). Authors noted that the customer's search costs associated with shopping across retailers increases with the number of competing alternatives. In contrast, an increase in the number of available alternatives at a single retailer can greatly reduce the costs of time and inconvenience and search expended in virtual store hopping. The *choice* thus enhances e-loyalty.

Schaffer (2000) argues that a convenient web site provides a shorter response time, facilitates faster completion of transactions, and minimizes the customer's effort. If the customers are frustrated in their efforts to materialize transactions, then they are less likely to return (Cameron, 99). In simple terms the

convenience refers to how simple, intuitive and user friendly a site is. In fact it has been studied that 30% of the customers who leave a web site with out purchasing anything do so because they are unable to find their way out through the web site. If the web sites were logical and convenient to use then there would be less likelihood of customers abandoning sites out of frustration and will find their shopping experience more satisfying. This will result in enhanced loyalty.

Character can be defined as an overall image or personality that e-retailer projects to consumers through use of inputs such as text, graphics, style, logos, colour and slogans or themes on the web sites. These inputs enable to enhance the site recognition and recall. Besides, these (e.g. logos, colour ambience)) invoke shared associations or meanings to create positive customer attitudes (Handerson & Cote, 98) towards the company.

Thus the following hypotheses will be tested in the Indian Context: -

H1: More is the level of customization, contact interactivity, customer cultivation, care, Community, choice, convenience and character of the e-retailer, more will be the e-Loyalty of its customers.

H2: More is the level of loyalty more will be the positive word of mouth behavior.

H3: More is the loyalty more will be the willingness to pay more for the product /service.

H4: More is the e-loyalty less will be the amount of effort expended in searching for alternatives.

3. RESEARCH METHDOLOGY

The study is based upon the factors (8 C's) outlined (Srinivasan et al. 02) for measuring the e-customer loyalty and its effect on customer behavior. An instrument with multiple item scales for the constructs (8 C's) has been administered among students as Mettos et. al. (2002) point out that, these younger people are confident about new technology, and hence able to give some useful data. The questionnaire has been pre-tested for its suitability in the Indian context and modified wherever possible. E-loyalty has been measured using items adapted by Srinivasan et al (2002); Gremer (95) and Zeithmal, Berry and Parsuraman (96). Measures for search conduct were adapted from items used by Urbany, Kalapurakal & Dickson(96). Willingness to pay more has been measured by adapting relevant scales from Zeithmal, Bery, Parsuraman (96). This has been done as few searches for the alternatives; word of mouth and willingness to pay more are the likely behaviors that are the expected outcomes of the e-loyalty (Srinivasan et. al., 02)

4. DISCUSSION: ANALYSIS OF RESULT AND INTERPETATIONS

For the purpose of the study the questionnaire based upon Likert's 5-point scale was administered in three dotcoms namely Bazee.com, Indiatimes.com and Naukri.com. The reason for choosing these sites was the significant familiarity of the students with these sites, as the students were the main the subjects of the study. The data from Bazee.com was taken prior to its recent merger with e-Bay.

5. CUSTOMISATION OF WEB OFFERINGS AND E-LOYALTY

It has been observed from the data collected, through the survey instrument that the customers were not particularly satisfied with the kind of customization that is being offered by the web sites. This is evident from their low respondent mean scores (MS) computed at 2.88, 2.77, and 2.69 for the three companies i.e. Bazee, Indiatimes and Naukri respectively (Table 1). Bazee, however, was found to be slightly better in customization of its web site as compared to the other two sites. Also, there existed a strong positive correlation between the *customization* of the web site and the perceived e-Loyalty of the customers.

Table 1. Perceptions towards Level of Customization

Name of Dot com	Mean Score	Rank	R Value
Bazee	2.88	1	.69
Indiatimes	2.77	2	.89
Naukri	2.69	3	.72

6. CONTENT INTERACTIVITY AND E-LOYALTY

Lack of interactivity can be a problem with many web sites. The survey data shows that the sites namely Bazee, Indiatimes and Naukri are scoring fairly low on the issue of contact interactivity with their mean scores of 2.88, 2.75 and 2.71 respectively for the three sites. Further analysis shows that the contact interactivity has been found to have a strong correlation with e-Loyalty. The r-values have been computed at .69,74 and .71 for the three sites respectively (Table 2)

Table 2. Perceptions Towards Contact Interactivity

Name of the Dot Com	Mean Score	Rank	R Value
Bazee	2.88	1	.69
Indiatimes	2.75	2	.74
Naukri	2.71	3	.71

7. CULTIVATION AND E-LOYALTY

In order to assess the level or extent to which the web sites in India are cultivating their customers, the responses were collected. It has been seen that the three dot coms namely Bazee, Indiatimes and Naukri are scoring mean values at 2.8, 2.7 and 2.6 respectively. This shows that the sites are unable to engage customers in meaningful ways and build long lasting relationships. Also, *cultivation* has a strong correlation with e-loyalty with r-values computed at .82, .90,73 respectively (Table 3). This shows that lack of cultivation has resulted in low customer perceptions towards e-loyalty.

Table 3. Perceptions towards the Cultivation

Name of the Dot Com	Mean Score	Rank	R Value
Bazee	2.8	1	.82
Indiatimes	2.7	2	.90
Naukri	2.6	3	.73

As can be seen from the data tabulated above Bazee performed slightly better than the others in terms of its efforts to cultivate customers. However, the difference in the three sites was not found to be very significant.

8. CARE AND E-LOYALTY

The respondents feel that the Bazee (MS=2.99) provides better care to its customers followed by Indiatimes (MS=2.87) and Naukri (MS=2.86). The care is experienced in terms of attention the retailer gives to details in order to ensure the continuity in service and the concern that services do not breakdown and disruption in service is resolved when the breakdowns do occur. The data suggests need for improvement to enhance customer care (Table 4).

Table 4. Perceptions Towards Customer Care

Name of the Dot Com	Mean Score	Rank	R Value
Baazee	3.12	1	.67
Indiatimes	3.02	2	.59
Naukri	3.01	3	.71

9. COMMUNITY AND E-LOYALTY

Since the customers who identify with a retailer or a brand within a larger context of community can develop strong lasting bonds with those entities (Mael and Ashforth, 92). The 'hotness', 'coldness' or 'warmth' experienced by the community members towards the organization or towards its products and services whether perceived or real, can affect the organization and thereby the loyalty (Selvam, 90). This affect can be remarkable in the on-line environments, as the community members would be just a mouse click away.

It has been seen from the collected data that the perceptions of the customers towards whether the subject dotcoms have been facilitating the development of communities, the responses were low with mean scores at 2.78, 2.77 and 2.71 respectively for the Bazee, Indiatimes and Naukri (Table 5). There exists a correlation between the *Community* and the Loyalty with respective r-values at .62, .91 and .57. In other words, the absence of community context for sharing the product/ service information and exchange can severely impact the loyalty of customers towards the company.

Table 5. Perception towards the Community Context

Name of Dot Com	Mean Score	Rank	R Value
Bazee	2.78	1	.62
Indiatimes	2.77	2	.91
Naukri	2.71	3	.57

10. CHOICE AND E-LOYALTY

Ariely (99) demonstrates that electronic environments that allow greater flexibility in search increases customer's satisfaction with the site. Towards this end, the respondent's responses were collected from the dot coms and was found that Bazee offers more choice (MS= 3.00) as compared to Indiatimes (MS=2.55) and Naukri (MS=2.57). There also exists a strong co-relation between the *choice* and e-Loyalty perceived by customers. This is evident from high correlation values of .63, .91 and .57 for the three respective companies (Table 6). It can be seen, however, that indiatimes has scored higher than Baazi and Naukri as far as the number of alternatives available at a single retailer is concerned. As this not only reduces the cost of time and inconvenience in searching for alternatives but also builds a sense of 'wholesomeness'

Table 6. Perceptions Towards the Choice Available

Name of the dotcom	Mean Score	Rank	R Value
Baazee	3.00	1	.63
Indiatimes	2.55	3	.91
Naukri	2.57	2	.57

11. CONVENIENCE AND E-LOYALTY

It is need less to say that e-retailing is a convenient method for shopping and is also that the whole on-line model is based upon that premise. Shopping on- line reduces the time and effort expended in locating vendors, finding products and service of choice and finalizing the deals (Bala Subramaniam, 97). Besides the customers can obtain merchandize on-line by being in the comforts of home environs. This time and

browsing benefit of on-line shopping is evident from strong positive correlations that exist between the perceptions of *convenience* and e-Loyalty. The r Values have been computed for Baaze (.74), Indiatimes (.86) and Naukri (.75). Also, Bazee (MS=3.01) and Naukri (MS=3.05) are perceived as offering more convenience to customers as compared to Indiatimes (MS==2.86)(Table 7).

Table 7. Convenience and e-Loyalty

Name of the Dot Com	Mean Score	Rank	R Value
Bazee	3.01	1	.74
Indiatimes	3.05	2	.86
Naukri	2.86	3	.75

12. CHARACTER AND E-LOYALTY

As discussed in the initial paragraphs, character is defined as an overall image or personality that e-retailer projects to consumers through use of text, graphics style, logos, colour effect for site recognition and recall. The overall ambience associated with the site itself and how it functions could play a role in e-satisfaction and thereby the e-loyalty by economizing the cognitive effort consumers spend in figuring out how to shop effectively on-line. The survey data indicates a strong correlation between the perceived character of the web site and perceived e-loyalty. The coefficient of correlation has been worked out at .58, .79, .71 for the three respective companies (Table 8)

Table 8. Perceptions Towards Character of the Site)

Name of the Dot Com	Mean Score	Rank	R Value
Bazee	3.16	1	.58
Indiatimes	2.83	2	.79
Naukri	2.77	3	.71

Further, from the table above, it can be seen that Bazee (MS=3.16) has scored higher on the *character* as compared to Indiatimes (MS=2.83) and Naukri (MS=2.77) respectively.

13. OVERALL LOYALTY TOWARDS THE WEBSITE

The data for all the above 8 C's was aggregated to find the overall perception of the customers and their loyalty towards each site under study (Table 8). The data shows that Bazee.com scored higher (MS=2.88) on the e-loyalty as compared to Indiatimes (2.75) and naukri (2.71). However there is no significant difference in their mean values. It can see that the customers are less loyal in the overall e-commerce scenario with mean value falling much below the average mark (H1: Accepted)(Pl. refer Table 9).

Table 9. Perceptions towards the Web Site Loyalty

Name of Dot Com	Mean Score	Rank
Baazee	2.88	1
Indiatimes	2.75	2
Naukri	2.71	3

It can be seen from the Table 10 that in spite of the fact that customers feel less loyal to the organizations under study, their responses are indicative of the positive word of Mouth behavior (H2: Rejected). Customers are appreciative of the web sites on the whole and are appreciative of Bazee (MS=3.07), Naukri (MS=3. 03) followed by Indiatimes (MS= 2.90).

As far as the customer's willingness to pay more on the site is concerned, it has been seen that they are not willing to do that. The mean scores for the three sites have been 2.66, 2.68, and 2.48 respectively (H3: Accepted).

The respondents also feel that there has been no reduction is their search costs. The customers still spend a lot of time and effort in searching for the alternatives (H4: Accepted).

Table 10. Behavioral Outcomes of Loyalty

Name of Dotcom	Overall E-Loyalty	Positive Word of Mouth Behavior	Willingness to Pay More	Reduction in Search Costs
Baazee	2.80	3.07	2.66	2.66
Indiatimes	2.75	2.90	2.68	2.65
Naukri	2.71	3.03	2.48	2.59

14. CONCLUSION

The Internet and the communications technologies has ushered in an era closer to the economists concept of perfect competition. This has resulted in intense competition and lower margins (Peterson, 97). Customer's access to perfect information has been a challenge for the e-retailers. To compete successfully the e-retailers will have to develop and maintain e-loyalty. An investigation of the three Indian sites, based upon the concept of 8 C's (Srinivasan et al), indicates that the customers have very less loyalty towards the web sites. They are spending lot of time and effort in searching for the alternatives and are also, on an average, not willing to pay more on the sites. One positive outcome of the study has been that they are exhibiting positive word of mouth behavior.

The on-line companies can skillfully design their web sites so that 8 C's can fit in their offerings keeping in mind the socio-cultural and psychological profile of the customers. This will enable the companies to manage the behavioral outcomes of the customers.

As e-commerce is naive in India, the research is preliminary in nature and could be extended to cover different groups in terms of age, sex, region etc. It can also serve as a base point for further research in the area to assess the changes in the consumer attitudes over a period of time.

REFERENCES

1. Seth and Rendall (99), Quoted by Mettos N. and Roberts M. Customer Perceptions of the Internet for Grocery Shopping. Proceedings of the Conference *Constructing IS Futures*, Manchester Metropolitan University, 30-31st Oct., ISBN 0905304 381

2. Mettos, Nekatarious, Robert M., (2001), "Customers Perceptions of the Internet For Grocery Shopping", Proceedings of the Conference *Constructing IS Futures*, Manchester Metropolitan University, 30-31st Oct., ISBN 0905304 381

3. Kuttner Robert(1998). The Net: A Market too Perfect for Profits. *Business Week*, 3577(May 11), 20

4. Reichheld, Fredrick and W Earl Sasser, Jr (1990). Zero Defections: Quality Comes to Services. *Harvard Business Review*, 68 (Sept- Oct), 105-111

5. Assarel, Henry (1992). Consumer Behavior and Marketing Action. Boston, MA: PWS-KENT Publishing Co.

6. Keller, Kevin Lane (1993). Conceptualizing, Measuring and Managing Customer Based Brand Equity. *Journal of Marketing*, 57(Jan), 1-22

7. Engel James F. and Roger D Blackwell (1982*), Consumer Behavior*, New York, Dryden Press.

8. Gremler, David D. (1995). The Effect of Satisfaction, Switching Costs and Inter Personal Bonds on Service Loyalty. Doctoral Thesis, Arizona State University.

9. Srinivasan S. S., Anderson Rolph, Pnnavolu Kishore (2002). Customer Loyalty in E-commerce: An Exploration of its Antecedents and consequences. *Journal of Retailing*, 78:1, 41-50

10. Scharge, Michael (99). The Next Step in Customization MC Technology. *Marketing Intelligence*, 8(Aug), 20-21

11. Alba Joseph; John Lynch; Barton Wertz; Chris Janiszewster; Richard Lutz; Alan Sawyer A.; and Stacy wood (1997). Interactive Home Shopping: Consumer, Retailer and Manufacture Incentive to Participate in Electronic Market Places*. Journal of Marketing,* 61(July) 38-53.

12. Hoffman, Donna L. and Thomas P Novak (1996), Marketing in Hyper Media Computer Mediated Environments: Conceptual Foundations. *Journal of Marketing,* 60(July) 50-68

13. Bitner Mary Jo., Bernard H Booms and Mary S. Tetreault (1990). The Service Encounter: Diagnosing Favorable and Unfavorable incidents. *Journal of Marketing*, 54(Jan), 71-84

14. Hagel, John III and Arthur G Armstrong (1997). Net Gain: Expanding Markets Through Virtual Communities. *Mckinsey Quarterly,* (Winter) 140-146)

15. Mael, Fred and Blake E Ashforth (1992). Alumni and their Alma Mater: A Partial Test of the Reformulated Model of Organizational Identification. *Journal of Organization Behavior*, 13(March), 103-123

16. Feinberg, Richard J, Brent Sheffer, Jennifer Meoli and Amy Rummel (1989). There is something Social Happening in the Mall. *Journal of Business and Psychology*, 4(Fall) 49-63

17. Bergen, Mark, Shantanu Dutta and Steven M Shugan (1996). Branded Variants: A Retail Perspective. *Journal of Marketing Research*, 33(Feb) 9-19

18. Schaffer, Eric (2000). A Better Way of Web Design. *Information week*, 784(May 1) 194

19. Cameroon Michelle (1999). Content that works on the Web. *Target Marketing*, 1(Nov), 22-58

20. Handerso Pamella W. and Joseph A. Cote (1998). Guidelines for Selecting or Modifying Logos. *Journal of Marketing*, 62(April), 14-30

21. Zeithmal, Valarie A., Leonard L. Berry and A. Parsuraman (1996). The Behavioral Consequence of Service Quality. *Journal of Marketing*, 60(April), 31-46.

22. Selvam M. Factors Affecting: Climate. *Indian management*, Vol. 29(1990). 23-25

23. Ariely, Dan (1999). Controlling Information Flow: On the Importance of Control in Decision Making and Value of Information. Working paper, MIT, Cambridge, MA, quoted by Lynch, John and Ariely Dan in *Marketing Science*, Vol, No 1, winter 2000, 83-103,

24. Balasubramaniam, Sridar (97), quoted by Szymanski M. D. and Hise R. T (00). e-Satisfaction: An initial Examination. Quoted in *Journal of Retailing*, volume 76(3), 309-322

25. Peterson, Robert A. (1997), *Electronic Market and the Consumer*, Thousand Oaks: Sage.

THE ROLE OF E-GOVERNANCE:
A CASE STUDY OF INDIA

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ABSTRACT

A central question in the globalization debate is the usefulness of Information and communication technologies (ICT) in serving as a catalyst to enhance economic development and the quality of life in developing countries. The term digital divide has been used to refer to the gap between those who have access to and utilize ICT versus those who do not. The government of any country plays an important role in influencing the forces that often increase the digital divide as well as those that can provide the means to bridge it. This paper examines the government's role in influencing the use of ICT (or E-governance) in improving the quality of life for the rural and poor segments of developing countries such as India and to argue that government and other public institutions have an important role to play in bridging the digital divide in developing countries. Further, the direct role of government is distinguished from the indirect role in order to clarify and delineate the various ways in which public policy can facilitate in bridging the digital divide and enhance human development in such countries.

KEYWORDS

Digital Divide, Information and Communication Technology, Role of Government.

1. INTRODUCTION

In the current era of global technological growth and innovation, a central question is the usefulness of information and communication technology (ICT) in serving as a catalyst to enhance economic development and the quality of life in developing countries. The discussion ranges from debates regarding whether IT is a panacea for developing countries to discussions about the most appropriate theoretical frameworks for understanding the impacts of IT developments in developing countries (Lu, 2001). India is used as an illustrative case to highlight the use of IT to enhance the quality of life for the rural segments of the Indian population and to argue that E-governance is necessary to bridge the digital divide in developing countries.

The term 'digital divide' received widespread attention in a U.S. Department of Commerce report in 1995 to raise the issue of the 'haves' versus the 'have-nots' in rural and urban America who were not able to access or participate in the IT revolution (Compaine, 2001). Defining the 'digital divide' became part of the title of the National Telecommunications and Information Administration, 1998 report, because of the focus on documenting the nature of the divide. The term was defined as "…disparities in access to telephones, personal computers (PCs), and the Internet across certain demographic groups…" (NTIA, 1998, in Compaine, 2001). In more recent years, the digital divide in the U.S. has become an issue of internet access with income dividing the internet "haves and have-nots" (Walsh, Gazala & Ham, 2001). Household income also explains differences in home computer ownership, PC access at work, and internet access (Compaine, 2001). In addition, as Riggins (2004) suggests, efforts to bridge the digital divide may have unforeseen consequences. Riggins (2004) states that the digital divide artificially segments the marketplace and bridging the divide can result in lower product quality and lesser service for low-type consumers. Thus, the divide refers to disparities in both infrastructure and access.

The main objective of this paper is to highlight the important role played by government and public institutions (or E-governance) in bridging the digital divide. It is argued that delineating the various indirect and direct roles that governments and public institutions can play is an essential first step in ensuring that all

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segments of a country will be able to participate in and benefit from the digital revolution. The paper is organized as follows. First, the rationale for the role of government in bridging the digital divide is highlighted based on extant research. This is followed by the use of India as an illustrative case to document both how the digital divide can sometimes be exacerbated in developing countries, as well as to document the role of government and public institutions in bridging the digital divide.

2. RESEARCH FOCUS AND RATIONALE

The rationale for the role of government developed in this paper is based on examining the existing literature on IT utilization in developing countries and the lessons learned from country level economic transitions in both the developed and developing countries. The literature on IT utilization highlights the reality of the digital divide between the developed and developing world and the critical need to bridge this divide (Palvia, et.al., 2002). However, the answer to the critical question of how to bridge the digital divide is not necessarily straightforward. Are market forces and institutions enough to narrow the gap? Or is there a role for public and governmental institutions? To address these questions, the literature on country level economic transitions is examined to underscore the significance and nature of the role of government institutions and policies in major economic transitions in different regions of the world.

2.1 The Digital Divide

Although the ubiquitous nature of ICT is easily recognized in the developed world, for more than half the world's population the IT revolution might well be irrelevant (Meall, 2002). In fact, as Hamelink (1995) claimed, trends in world communication can actually marginalize individuals and poorer nations. Segments of the population (at the national or world level) that do not have access to ICTs, especially in an era of rapid advancements in ICTs, are unlikely to benefit from these advancements, leading to an increasing divide between those with access and those without. In developing countries there is evidence of digital enclaves created by the availability of highly skilled, low-cost workers, but with little benefit accruing to segments of the population outside these enclaves (Heeks, 1996; Mansell, 2001).

So, the critical question focuses on how to bridge the digital divide. This question has become increasingly important in the existing literature on IT utilization in developing countries. Although there is a strong expectation that deployment of advanced ICT will provide a major stimulus for economic growth, several scholars caution that this outcome is difficult to achieve (Mansell, 2001). First, in applying lessons learned from country level economic transitions, it is not clear if the institutional conditions and market forces that have succeeded in developed countries can necessarily be applied to developing countries. For example, the challenges of applying the radical free market policies dominant in the 1980s in western economies to the transition economies of Central and Eastern Europe and other developing economies, have been discussed in the literature (Marangos, 2002). In claiming that the conversion from communism to capitalism in Central and Eastern Europe is now seen as less successful than originally hoped, Bateman (2000) critiques the free market policies that were applied as the model that had proved successful in western economies. Similarly, Marangos (2002) critiques the implementation of neoclassical policies that were applied to the Commonwealth of Independent States in Central and Eastern Europe, suggesting that these policies resulted in a reduction in economic output, high unemployment and inflation, and a breakdown of institutional norms that resulted in corruption.

In such discussions, the focus is on highlighting the fact that state intervention, particularly at the local level, has played a pivotal role in the economic successes of some countries (e.g., the East Asian "Tiger" economies). These countries have also undertaken rapid transitions after war or other financial crises (Bateman, 2000). In contrast to the "market fundamentalist" model implemented in the US and UK, Bateman develops a model termed the "local development state", which is situated around the construction of a variety of inter-linking local state capacities, funding institutions, promotional agencies, and regulatory functions (page 276). Similarly, in offering a post-Keynesian critique of privatization policies in transition economies, Marangos (2002) argues that because the capitalist economic system lacks any internal self-correcting mechanisms for maintaining appropriate levels of aggregate demand and low levels of unemployment, there is a need for the government to play an active role in the market process. Mistry (2005) integrates research

from various disciplines and utilizes Matsuyama's (2002) virtuous cycle of productivity gains and expanding markets to develop a research framework to examine the role of E-governance in bridging the digital divide.

Thus, lessons learned from analysis of country level economic transitions, suggest that market forces that have succeeded in bringing about a digital revolution in developed countries cannot necessarily be expected to work in the same manner in the developing world. Further, in the context of developing countries, the lack of self-correcting mechanisms in the capitalist economic system highlights the role of central and state governments in bridging the digital divide. A proposed distinction between the government's indirect role as an "enabler" and a more direct role is presented in the next section.

2.2 Government's Indirect and Direct Role in Bridging the Divide

There is increasing recognition of the important role that government and public institutions need to play in order to ensure that the benefits of digital enclaves spread beyond the enclave boundaries. Some of the tasks to reduce the digital divide that may require government intervention include ensuring widespread and affordable access to advanced ICTs, an appropriately trained workforce, as well as, policies and institutions that create an environment facilitating innovation and access to international markets. "The development of partnerships between the government and the private sector to mobilize investment in education and skills, to build institutions to support the use of advanced ICTs, and to promote the absorption of advanced hardware and software is crucial for the success of technological leapfrogging strategies" (Mansell, 2001, p.292).

In this paper, the direct and indirect role of government is distinguished in order to delineate the various ways in which public institutions can facilitate bridging the digital divide. The role of government in providing the physical, monetary, legal and political infrastructure, as well as the policies and regulatory functions that allow market forces to operate for overall economic development are examples of the indirect role, because they serve primarily as enabling forces in their impact on the economy. In contrast, governments can also take a more direct role by targeting particular aspects of economic development (e.g., subsidies to farmers, or direct aid to specific industries). In the next section, the case of India is presented to exemplify the various roles that governments can play in facilitating the bridging of the digital divide.

3. INDIA AS AN ILLUSTRATIVE CASE

The financial and economic reforms undertaken in 1991 led to India's accelerated progress towards an open market economy both in its internal operation and in its linkages with the global markets (Kaushik, 1997). The relatively brief historical period during which the forces of globalization and the growth of ICT has begun to impact the Indian economy enables examination of assumptions about how these forces are expected to help developing countries enter into the virtuous cycle of productivity gains and expanding markets. Since India is a large developing country that has only recently, but very rapidly, become a key player in the growth of the IT industry worldwide, it is particularly illustrative to examine if the promise of using IT to facilitate economic development of all segments of the population has the potential to be actualized.

The role of the government in bridging the digital divide is viewed as both indirect as well as direct. The government's indirect role is represented as primarily focused on creating and maintaining the commercial, physical, and financial infrastructure as well as related policies that ensure a favorable investment climate for domestic as well as international business. However, this role is not adequate to ensure that all segments of the population benefit from the ICT revolution. Therefore, it is argued that the government also needs to take on a more direct role in reducing the digital divide and ensuring that all segments of the population are integrated. The direct role of government is represented by the provision of resources to a targeted industry or segment of the population to stimulate growth (see Fig. 1). The distinction between the government's indirect and direct role is illustrated by examples from India, with a focus on the role of public, private, and non governmental organization partnerships.

3.1 Indirect "Enabling" Role of Government and Public Institutions

The first and foremost task of government in creating an enabling environment for economic activity is to

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create the infrastructure that is necessary as a foundation for the targeted industry (in this case ICT). In addition, institution building activities, as well as policies and incentives to encourage the establishment of companies and to encourage innovation and entrepreneurship are also significant but indirect means of government intervention. The first step taken by the central government in India was to establish the Department of Information Technology (DIT) as a unit of the Ministry of Communications and Information Technology. The main mission of the unit is to establish India as an IT superpower by 2008 through the "creation of wealth, employment generation, and IT led economic growth".

3.1.1 Government's role in generating an educated workforce

A critical basis for employment generation is the availability of a work force. The recent economic growth in India, fueled by the ICT industry, has been attributed in part to the availability of a highly educated and trained workforce. Despite the fact that large segments of the population are illiterate, there is a significant segment that is highly educated and well trained. The number of recognized institutions of higher education (colleges and universities) has more than doubled since the 1970s (IndiaStat, 2003).
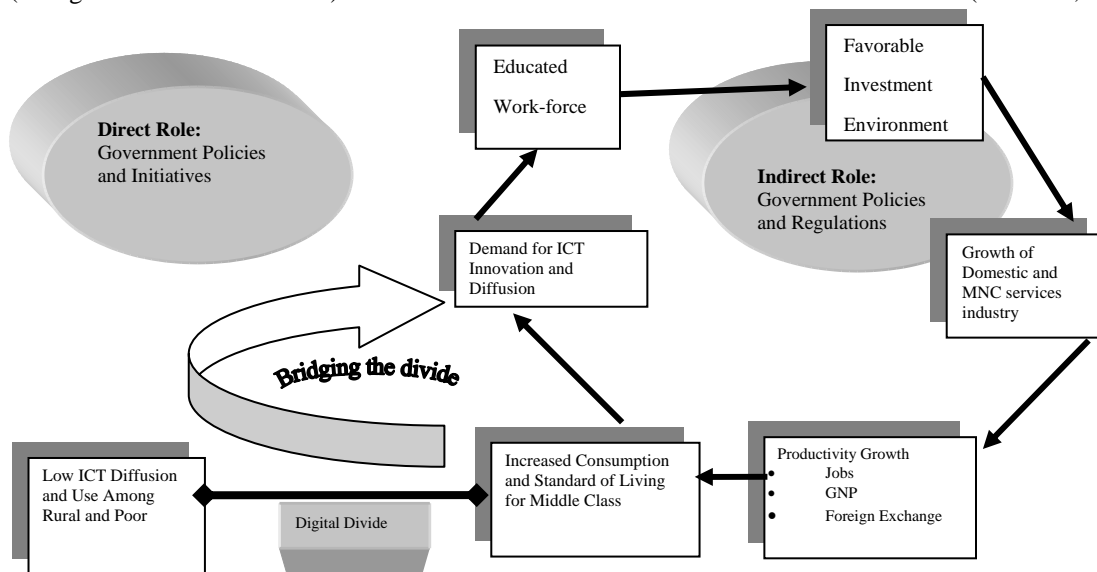
Figure 1. Conceptual Model: Role of Government in Bridging the Digital Divide

Further, India is well known for producing a high proportion of math and science graduates. Engineering graduates have grown from 44,144 in 1992 to 184,347 (IndiaStat, 2003). India also boasts the seventh largest number of scientists and engineers in the world. In addition, most higher education graduates are well versed in English - the language of global business – which further strengthens India's position in the global community.

Historically, the role of government and public institutions of higher education in the creation of an educated workforce has always existed. Even the most competitive, elite, and well-reputed institutions of higher education (such as the Indian Institutes of Technology and the Indian Institutes of Management) are public institutions supported by public funds. So, historically, it has been possible for an individual to get superb higher education at a fraction of the tuition costs relative to many developed countries. In recent years, since the potential for IT fueled economic growth has become apparent, government and public institutions have stepped up their efforts to facilitate widespread literacy and education. For example, the DIT has prioritized the use of ICT to enhance widespread literacy and education among the population. Programs have also been initiated to enhance ICT connectivity and infrastructure in government aided schools and institutions of higher education. For example, 200 secondary schools have been connected in one pilot project. In another initiative to ensure widespread computer literacy, information processing and exchange software is being developed in local languages. The DIT is promoting the standardization of Indian script codes, machine translation, speech analysis and synthesis, lexical resource development and other means to ensure wider access to education facilitated through IT.

In even more targeted initiatives, some state governments have focused specific IT training. For example, in the context of increasing growth in the BPO industry, Karnataka has developed a BSAT (BPO skills assessment test.). The test assesses a person's skills in speaking, accent, clarity, and grammar. The tests help companies to choose the right candidates, based on the test results that can be retrieved directly from a database. The aim is to encourage people to take the test and also to train the people who are lacking the required skills. Companies like DELL and AOL have used and tested this service and refinement of the BSAT is still in progress. New training centers have been setup especially for this purpose all over the state.

Thus, India's quality workforce, abundant and low-cost skilled manpower, and the language advantage have created a favorable investment climate in India for the global market. According to Tata Telecom Ltd. (Offshoring @ India, 2004), India currently has the highest "people attractiveness" in a comparison of eight countries. Moreover, India's time zone attractiveness has also helped the country a great deal in the establishment of 24 hour customer support call centers for various multi-national companies. This enables multinational companies to ensure around-the-clock customer satisfaction. The language advantage along with the time zone attractiveness has given India a competitive edge over other countries.

3.1.2 Favorable Investment Climate

Although financial and economic reforms undertaken in 1991 had already laid the foundations for the expansion of the IT industry, the government has since then recognized IT as the key in the national agenda and several policies have been established to achieve maximum benefit from the IT industry. The liberalization initiatives taken by the government in order to support global economy are encouraging more IT exports. Barriers and restrictions on foreign investments have been removed, and the government is supporting IT by providing initiatives in the form of tax benefits and concessions.

In addition, the government has provided incentives, such as reduced land prices, reduced registration charges, exemption from tariffs and zone regulations, and concessions for creating employment, to promote the ICT industry. Further, one example of coordinated efforts to create the necessary infrastructure (and an example of the Government's indirect role) is the infrastructure building initiatives that are occurring in several major cities in India – i.e. the establishment of ICT Parks. For example, in 1997, the Government of Karnataka along with the TATA group and a Singapore Consortium established a park in Bangalore, which contains a world-class infrastructure of facilities, telecom connectivity, power security and water availability.

3.1.3 Growth of Domestic and Multinational Corporations

India's attractiveness is evident from the number of IT companies that have made investments in India. According to Mr. S.M. Krishna, Former Chief Minister of Karnataka, one new international company has been opening a new branch every week for the last three years (on average), ever since he took office (Chatterjee, 2001). The growth of outsourcing by multinational companies to India and the growing demands of software exports from India have led to the emergence of many leading companies in information technology, which were established in India but have developed their presence all over the globe. Further, export of computer software and services is growing at an average rate of 44.7% and has almost tripled in the last five years. By 2002, India's software exports had reached $8.4 billion, a growth of approximately $5 billion in just over five years (IndiaStat, 2003).

Once again, the government has a critical, indirect but enabling role in facilitating and maintaining the growth of the domestic and multinational industry. It has the potential to unlock growth through establishing a world-class physical infrastructure, including the construction of roads and improving telecommunications, providing uninterrupted supply of power to IT firms. Keeping India's IT potential in mind, a government official once said, "Give foreign companies' power and roads, and India will attract a lot of foreign investment." The government has recognized their role and is taking major initiatives to promote IT in the Indian society. In terms of road connectivity, several initiatives have been taken by the government to connect Indian villages by proper roads. It is essential to bring the village population in par with the urban sector for overall growth of the economy.

3.1.4 Growth in Productivity

It is important to note that in India ICT facilitated growth has primarily occurred through the services industry. While industrial activity has accounted for only 27% of the cumulative increase in India's GDP between 1990 and 2003, the services portion of Indian GDP has increased from 40.6% in 1990 to 50.8% in

2003 – accounting for 62% of the cumulative increase in the GDP (Roach, 2004, p 17). Further, a recent study conducted by McKinsey for NASSCOM concluded that the growth of the IT software and services industry (domestic and export) has and will continue to result in the generation of approximately two million jobs between 1999 and 2008, increasing from the 0.5 million people currently employed in the industry. Other employment opportunities are also being created in areas of support services, training, food, transport, housekeeping, security, and many more (Offshoring @ India, 2004).

In addition to the growth of job opportunities in ICT, the increasing export of ICT products and services and the increasing number of foreign companies investing in India have led to a tremendous increase in the foreign exchange reserves of India. These reserves have increased from $5.8 billion in 1990-1991 to over $ 55.4 billion in 2002 (IndiaStat, 2003). Thus, the increase in foreign exchange reserves of a country, emergence of domestic and multi-national companies, and IT exports have created tremendous job opportunities, which in turn has increased the per capita income of India over the years. However, the news is not all positive. The growth in per capita income has not been uniform – there is a widening income gap and digital divide.

3.2 Low ICT Diffusion in the Rural Areas: The Widening Digital Divide

The human development index (HDI) that incorporates three critical dimensions of well-being, is a key measure of the broad attributes of human well-being of the citizens of any country. It includes indices to represent life expectancy, literacy, and per capita GDP. India's HDI has increased from 0.406 in 1975 to 0.577 in 2002 (Planning Commission, 2002). However, despite making steady progress on the HDI at the national level over the years, a closer look at country level data suggests that wide levels of disparity between different segments of the population in India continue to exist. As Table 1 indicates, when indicators include per capita consumption expenditure, incidence of poverty, access to safe drinking water, proportion of households with 'pucca' houses, literacy rate for the age group seven years and above, intensity of formal education, life expectancy at age one and infant mortality rates, then national level data clearly demonstrate that although there has been progress on all the indicators from the 1980s to the 1990s, there are substantial urban-rural differences on all indices.

Table 1. Standard of living indicators in India for urban and rural areas (late 1990's)*.

	Urban	Rural
Formal Education	3.0**	1.5**
Per Capita Expenditure	2.0	1.0
Infant Mortality	2.0	1.0
Poverty	2.0	1.5
Life Expectancy	3.0	2.25
Safe Drinking Water	4.0	2.075
"Pucca" House	3.5	2.0
Literacy***	3.5	2.25

* Source: National Human Development Report (2001) – Planning Commission, Government of India.
** Scaled and normalized - scale ranges from 0 to 5 (5 = best).
*** Age group 7 and above.

Although an increased standard of living and the related increased consumption can lead to a demand for increased ICT diffusion and innovation, this is likely to occur only for the upper and middle class segments of the population, who primarily reside in urban areas. In addition, HDI data indicates that the increased standard of living is occurring primarily in urban areas. The risk that the ICT revolution can bypass the primarily rural segments of the population is real and ever-present.

Such data, highlighting the stark differences on human well-being between urban and rural areas provide evidence of the wide disparities that can potentially increase the digital divide and prematurely interrupt the virtuous cycle of ICT fueled economic growth (Mistry, 2005). In India, the digital divide refers to disparities in both digital infrastructure and the gap of access. According to the Annual Information Social Index (ISI), which measures computer infrastructure, Internet infrastructure, social infrastructure and information infrastructure in each country, India was ranked 54th out of the 55 countries in the ISI 2000 (Welch, 2000).

Statistically speaking, India has 22 telephone lines per 1,000 people and only one out of every 1,000 have a personal computer. "The lack of access to communications and ICT tools, coupled with the high percentage of illiteracy in the rural areas, act as major roadblocks in the nation's fight against socio-economic problems and its leapfrog to a knowledge-based society" (Chatterjee, 2001).

3.3 Direct role of government

It is in this context, that it often becomes necessary for governments to take a more direct role by targeting particular aspects of economic development (e.g., subsidies to farmers, or direct aid to specific industries). Governments can also initiate specific programs and investments to directly stimulate economic growth and entrepreneurship (e.g., initiating public works projects during periods of economic recession). The main reasons for the increasing digital divide in India have been non-uniform access to ICT (either due to lack of resources to purchase necessary equipment or due to lack of connectivity) and differences in people's ability to utilize ICT (Parvathamma, 2003). Therefore, the examples used to illustrate the direct roles of government and the public sector are attempts to address these two challenges.

The direct role of governments, rather than merely enabling growth, is aimed at providing resources and support directly to targeted sectors or programs. Subsidizing internet access in rural areas, financing community internet cafes, providing internet-based services and electronic governance are examples of the direct role of governments in establishing the basis infrastructure and providing resources for greater connectivity and access to the "have-nots" in the rural areas. Specific examples of government initiatives that represent such direct roles are presented in this section.

In 2002, the DIT set up Community Information Centers (CICs) equipped with computers and internet access in 487 blocks in seven north-eastern states of India in order to directly subsidize internet access to the rural population. In a similar venture set up over a decade ago, to bring widespread telephone access, the government set up telephone kiosks and subsidized the cost of long-distance phone calls such that it was cheaper to use these kiosks rather than make long-distance phone calls from private phones at home. This had proved effective in bringing low cost telephone service to vast segments of both the urban and rural population in India.

Pioneering public-private partnerships have utilized the government subsidized infrastructure for internet access to initiate a variety of services for rural populations and to develop pro-poor IT innovations that are replicable and sustainable (James, 2003). An example is N-Logue, a company set up through a partnership between the Indian Institute of Technology, Madras, and a non-profit organization "Vishal Bharath Comnet" (Jagadish, 2003). N-Logue has developed a system that utilizes wireless connections that can be accessed by kiosks or small centers within a 25 km radius (James, 2003). Each kiosk is supplied with a wall set that receives the signal, a personal computer, with peripherals such as a video cam, printer, speakers, and CD ROM drive. One N-Logue hub can connect up to 200 villages, and kiosks can be set up and maintained by private owners who pay on a connection basis to N-Logue. N-Logue hosts and manages the service for the local kiosk owners, while also developing partnerships with public and private institutions such as government and municipal offices, hospitals, agricultural universities, and other educational institutions to enhance access by villagers to government, medical, and educational services.

In yet another example of providing direct resources, a partnership between the public and private sector has resulted in the development of the 'Simputer' (Simple Computer). The Simputer is a portable, simplified computer that runs on batteries and uses Information Mark-up Language to convert English content (from the internet) into many local Indian languages. Scientists from the Indian Institute of Science (a public institution) and Encore (a software company) developed the Simputer. Illiteracy is not a barrier to the use of the Simputer because it includes a text-to-speech converter. Further, it is designed to be multi-user compatible, so that rural associations and schools can buy the base equipment, while individual users store personal information on smart cards which they can plug into the base equipment (Meall, 2002).

Perhaps the most impressive example of government initiatives that directly affect a wide range of the population is the gradual transformation to electronic governance. Government initiatives to use IT to automate services in a variety of government functions at the Central, State, District, and Municipal levels are being implemented on a large-scale basis. Many of these initiatives are based on close cooperation and partnerships between the public and private IT sector and have already demonstrated benefits "...in terms of drastically enhanced speed of response, significantly reduced errors, and most importantly reduced corruption

in services delivered to citizens" (Sukumar and Murthy, 2003, p. 185). "Bhoomi" is an example of one such initiative. This project, funded by the central government and state government of Karnataka, was designed to computerize 20 million land records and set up land record kiosks (known as "Bhoomi" centers) that are linked to the central data base. Farmers can now access their land records and dealings for a nominal fee, and access other related services (e.g., bank loans) with drastically reduced response times and without fear of tampering by corrupt officials. Further, the software enables the administrators to generate various reports based on type of soil, land holding size, type of crops grown, thus providing updated reports and aggregated information essential for administrators to make informed policy decisions.

In addition, the DIT is currently monitoring and following several pilot projects in various states that are developing ICT enabled public administration services such as computerized ration cards or identity cards, citizen databases, registration, and village level administrative services. "Khajane" is an example of such a project in which the state of Karnataka's treasury payment system, which currently serves 470,000 government pensioners of Government service, is being computerized. Similarly, "Therige" is a project initiated by the Commercial Taxes Department in Karnataka and is designed to computerize the verification process for taxes on certain commodities.

Another example of innovative use of ICT for public administration is the establishment of computerized interstate check-posts in the state of Gujarat. The government introduced a new ICT-enabled system at ten interstate check-posts that use a video-camera to scan the license plate of vehicles transporting manufactured goods between states. The signal is transmitted to a central database for validation, checking validity of permits, calculation of taxes and so on. Vehicle owners are provided smart cards that enable them to make efficient payment of dues and penalties. This system has not only led to reduction of processing time at check-posts but also helped to curb corruption and enhance government tax collections and thereby, revenues (Sukumar and Murthy, 2003).

The examples of ICT-based public administration services discussed thus far document government initiatives that directly target the enhancement of the quality of life for the rural segments of the Indian population. The proliferation of ICT-based health, human development, and public administration services, along with the financing of community-based ICT centers specifically target the challenges of low ICT diffusion and use among the rural and poor segments of the population that has resulted in the digital divide.

4. CONCLUSION

In this paper, the literature on global IT issues (Palvia, et. al., 2002) is utilized to create a broad lens with which to view the creation and bridging of the digital divide within developing countries. The essential role of the government in bridging the digital divide is specifically highlighted and India is presented as an illustrative case study in order to delineate the specific context, opportunities, and challenges within which ICT facilitated economic growth has been targeted in a specific country. In India, the growth of a knowledge based services industry has been facilitated by the availability of a highly educated workforce, well-versed in the language of global commerce (i.e., English), and the availability of a low-cost but highly skilled labor market has driven the growth of a knowledge based services industry which has led to the growth of global organizations. However, despite increased ICT facilitated economic growth, the existence of large masses of illiterate and poor segments of society, concentrated in rural areas, has created conditions that have exacerbated the digital divide. In this context, the conditions are ripe for active intervention of the government to play both an indirect as well as direct role in bridging the digital divide.

The contributions of this paper are multifold. First, by focusing on developing countries, the paper responds to concerns that much of the IT research is from the perspective of technologically developed countries and therefore may not be applicable to developing countries. A meta-analysis of global IT research documents the link between the level of a country's economic development and the ranking of IT issues. Although IT management issues in advanced countries are strategic in nature, the issues are more basic in developing countries (Palvia, et. al., 2002). The development of frameworks specifically focused on developing countries fits in with increasing interest in understanding IT issues, such as outsourcing.

Second, the focus on developing countries includes delineation of the specific context, opportunities and challenges within which ICT facilitated economic growth has been targeted in India, the illustrative case study. This framework is applicable and relevant for developing countries that face similar challenges and

opportunities for economic growth. In delineating the missing link between digital opportunities and economic impact in developing countries, Mansell (2001) argues that in developing countries measures to develop ICT growth must be embedded within the framework of appropriate institutions and development goals. If not, then economic development and benefits are likely to be restricted to technological enclaves, thus creating a digital and economic divide within the developing country.

REFERENCES

Bateman, M. 2000. Neo-liberalism, SME development and the role of business support centers in the transition economies of central and Eastern Europe. *Small Business Economics,* Vol. 14, No. 4, pp. 275-295.

Compaine, B. M. 2001. *The Digital Divide: Facing a Crisis or Creating a Myth?* MIT Press Sourcebooks, The MIT Press, Cambridge, MA.

Chatterjee, S. 2001. India faces huge digital divide, inspite of change. *India Abroad News Service.*

Davidson, R., Harris, R., Vogel, D., & Jan de Vreede, G. 1999. Editorial preface: information technology in developing countries: closing the digital divide. *Journal of Global Information Technology Management,* Vol. 2, No. 3, pp. 10-14.

Hamelink, C.. J. 1995. *The Politics of World Communication.* San Francisco, CA: Sage Publications, Inc.

Indiastat 2003. *Revealing India statistically*. http://IndiaStat.com

Jagadish, S. 2003. The ice has broken with ICT. *Economy and Business.* pp. 1-4.

James, J. 2003. Sustainable Internet Access for the Rural Poor? Elements of an Emerging Indian Model. *Futures*, Vol. 35, pp. 461-472.

Kaushik, S. K. 1997. India's evolving economic model: A perspective on economic and financial reforms. *The American Journal of Economics and Sociology*. Vol. 56, No. 1, pp. 69-85.

Lu, M. T. 2001. Digital divide in developing countries. *Journal of Global Information Technology Management,* Vol. 4, No. 3, pp. 1-5.

Mansell, R. 2001. Digital opportunities and the missing link for developing countries. *Oxford Review of Economic Policy,* Vol. 17, No. 2, pp. 282- 290

Marangos, J. 2002. A post-Keynesian critique of privatization policies in transition economies. *Journal of International Development*. Vol. 14, pp. 573-589.

Matsuyama, K. 2002. The rise of mass consumption societies. *The Journal of Political Economy* Vol. 110, No. 5, pp. 1035-1071.

Meall, L. 2002. Business: The Digital Divide – Eastern Promise. *Accountancy,* Vol. 129, No. 1303, pp. 1-4.

Mistry, J.J. 2005. A Conceptual Framework for the Role of Government in Bridging the Digital Divide. *Journal of Global Information Technology Management*, Vol. 8, No. 2, pp. 28-46.

Offshoring @ India: The No. 1 offshoring destination. 2004. *India Advantage.* http://www.tatatelecom.com/experienceindia/Advantage

Palvia, P., Palvia, S. & Whitworth, J. 2002. Global Information Technology: A Meta Analysis of Key Issues. *Information and Management,* Vol. 39, No. 5, pp. 403-414.

Planning Commission Government of India. 2002. *National Human Development Report.* New York, NY: Oxford University Press.

Parvathamma, N. 2003. Digital Divide in India: Need for correcting urban bias. *Information Technology and Libraries,* Vol. 22, No. 1, pp. 35-39.

Roach, S. 2001. The Challenge of India and China. *Financial Times*, pp. 17.

Riggins, F. J. 2004. A Multichannel Model of Separating Equilibrium in the Face of the Digital Divide. *Journal of Management Information Systems,* Vol. 21, No. 2, pp. 161-179.

Sukumar, S., & Murthy, N. R. 2003. Influence of ICT on the development of India's competitiveness. In S. Dutta, B. Lanvin, & F. Paua (Eds.), *The Global Information Technology Report: Readiness for the Networked World,* (pp. 178-190. New York, NY: Oxford University Press.

Welch, W. 2000. The Information Society Index (ISI) 2000. *Development Outreach,* Special Report, Spring 2000.

Walsh, E. O., Gazala, M. E. & Ham, C. 2001. The Truth about the Digital Divide. In Companie, B. M. (Ed.) *The Digital Divide: Facing a Crisis or Creating a Myth*? MIT Press Sourcebooks, The MIT Press, Cambridge, MA.

MANAGING INFORMATION TECHNOLOGY ACQUISITION IN ORGANIZATIONS: A STRATEGIC EVALUATION FRAMEWORK

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ABSTRACT

Use of information technology (IT) in business organizations is quite common and its benefits are also well appreciated. In many organizations IT has attained the status of infrastructure. Despite the advancement in the technology front and its ease of use for automating business processes, many organizations fail to leverage the benefits of IT infrastructure. IT infrastructure at enterprise level is quite capital intensive and therefore, its evaluation is a growing concern. It is often argued by the researchers that existence of a robust information systems (IS) infrastructure would lead to better management of IT acquisition process facilitating effective use of the IT infrastructure. The IT acquisition process therefore, should be preceded by a rigorous exercise in the acquiring organization to build the IS infrastructure. In this paper, it is aimed to understand the management principles behind the IT acquisition process, to assess its various stages and to build a relationship among these stages through a conceptual framework. A model developed based on the framework uses variables to predict organization's preparedness in the defined stages of the acquisition process. Validation of the model is based on 604 respondents and application of structural equation modeling principles. The validated model is then applied to an organization where each stage is evaluated. The model is useful for the acquiring organization to assess its preparedness to acquire IT, assess capability to manage acquisition of IT.

KEYWORDS

IS infrastructure; IT Acquisition; Process models; Stages in IT acquisition process; Structural equation modeling.

1. INTRODUCTION

IT has become an integral part in any organization today. But the magnitude of the use of IT varies across organizations. While organizations acquire IT for its processes with expected deliveries, many acquire IT to meet the larger interest of the organization such as enterprise resource planning (ERP) based solutions, e-business, e-commerce at enterprise level. These enterprise level acquisitions are resource intensive and demand support from all the stakeholders (Palaniswamy, 2002; Datnthanam, and Hartono,2003; Eskelin,2001) and in the process organization's dependency increases manifold on IT. Thus any failure of the technology to deliver sustainable result might affect the organization's processes adversely (Lycett et

al.,2003). It is often seen that IT failure to deliver is attributed to lack of strategy in the organization, inconsistency in inter-process relationship, poor usability of the systems and even lack of interest among IT users. It is therefore, essential that IT acquisition is strategically managed in an organization (Luftman, 2003; Ward and Peppard,2002; Ahen et al.,2001). In this paper, a framework is discussed which emphasizes the management of IT acquisition process in the organization. It establishes through a structural equation modeling (SEM) that success in the IT acquisition in an organization is influenced by the organization's preparedness in early stage of the acquisition process followed by the way the acquisition is managed. It recommends that organizing and managing the resources early in the acquisition process would benefit the organization.

2. THE IT ACQUISITION PROCESS

In this paper, the IT acquisition process is defined to be an organizational activity and the IT acquisition process is based on three dimensions. First, the acquisition process requires information system infrastructure and then creates information technology infrastructures. Second, there are various stakeholders who participate and contribute to the process and third, the whole acquisition process is conducted in stages. An IT acquisition process leads to creation of two types of infrastructure i.e., IS infrastructure and IT infrastructure (Davis, and Olson, 2000; Herron,2002; Broadbent and Weill,1993). Creation of infrastructure needs planning and IT infrastructure acquisition is no exception. In IT planning process a roadmap for identification of IS, prioritization of IS for implementation needs to be framed in the organization in order to avoid "information islands" (Earl,1987; Luiftman,2003; Luftman et al.,2002; Braodbent et al.,1999). In IT acquisition process two groups of stakeholders generally contribute. These two groups are IT service providers and IT users (Davis and Olson, 2000; Broadbent, and St. Calir, 1999) and these groups need to display their capability to organize the acquisition process (Ward and Peppard, 2002; Luftman, 2003). While there are various recommendations on the stages that the acquisition process can have, in this paper three broad stages have been discussed (Eskelin, 2001). These three stages are "Pre Acquisition", "Acquisition" and "Post Acquisition".

3. THE FRAMEWORK

It is a matter of concern for the organization to manage its capabilities in the various stages of the acquisition process and evolve a strategy for the purpose (Ward and Peppard, 2002; Luftman et al., 2002). In order to appreciate the acquisition process, each stage is discussed hereunder.

3.1 Pre Acquisition Stage

In this framework, strategic approach is advocated to understand the process preparedness and climate preparedness (Segars and Grover, 1998; Jokela and Abrahamsson, 2000; Earl, 1993c; Huang and Hu, 2004). Pre-acquisition process preparedness consists of three components namely preparedness of users, IS and IT. Users' involvement in the acquisition process is essential and in this framework, users are identified based on their role in the organization and IS principles largely accept these users as "Strategic Users", "Tactical Users" and "Operational Users" (Kohli and Sherer, 2002; Davis and Olson, 2000). Requirement of these stratified users is different in a decision making process and therefore, they need to collectively organize their preparedness.

IS preparedness is the organization's preparedness to harness IT. IS is an important component of the organization for building interfaces (Seddon et al., 1999), and for integration of processes (Broadbent et al. 1999). It is experienced that strong orientation of IS towards business processes rather than becoming IT centric would provide better results and better use of IT artifacts (Alter, 2003). IS preparedness looks for existence of a strategy for establishing systems orientation to information, an IS framework for successful transactions (Abdulla, Kozar, 1995; Lamb and Kling, 2003; Seagars and Grover,1998; Lee et al., 2003). IT preparedness aims to assess organization's strategy to organize IT (Broadbent and Weill, 1996). IT comes

with relevant components (networks, databases, applications and expertise etc.) and a strategy must be formulated for acquisition of each component in alignment to the IS (Huang and Hu, 2004). Effecting control over the IS driven IT infrastructure for meeting the business needs is an indicator of IT preparedness (Datnthanam and Hortono, 2003, Lamb and Kling, 2003). Mapping the readiness of IT department and IT staff to gain control over technologies and understand business processes is the deliverable for this component. Climate preparedness aims to recognize the importance of the organizational climate that affects the IT-acquisition process. Organization's climate often is termed as a catalyst to accept the change (Olson, 1982). Organization culture is one of the important factors that affect climate in an organization. User' perception on the organization especially strategic user's consistency in the decision making style, provides a formal ambience to accept IT and help in imbibing a good work culture. It is often found that managers and professional workers are averse to IT because of fear and anxiety due to this new technology (Grover et al., 1998; Karahanna et al., 1999). It is also interesting to note that in some cases business professionals perceive IT professionals as "bad elements" in the business process (Evans,2004).

3.2 Acquisition Stage

This stage, subsequent to the pre-acquisition stage in the acquisition process, assumes that proper information systems planning is in place and priorities are set for adopting technology. Roles of the acquiring organization and the vendors and other service providers are specific in this process.

3.2.1 IT Acquisition Management Capability

During this stage IT assets are acquired. IT assets include all hard and soft components. Therefore, involvement of project managers, IT vendors and users is essential. The project becomes successful with a strategic approach to acquisition of hard and soft assets in its entirety. Even during the project execution, project managers' success relates positively to the IS planning maturity and also outcome of the project largely depends on it (Jiang et al., 2001).

3.2.2 Vendor Management

Service providers and vendors need to be evaluated during acquisition process. Vendor supplying a product or developing an application to be used as a component needs to understand the process (Papp et al., 1996). Thus there should be a cohesive relationship between the IT acquirer and IT service provider. Quality assurance from the vendor is probably one of the most useful indicators that acquirer could ascertain during evaluation as well as during execution of the project. Therefore, vendors must display this strength to get accepted by the acquirer (Jalote, 2002; Rai et al.,2002; Pressman,1997; Luftman, 2003).

3.3 Post-Acquisition Stage

In the post-acquisition stage the facts regarding IT acquisition are gathered, assessed and analyzed. In this stage focus is on usability of the product delivered, user satisfaction, project success, performance of the vendors, economic and financial assessments of the investments etc. IS-IT alignment issues as existing are also discussed. In this framework it is tried to bring some useful indicators in order to assess the "fit" that IT has brought in with the IS. This stage has some variables that lead to such assessment mostly drawn from the research models used extensively in this area, but with a motive to provide a scope of assessment. These variables are "Life Cycle", "Successful Acquisition", "User satisfaction" and "IS-IT Alignment" (Rai et al.,2002 ; Jokela, 2001; Ward & Peppard 2002; Luftman, 2003).

4. THE DEVELOPED MODEL

As discussed in the framework, three stages of the acquiring process are represented through a model displaying their relationship vide figure 1. Through this model, it is aimed to capture preparedness of the acquiring organization in various stages of the IT-acquisition process and assess relationships among the stages.
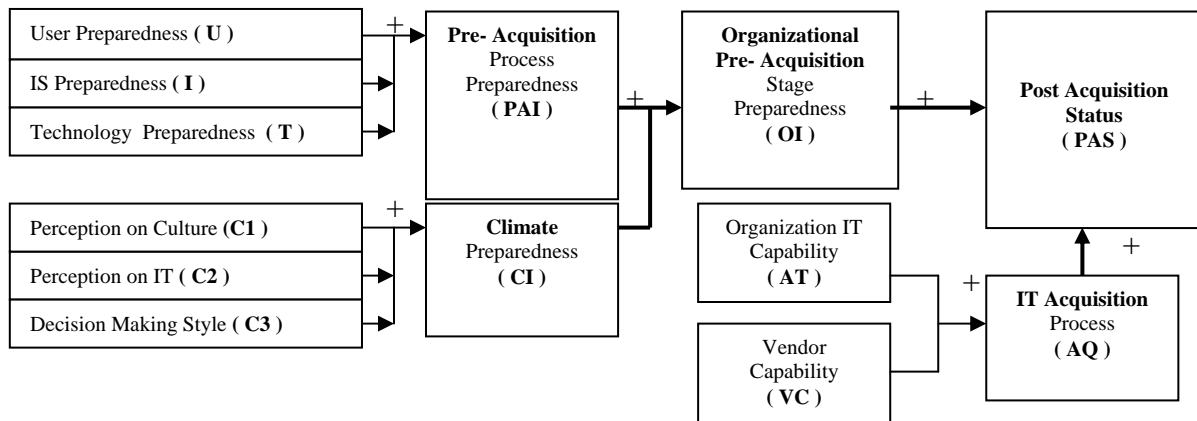
Note: ──────▶ Indicates forward aggregation of variables for assessing the preparedness

Figure 1. The Developed Framework

4.1 Explanation for Construction of the Model

A model is an abstracted representation of reality and it supports decomposition (Basili et al.,1994). The model in figure 1 shows the variables denoting the phases and their corresponding attributes (Misra et al.2003). Each attribute in the model has specific contribution to assessment as explained in table-1 based on the dependency. This dependency is considered unidirectional since the stages in the acquisition process are sequential. Though feedback mechanism can be established to understand the issues across stages; each acquisition process stems from the requirement stage and goes through the iterative process.

Table 1. Dependency Matrix to display Relationship among Variables for First Group

Dependency	Explanation
PAI= d* (U, I, T)	Pre acquisition process preparedness would _depend_ on user preparedness , IS preparedness and technology preparedness
CI= d* (C1, C2, C3)	Climate preparedness would _depend_ on user perception on organization, user perception on IT and user perception on decision style
OI= d* (PAI, CI)	Pre acquisition organization preparedness would _depend_ on pre acquisition process preparedness and climate preparedness
AQ= d* (AT, VC)	Acquisition stage would _depend_ on the capability of the IT department and vendor capability to manage projects
PAS= d* (OI,AQ)	IT acquisition status in the acquiring organization would _depend_ on organization's preparedness to acquire IT and the IT acquisition process

* "d" denotes "Predictive Dependency";

4.2 Research Design and Survey

The objective of the research is to address two issues. First, independent variables as defined in table 1 are measured. Second, dependency of dependent variables on independent variables is tested to understand predictive features of these variables. The dependency also tests the causal relationship among variables through SEM. Items, the independent variables, are developed on the Goal-Metric Questions Model (GQM) principles (Basili et al.,1994). Independent variables are in summative scale form which is generated from the responses of the subjects of the sample. Each set of questionnaire has been designed to record responses in a "**Likert scale**" with range over 1-7 (1: Strongly Disagree, 2: Disagree, 3: Somewhat Disagree, 4: Un-Decided, 5: Somewhat Agree, 6: Agree, 7: Strongly Agree) (Nunnally, 1978;Mcliver and Camines,1994). The survey was based on choosing organizations, determining sample size, and collecting responses. Twenty organizations were contacted in which the first author had unrestricted access to them. Thirteen of them responded to the exercise. As regards sample respondents, all the three layers in the management hierarchy

were given due importance in the process as required in the "stratified sampling" methodology. The overall response rate was around 21 percent. IT staff constituted 30 percent of the total responses. 604 respondents, out of 3152, across 13 organizations returned the filled-in questionnaire. The classified respondents are shown in figure 2. The dependency was assessed through the coefficients that each relation is displayed by the SEM technique. This technique also generated structural equations to establish the relationship among dependent variables.
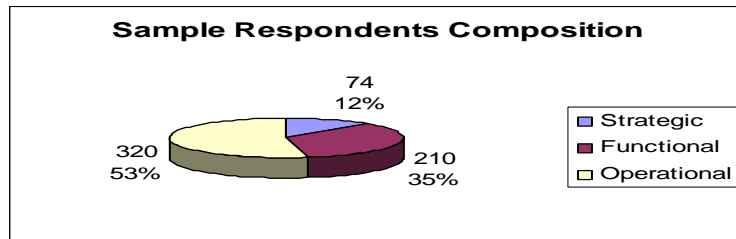
Figure 2. Composition of Sample Respondents

5. ANALYSIS

The model is used for finding the causal relationship among the independent and dependent variables. U, I, T, C1, C2, C3, VC, and AT are considered as independent variables and PAI, OI and PAS are considered to be the dependent variables variables. The model depicted in figure-3 is represented through a path analysis and postulates one-way causal flow. The confirmatory factor analyses have been done through LISREL-SEM (ver-8.7) (Minieka and Kurzeja, 2001). In this section, the model has been applied to test the dependency, establishing causal relationship through structural equations.

5.1. Analysis based on Dependency

Dependency as noted in table 1 is reflected through coefficients determined by the LISREL software using SEM technique. The positive coefficients displayed the relationship among the variables used for the model. It therefore, confirmed that the variables did provide causal relationship not only among independent variables, but also the dependent variables used for assessing each stage of the acquisition process.
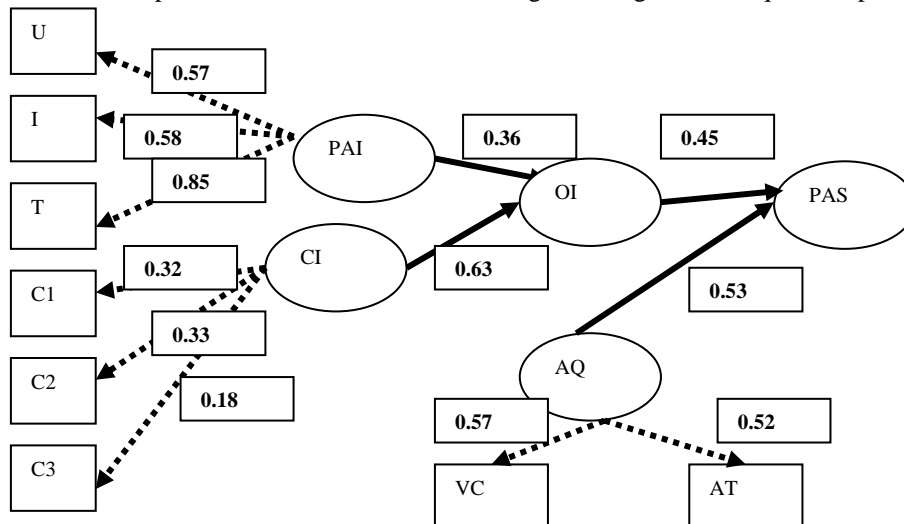
Figure 3. Validation of the Developed Model

5.2 Structural Equation for the Model

The model generated relationships among variables used for assessment of each of the stages, and particularly the pre-acquisition stage, in the acquisition process through structural equations. Table 2 indicates the extent of relationships. Equation 1 established the relationship of the variable "Organizational preparedness in pre-acquisition stage" with "Process preparedness" and "Climate preparedness".

Table 2. Structural Equation for IT Acquisition Process

Equation No.	Structural Equations Of The Model
1	Organization's Preparedness (Pre-Acquisition Stage) = 0.36* (Process Preparedness in Pre-Acquisition Stage) +0.63* (Climate Preparedness in Pre-Acquisition Stage) +0.035
2	Organization's Acquisition Scenario (Post Acquisition Stage) = 0.45* (Organization's Pre-Acquisition Preparedness) +0.53* (Acquisition Process) + 0.024

The second equation established the relationship of pre-acquisition stage and acquisition stage with eventual success of the acquisition process. It may be mentioned that acquisition process is expected to be based on a strong capability of acquiring organization to manage its vendors and projects as well as a knowledgeable vendor that has displayable capability to understand the information systems of the acquiring organization with command on the technology. Hence necessity to pay attention to these variables cannot be undermined in the acquisition process.

5.3 Application of the Model on a Case

This case is related to a cement company, was set up in the year in 1968. In order to survive stiff competition, the production system was changed to dry-process and this change was effective in 1995. The market network depended on dealer network who were managed though branch offices manned by marketing managers of the company. As regards human resource, it had strength of 816 directly employed and around 2000 indirectly employed persons. The company took some strategic steps to re-organize its marketing network into 6 zones headed by a zonal manager apart from existing 12 branch managers to manage cost. Apart from attempts to reduce transaction cost and the variable cost of sales through IT enabled processes, emphasis was given on tracking sales, market and debtors. System Development Life Cycle (SDLC) approach was adopted to complete the project.

Table 3. Application of Model for assessment of IT Acquisition

IT-Acquisition Scenario in the Organization	Preparedness of Organization	Attributes of Organization	Components of Organization Preparedness
Effectiveness of the IT-Acquisition (3.10)	Organizational Preparedness in Pre-IT Acquisition process (3.37)	Pre-Acquisition Process (3.05)	User Preparedness (3.20)
			IS Preparedness (3.18)
			Technology Preparedness (2.77)
		Climate Preparedness (3.66)	User Perception on Organization (3.61)
			User Perception on IT (3.35)
			Decision Style of organization (4.01)
	IT-Acquisition Process (3.06)		Vendor Control and Management (2.53)
			IT-Service Providers Capability (3.24)

Analysis of the described case followed the model developed. In table 3 scores for the variables are indicated in a 0-7 scale. These scores were obtained from the responses of employees who participated in the evaluation process through the model. The structural equations shown in table 2 were used to measure dependent variables. Though scores for User preparedness (3.20), IS strategy (3.18), and technology preparedness (2.77) are moderate, these have played a supportive role in bringing the technologies in to its

present form. User perception on IT (3.35), user perception on organization (3.61) also displayed a supportive role in accepting IT. However, the disturbing factors in the organization are poor vendor control and management capability (2.53), project management and control (3.24). The application of model indicated that there was a moderate preparedness in pre acquisition process (3.05). The pre acquisition preparedness in the organization however, indicated an improved result (3.37) because of a better climate (3.66). It also indicated that the competence of IT department including the IT manager was not adequate. Multiple vendors executed the projects disjoint to each other. The entire IT acquisition thus, was not remunerative (3.06). Therefore, the model appropriately diagnosed the preparedness issues and indicated the post acquisition status was not encouraging (3.10).

6. CONCLUSION

In recent times, component based technologies coupled with product based applications have paved the way for deployment of large and integrated IT enabled applications to pursue larger interest of the business organizations (e-Business), remain competitive (enterprise resource planning), ensure better customer relationships (CRM) and managing the stakeholders (supply chain management).This strategy demands capital intensive and critical IT infrastructure for the organization crossing the boundary of intranet (extranets are the order of the day). IT infrastructure acquisition therefore, is a risky proposition and it is perhaps expected that acquiring organization should strategically plan the acquisition process. Organizing preparedness for such acquisitions is quite essential. The usefulness of the model developed is quite evident since it is intended to be used by the acquiring organization to assess its preparedness in the pre acquisition stage and the capability to execute the acquiring process. Besides, it also demonstrated through a case to assess the IT acquired in the post acquisition stage and relates the result to the previous two stages of the acquisition process so as to ascertain it strength, weaknesses to organize the corrective action it needed. The next step of the research is to apply the model in large organizations for testing its universality.

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REFERENCES

1. Abdul-Gader, Abdulla H.; and Kozar, Kenneth A, (1995), The impact of computer alienation on information technology investment decisions: An Exploratory Cross-National Analysis, *MIS Quarterly*, December, pp. 535-559.

2. Ahen Dennis M., Clouse Aaron and Turner Richard, (2001), *CMMI Distilled: A Practical Introduction to Integrated Process Improvement*, Addison-Wesley, New York, pp.6-17

3. Alter, Steven, (2003), 18 reasons why IT-related work systems should replace "The IT Artifact" as the core subject matter of the field, *Communications of the Association for Information Systems*, Vo. 12, pp. 365-394.

4. Basili, V.R., Caldiera, G. and Rombach, H.D., (1994), *Goal Question Metrics Paradigm, Encyclopaedia of Software Engineering*, Vol.1, pp.528-532, Wiley.

5. Broadbent, M., Weill, P., and St. Calir, D., (1999), The Implications of Information Technology Infrastructure for Business Process Redesign, *MIS Quarterly*, 23(2), June , 159-182.

6. Broadbent, M. and Weill, P., (1993), Improving business and information strategy alignment: learning from the banking industr*y. IBM Systems Journal*, Vol. 32, No. 1, pp. 162-179.

7. Davis, B. Gordon, and Olson, Margarethe H., (2000), *Management Information Systems: Conceptual Foundations, Structure and Development*, 2nd Ed, McGraw-Hill, Singapore.

8. Datnthanam, Radhika and Hartono, Edward, (2003) Issues in Linking Information Technology Capability to Firm Performance, *MIS Quarterly* , Vol.27 No.1, March, pp125-153.

9. Earl, M. J., (1987), *Information systems strategy formulation,* in R. J. Boland and R.A. Hirschheim, eds, *Critical Issues in Information Systems Reasearch*. John Wiley and Sons, Chichester, UK.

10. Eskelin, Allen, (2001), *Technology Acquisition: Buying the Future of Your Business*, Addison-Wesley, New Jersey, June.

11. Grover, V., Teng, J. Segars, A., and Fiedler, K., (1998), "The influence of information technology and business process changes in perceived productivity: the IS executive's perspective, *Information and Management* 34 (3), pp. 141.

12. Herron, David, (2002), *IT Measurement: Practical advice from Experts, International Function Point User Group-Part-I.* Boston: Addison-Wesley Professional, First Edition, pp 27-28.

13. Huang, C., Derrick C., and Hu, Oing, (2004), Integrating Web Services with Competitive Strategies: The Balance Scorecard Approach, *Communications of AIS*, Volume 13, Article 6, January,pp1-45.

14. Jiang, James J., Klein, Gary, and Shepherd, Morgan, (2001), The Materiality of Information System Planning to Project Performance, *Journal of the Association of Information Systems*, Vol. 2(5), article 5, September.

15. Jokela, T., and Abrahamsson, P, (2000), Modelling Usability Capability-Introducing the Dimensions, *Proceedings of PROFES 2000*, Oulu, Finland.

16. Karahanna, Elena; Straub D W.; and Chervany, Norman L., (1999), Information Technology Adoption Across Time: A cross-Sectional Comparison of Pre-Adoption and Post-Adoption Beliefs, *MIS Quarterly*, Vol. 23 No.2, June, pp-183-213.

17. Kohli, Rajiv, and Sherer, Susan A., (2002), Measuring Payoff Information Technology Investments: Research Issues and Guidelines, *Communications of AIS*, Vol 9, Article 14, October.

18. Lamb Roberta and Kling Rob, (2003) Re-conceptualising Users as Social Actors in Information Systems Research, *MIS Quarterly*, Vol27 No.2, June, pp197-235.

19. Lee, Younghwa, Kozar, Kenneth A. and Larsen, Kai R.T., (2003) The Technology Acceptance Model: Past, Present and Future, *Communications of AIS*, Volume 12 Article 50, July, pp.750-780.

20. Luftman, Jerry, (2003) Assessing IT/Business Alignment, *Information Systems Management*,Vol. 20 (4), pp. 9 – 21.

21. Luftman, Jerry N., Papp, Raymond and Brier, Tom, (2002), Enablers and Inhibitors of Business-IT alignment, *ABInsight*, September.

22. Lycett Mark, Macredie Robert D., Patel Chaitali and Paul Ray J. (2003) " Migrating Agile Methods to Standardised Development Practice," *Computer Magazine, IEEE Computer Society*; June 2003, Volume 36, Number 6, New York, pp79-85.

23. Mcliver, John P., and Carmines, Edward G., (1994), *Unidimensional Scaling, International Handbook of Quantitative Applications in the Social Sciences*, Volume 4, Sage Publications, London, UK, pp.154-160.

24. Minieka, Edward, and Kurzeja, Zoriana Dyschkant, (2001), *Statistics for Business with Computer Applications Thomson Learning*, Ohio, USA, pp.349-350.

25. Misra Harekrishna, Satpathy Manoranjan and Mohanty Brajaraj (2003), A User Centric IT-Acquisition Model, *Proceedings of Sixth International Conference on Information technology*, Bhubaneswar, 22-25 December, pp. 439-445.

26. Nunnally, J C., (1978), *Psychometric Theory*, New York, McGraw-Hill, pp.66-68.

27. Palaniswamy Rajagopal (2002), "An innovation – diffusion view of implementation of enterprise resource planning (ERP) systems and development of a research model", *Information & Management*, Vol. 4, pp. 87-114.

28. Pressman, Roger S. (2001), *Software Engineering A Practitioner's Approach*, New York: McGraw-Hill, pp 28-43.

29. Rai, Arun, Lang, Sandra S. and Welker, Robert B., (2002) Assessing the Validity of IS Success Models: An Empirical Test and Theoritical Analysis, *Information Systems Research*, Vo.13, No.1, March, pp.50-69.

30. Seddon, Peter B.; Staples, Sandy; Patnayakuni, Ravi and Bowtell, Mathew, (1999), Dimensions of Information Systems Success, *Communications of AIS* Volume 2(20), November.

31. Segars, Albert H. and Grover, Varun, (1998), Strategic Information Systems Planning: An Investigation of the Construct and its Measurement, *MIS Quarterly*, June, pp. 139-163.

32. Ward, John, & Peppard,Joe, (2002), *Strategic Planning for Information Systems*, John Wiley and Sons, England, pp. 40-45.

TARGETING INTERVENTIONS FOR INTRA-ORGANIZATIONAL IT ADOPTION

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ABSTRACT

The acceptance and use of new technology has developed into one of the central research themes in the field of IT/IS. Related literature has proliferated ever since the introduction of the TAM in 1989. The strong knowledge base, however, has hardly materialized into a substantial impact in managerial practice. Managers still struggle with creating intra-organizational adoption of new IT systems and only limitedly apply theoretical insights to target their interventions. This paper aims at synthesizing and disseminating key elements from IT adoption theory to practitioners by developing a straightforward method in which theory is applied for targeting interventions for intra-organizational adoption of a new IT system. The method builds on ten years of TAM research in top ranking MIS journals and consists of a four-step process for developing targeted interventions.

KEYWORDS

Technology Adoption, Intra-organizational adoption, Interventions

1. INTRODUCTION

Achieving intra-organizational IT adoption is a major issue in contemporary business practice. The application of IT in organizations has grown substantially, especially since the emergence of e-business. An estimated 50 percent of all new organizational capital investments has been in IT since the 80's (Westland & Clark, 2000). For these IT investments to materialize into actual business benefits, they have to be accepted and used by employees within the organizations. Attractive business cases can evaporate when usage levels lag behind or require additional interventions. A recent roundtable discussion with 50 executives shows that managers struggle with realizing intra-organizational adoption and apply 'rule-of-thumbs' or a wide array of interventions to achieve their objectives. This leads to either 'trial-and-error' approaches or an 'overkill' of interventions, wasting scarce time and resources. To increase the effectiveness of interventions, they should be targeted and tailored for specific situations. This requires a profound understanding of the cognitive mechanism leading towards user adoption and the contingencies impinging on this mechanism.

A considerable amount of research has aimed at understanding the cognitive mechanism determining IT adoption. Notable approaches from the past three decades include the Theory of Reasoned Action (Fishbein & Ajzen, 1975), Social Cognitive Theory (Bandura, 1986), Theory of Planned Behavior (Ajzen, 1991), Model of PC Utilization (Thompson et al., 1991), Motivational Model (Davis et al., 1992), Technology Acceptance Model (Davis, 1998; Davis et al., 1989; Venkatesh & Davis, 2000) and the Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2003). The TAM model has dominated the empirical studies on IT adoption. Previous work on the TAM has concentrated on validating, replicating, extending and elaborating upon the TAM, resulting in a firmly grounded basic understanding of the determinants (Jeyaraj et

al., 2004; Lee et al., 2003). The TAM is widely recognized as one of the core models in IS research. Three constructs keep reoccurring in TAM related work: Perceived Usefulness (PU), Perceived Ease of Use (PEOU) and Social Norm (SN). These constructs collectively determine a Behavioral Intention (BI), which, in turn, predicts actual usage Behavior (B). Based on the initial TAM premises, we accept that external factors affecting the acceptance of IT are predominantly mediated through this cognitive mechanism (except for certain behavioral interventions). The collective understanding of external factors and the cognitive mechanism of IT adoption has progressed substantially since the introduction of TAM. The strong knowledge base, however, has hardly materialized into a substantial impact in managerial practice.

The TAM related research has identified the main cognitive drivers for adoption and can be used to assess the likelihood of success for new technology introductions. While many authors claim a contribution to managerial practice, designing proactive interventions for IT adoption on the basis of the TAM research remains difficult. Based on two roundtable discussions, we suspect that the actual usage of TAM related knowledge is limited in practice. We identify three main inhibitors for managers to apply research findings in their practice: a.) managers are not familiar with TAM research findings that can have an actual impact on their operations, b.) managers do not have the capabilities or resources to synthesize the plethora of fragmented findings in empirical TAM studies, and c.) managers question the applicability of previous empirical findings to their specific context. In this paper, we intend solving all of these three issues.

This paper synthesizes empirical findings from TAM research into a practical method for designing targeted interventions for intra-organizational adoption of a new IT system for a certain context, system, and individual. The method builds on a review of ten years of TAM publications in top ranking MIS journals. The review is aimed at identifying how external factors play a role in empirical TAM research as a.) a predictor of PU, PEOU, SN, BI or B b.) a moderator of the effect of PU, PEOU or SN on BI or c.) an intervention. The latter are factors that can be proactively manipulated in an intra-organizational context to affect the cognitive mechanisms of a target individual. The moderators can be used to determine the relative importance of targeting PU, PEOU or SN. The predictors can be used to assess the (initial) value of PU, PEOU, SN, BI, and B based on the assessment of context, system and target population.

A four-step process is suggested for developing and executing targeted interventions. The conceptual basis for this process model is provided by the IT use model (Pijpers, 2001). In this model contextual analysis is followed by the analysis of uncontrollable factors. These uncontrollable factors are used to make subgroups in the target population. Subsequently, the controllable factors are manipulated for specific subgroups. Finally, interventions are executed and evaluated. This same principle is used here. Which factors should be evaluated in steps 1 to 3 are extracted from the literature analysis. The four step method for developing targeted interventions for intra-organizational IT adoption is shown in Figure 1.

Figure 1. Method for developing targeted interventions for intra-organizational IT adoption.

The literature review is structured according to the first three steps of the process shown Figure 1. Afterwards, findings are synthesized and implications are discussed.

2. LITERATURE REVIEW

The literature review serves to identify external factors and their relationship with the TAM constructs PU, PEOU, SN, BI and B. The review consists of three parts: a.) assessment of context and system factors, b) assessment of individual factors to classify the target population, and c.) assessment of possible interventions, i.e. external factors that can be manipulated.

A total of 40 articles were selected for the literature analysis. First, a pre-selection of 11 journals was made based on their ISI impact score. The timeframe is limited to the last decade (journals published from 1995 till September 2005), resulting in a long list of 108 TAM related articles. The following additional selection criteria are used: a.) the article shows results from one or more empirical studies related to the TAM

constructs and b.) the research was conducted in an organizational setting (including students). 40 articles adhere to this additional criteria and are included in the literature analysis (see Table 1). The salient findings are discussed per step.

2.1 Step 1: Assess Context & System

The selected studies show the effects of 20 external factors related to context and system. The following categories are distinguished: task technology fit / job relevance and system characteristics. The predictive effects of the external factors on PU and PEOU are shown in Table 2. No predictors of SN or moderator effects are found in the selected articles. The findings are discussed briefly below.

2.1.1 Task technology fit / job relevance

Task technology fit (TTF) has been related to TAM and IT adoption by several different authors. Dishaw & Strong (1999) define TTF as "the degree to which an organization's information systems functionality and services meet the information needs of the task". They showed that PEOU is affected by TTF. When the fit between the task and the tool is higher, users perceive the tool to be easier to use for that task. This is confirmed by the research of Agarwal & Prasad (1999), McFarland & Hamilton (2004) and strongly by Wu et al. (2004). Burton-Jones & Hubona (2005) and Lucas et al. (1999) take the task or job itself as a surrogate measure for task-technology fit. Burton Jones & Hubona (2005) showed that managers perceive e-mail to be more useful in their work because they rely heavily on communication.

Job relevance is a construct that is conceptually related to TTF and can be defined as the degree to which the target system is applicable to the targets' job. Job relevance is a function of the importance within one's job of the set of tasks the system is capable of supporting. Goodhue & Thompson (1995) support the importance of job relevance: "users seem to view their systems as tools which assist or hinder them in the performance of their tasks". Hong et al. (2001) showed that job relevance is an important predictor of both PU and PEOU of the technology. In the five studies that include job relevance, all find significant relations with PU and only two with PEOU. TTF, on the other hand, is primarily found to be related to PEOU. A conceptual difference might therefore be larger than initially stated. Still, it is clear that both the fit and relevance are predictors of users' beliefs regarding the PU and PEOU.

2.1.2 System characteristics

The system is the focal object for the users to form their beliefs. The TAM constructs have been studied for a wide range of technologies, e.g. e-mail, Word, internet and ERP systems (see Lee et al., 2003 for an overview). Several characteristics of the system have been proposed as predictors for PU and PEOU. In our sample, quality is used most frequently (five studies). Igbaria et al. (1995) identified five different dimensions of system quality: functionality, equipment performance, interaction, environment, and the quality of the user interface. They found significant positive relations with both PU and PEOU. Other authors have found similar significant relations between system quality and both PU and PEOU (Lucas & Spitler, 1999, McFarland & Hamilton, 2004). System complexity is recognized as an important differentiating factor of the effect of PEOU in previous reviews (e.g. Sun & Zhang, 2005). In this review, Dishaw et al. (1999) use functionality as a proxy for complexity and demonstrate that it is indeed an important predictor of IT acceptance through PEOU. Many other (utilitarian) system characteristics have been included in earlier TAM research and especially in the wider area of innovation adoption research. Examples in the selected journals include, interface characteristics, screen design, and objective usability; all showing predictive effects on PEOU.

2.2 Step 2: Assess Target Population

The selected studies show the effects of 55 external factors related to the target population. The following categories are distinguished: age, gender, education, self efficacy & anxiety, experience & knowledge, and personality & culture. The effects of the external factors, both as predictor and moderator of PU, PEOU and SN, are shown in Table 3. The effects on BI and B are not included. Predictive effects on BI are only shown by Ong & Lai (2004) through gender, Hu et al. (2003) by self efficacy, and Liaw et al. (2004) by self efficacy

and perceived enjoyment. Moderation of the BI - B relation is only found by Taylor & Todd (1995) with experience. The findings for PU, PEOU and SN are discussed briefly below.

2.2.1 Age

Age is one of the individual characteristics that has received relatively limited attention in prior studies. Agarwal & Prasad (2000) found a negative correlation between age and PU. Burton-Jones & Hubona (2005) found that "older workers reported lower PEOU for mail and Word". Venkatesh et al. (2003) found that age moderates all of the key relationship in the TAM: younger workers put more emphasis on PU. PEOU and SN are more salient factors for the older generation of workers (Venkatesh et al., 2003). Related proxy constructs for age have also been proposed. For instance, Agarwal & Prasad (1999) included organizational tenure in their research. They, however, did not find a relationship with either PEOU or PU.

2.2.2 Gender

Gender is a more widely studied factor, both as a determinant as well as a moderator of the TAM constructs. Gefen & Straub (1997), Doll et al. (1998), Ong & Lai (2004) demonstrate higher values for PEOU for men. Brosnan (1999) and Gefen & Straub (1997) show higher values for PU for women. Research has also shown that the cognitive adoption mechanism is different for men and women. Brosnan (1999) found PU to be more relevant for males than females. Other research has identified that PEOU and SN may be particularly salient to females (Venkatesh & Morris, 2000). Ong and Lai (2004) revealed that men's perception of PU was also more significant and more salient than women's in determining BI e-learning. A wide array of explanations is offered by the authors for the effects for gender, e.g. men's relative tendency to feel more at ease with computers or that females tend to wait until technology is perceived to be useful before using. Even though explanations can be debated, still the support for the role of gender in shaping initial and sustained technology adoption is considerable.

2.2.3 Education

The sample of articles does not give a distinct view regarding the relationship between level of education and TAM. However it can be assumed that people with a higher level of education are likely to have more positive beliefs about new technologies in general. In the research of Burton-Jones & Hubona (2005), educational level is positively correlated to PU, but not with PEOU. On the other hand, Agarwal &Prasad (1999) show that level of education was positively correlated with PEOU, but not with PU. Spurious findings might be caused by underlying concepts as intellectual capability or other competence factors like "general competence and mental/cognitive capacities" (Chau & Hu, 2002). Explanations for different effects of education are offered using learning theories as people with higher learning capabilities are better able to recognize benefits and learn new technologies. Agarwal & Prasad (1999), however, contend this.

2.2.4 Computer Self-Efficacy & Computer Anxiety

Computer self-efficacy (CSE) is people's beliefs about their capabilities to produce designated levels of performance. In psychological literature the concept of self-efficacy is related to the way in which people behave and motivate themselves. Venkatesh & Davis (1996) found that users base their ease of use perceptions on CSE before hands-one system use, irrespective of the extent of procedural information given to them. This is supported by Venkatesh (2000). While the support for the relation between CSE and PEOU is substantial (Hong et al., 2001; Thong et al., 2002; Yi & Hwang, 2003; McFarland & Hamilton, 2004; Wu et al., 2004; Ong et al., 2004), only a few authors have found CSE to be related to PU (Hu et al., 2003; McFarland & Hamilton, 2004; Ong et al., 2004).

The concept of anxiety also finds its origin in psychology and refers to the disproportionate apprehension or dread for a certain behavior (Compeau & Higgins, 1995). Three articles in the sample tested computer anxiety and found inconsistent relations. Brosnan (1999) demonstrated a positive relation with PU, Venkatesh (2000) showed a negative relation with PEOU, and McFarland & Hamilton (2004) showed a negative relation with both PU and PEOU.

2.2.5 Experience & Knowledge

Experience has been included both as a predictor as well as a moderator. Experience refers to either using the

focal system or having used similar systems. The first is most likely to be easy to measure in organizations using system logs. Related experience or more general experience constructs have been included as well as prior similar experiences (Agarwal & Prasad, 1999; McFarland et al. (2004), tool experience (Dishaw & Strong, 1999), computer experience (Igbaria et al., 1995; Thong et al., 2002) and experience using operating systems (Liaw & Huang, 2003). The predictive findings are fairly consistent: seven studies support the straightforward relation between experience and PEOU. Three authors also find a positive relation of experience with PU; however, Igbaria et al. (1995) found a negative one. Taylor & Todd (1995) and Venkatesh et al. (2003) illustrate that PU, PEOU and SN on BI differ between experienced and inexperienced users. Together the studies show that the TAM constructs all attenuate with increasing experience. This corroborates with Jasperson et al. (2005) who propose that initial usage affects extended use directly. The effect of experience is closely related to the findings in studies including knowledge. Knowledge refers to a level of understanding that can be wider than the focal system. All four studies show the effect of knowledge on PEOU (Agarwal & Prasad, 2000; Hong et al., 2001; Thong et al., 2002; Lippert & Forman, 2005). Only Agarwal & Prasad (2000) also find a relation between prior technological knowledge and PU.

2.2.6 Playfulness, Personality & Culture

Personal characteristics have been included by authors referring to underlying drivers of behavior, e.g. internal motivation affecting PU and PEOU (Venkatesh et al., 2002). Personal innovativeness was not found to be a significant predictor (Agarwal & Prasad, 1998). Venkatesh et al. (2000) proposed that computer playfulness serves as a basis for people forming PEOU. Perceived enjoyment has also been found to affect PEOU and PU (Yi & Hwang, 2003; Liaw et al., 2004). Finally, Straub et al. (1997) tested TAM in Japan, Switzerland and the USA and found that culture affects PU.

2.3 Step 3: Interventions

Interventions are external factors that can be manipulated. The selected studies show the effects of 51 interventions. The following categories are distinguished: Influence, Training, Facilitating Conditions & Support, and Roll-out. These interventions have a predictive effect on PU, PEOU, SN, BI and B. The identified interventions do not have moderator effects. Table 4 shows the predictive relations between the interventions and the TAM. The findings are discussed briefly below.

2.3.1 Influence

Influences have the purpose of manipulating the external beliefs of people and have a cognitive nature. Some authors include an explicit source of the influences, for instance a superior or peer (Taylor & Todd, 1995). Other authors have included non-descript or more general social influences (Karahanna et al.,1999), like social presence (Karahanna et al., 1999) or image (Venkatesh et al., 2000). Besides active influences, passive influences have also been included such as 'other's use' (McFarland et al., 2004). Taylor & Todd (1995) found that superior and peer influences have significant effects on SN. Some studies use refinements of social influence without including the SN construct. In these studies, social presence, social influences, image and shared beliefs in benefits are found to positively affect PU. The latter also significantly affects PEOU.

2.3.2 Training

The role of training in the field of IT is relatively well understood (Jasperson et al., 2005). It is widely recognized as the means by which potential users acquire the skills and knowledge for actual usage. Training partly provides the prerequisite for usage, but also can serve as extended introduction shaping both PU and PEOU. The empirical findings on training are fairly consistent and supportive of the relations with PU and PEOU. Nine studies are identified that include a form of training, e.g. internal, external training (Igbaria et al., 1997), training in general (Agarwal et al., 1999; Venkatesh et al., 2002; Amoaka-Gympah et al., 2004) or the characteristics of the training, e.g. environment (Venkatesh et al., 2002). Training affects PU in six studies and PEOU in five. Surprisingly, social effects of training have not been tested in the sampled articles.

2.3.3 Facilitating conditions & Support

Facilitating conditions include constraints on behavior (Taylor & Todd, 1995) which are objective factors in

the environment that make an act easy to do (Thompson et al., 1991) and compatibility with existing values, needs, and experiences of potential adopters (Moore & Benbasat, 1991). The latter has been shown to affect PEOU (Chau & Hu, 2001; Hu et al., 2003). Besides support for the mediation of the effect of facilitating conditions on BI through PEOU, also direct effects on BI and B have been found. In our opinion, this indicates a difference between factors that are pure inhibitors and factors that also enable usage. Facilitating conditions with direct behavioral effects are primarily focused on the mitigation barriers or impediments for usage. A theoretical overlap exists between facilitating conditions and the perceived behavioral control construct which is primarily constraining (Taylor & Todd, 1995; Venkatesh et al., 2003). Support is the available assistance when learning and using the system. Support also combined with training (Karahanna & Straub, 1999; Wu et al., 2004), has been studied extensively. Both internal support (Igbaria et al., 1995, 1997; McFarland et al., 2004) as well as external support have been included (Gefen & Keil, 1998; Igbaria et al., 1997). A special type of internal support is 'management support' which indicates the level of managerial involvedness and commitment (Igbaria et al., 1995, 1997; Wu et al., 2004). From the eleven studies that have incorporated various forms of support, six positive significant relations have been found for both PU and PEOU (and insignificant in respectively five and three instances). Again, relations with SN have not been demonstrated.

2.3.4 Roll-out

The remaining external factors that were found in the literature review deal with the roll-out of a system. The factors are arguably elements of system characteristics (step 1). They are included here based on the premises that they can be manipulated. Examples of the identified factors include awareness, visibility, accessibility, demonstrability, compatibility, information quality and communication channels. Relations have been found with both PU and PEOU. The effects of the roll-out factors primarily have an effect on PU (11 out of the 16 factors compared to 6 with PEOU).

A special aspect of the roll-out is the perceived level of voluntariness. Voluntariness is defined as the extent to which potential adopters perceive the adoption decision to be non-mandatory (Moore & Izak, 1991; Venkatesh & Davis, 2000). In prior research voluntariness has been studied as both an explanatory and a moderator variable (not mentioned in Table 4). Venkatesh & Davis (2000) and Venkatesh et al. (2003) demonstrate that voluntariness reduces the effect of SN on BI. Agarwal & Prasad (1998) studied the influence of perceived voluntariness on current usage and future use intentions and found a negative significant correlation with usage. These findings support the argument that initial usage of a system may be influenced by perceptions of non-voluntariness (i.e. superior mandate), but that people will continue to use the system only if they find it useful. This is supported by Agarwal & Prasad (1998) and Karahanna & Straub (1999), who argued that "the influence of "compliance" might become insignificant over time". A high level of coercion does not lead to increased system usage. It is suggested that mandating the use of a system can increase initial system utilization, but that continued use of the system only occurs when users find it beneficial.

3. SYNTHESIS

The literature review gives an overview of 190 effects (153 significant and 37 non-significant) of 126 external factors with the TAM constructs extracted from the past decade of empirical 40 studies in 11 top-ranking IT journals. The review shows 58 significant relations with PU, 68 with PEOU, 3 with SN, 4 with BI, and 2 with B. The review shows 6 moderator effects on PU with BI, 5 on PEOU with BI and 7 on SN with BI. Overall, the antecedent effects of PU and PEOU have been explored extensively in the sampled articles. The antecedents of SN, BI and B and moderator effects have only been explored by a few authors. If one accepts that a cognitive mechanism differs per person, it seems that more attention to the moderators is justified. The same applies to the antecedents of SN: the role of social effects in TAM research has been surprisingly low.

The identified predictive and moderator effect supplement the four-step process shown in Figure 1. The method for developing targeted interventions for intra-organizational IT adoption is elaborated using the empirical findings. In the first step of assessing context and system, the 20 factors as shown in Table 2 can be used to make an initial prediction of PU and PEOU. In the second step the 55 factors in Table 3 can be used

to refine the prediction of PU and PEOU and use the moderator effects to assess the relative importance of the PU, PEOU and SN for different subgroups. As Venkatesh et al. (2005) point out, this is not a 'zero-sum' game. A differentiated approach, however, focusing on the cognitive determinants that matter most can increase the effectiveness of interventions. In the third step, interventions are made that either mitigate inhibitors for adoption or aim at manipulating the cognitive mechanism. The 51 interventions given in Table 4 collectively form the toolset to manipulate adoption cognitions. In the fourth step the interventions should be evaluated on their effectiveness of realizing behavioral change.

Certainly, questions remain how factors correlate. When an assessment is performed on the factors, no clear cut prediction can be made. The TAM models have proven to be idiosyncratic to some extent, and the development of a generalizable analytic tool is therefore difficult. The four step method augmented with the tables in this article, therefore, primarily give guidance to what factors have previously been demonstrated to affect the cognitions, how the relevance of the cognitions differ per different type of person, and what the available toolset is to intervene in the cognitions.

4. DISCUSSION

This article elucidates which factors affect the TAM cognitions, how the relevance of the cognitions PU, PEOU and SN differ per subgroup and what the available tools are to intervene in the cognitions. The results of the analysis show that the antecedents of both PU and PEOU have been explored extensively. The identified antecedents of SN, on the contrary, are very limited. More research is justified on the intricate working of social influence processes, especially since this is one of the key elements within the available managerial toolset. Targeting interventions can take place by knowing how different individuals have a different sensitivity to certain cognitions. The amount of moderators identified in this review only support discriminating approaches based on age, gender and experience. In practice, using these factors to differentiate interventions might be controversial. Sun & Zhang (2005) make a strong case for including more moderators in TAM research. We would like to resonate their call, specifically for factors that can be measured directly in practice. Latent constructs require additional measurement of the target population which could be cumbersome in practice. Specifically, it would be interesting to uncover the moderator effects of easily measurable factors as level of education, type of task or geographical location.

Certainly, we recognize some limitations to this review. First of all, the sample of articles is limited. It might exclude excellent older work or relevant studies outside the selected journals. This paper is by no means an exhaustive overview of external factors and relations with TAM constructs. Still, we believe to have sampled such a proportion of TAM related empirical research to include the most salient factors and effects.

We did not survey the internal structure of the TAM model. We only focused on the direct effects of external factors on the constructs, not the relations among the constructs. While PU, PEOU, and SN are often treated as independent factors, support has also been found for SN influencing both PU and PEOU (e.g. Wu et al., 2004, Zweig et al., 2003). The SN construct has also shown contradictory findings and surrogate constructs, like Shared Beliefs in Benefits (Amoaka-Gympah & Salam, 2004) or norms (Lucas & Spitler, 1999) have been used. Some contingencies on the relevance of SN have been identified; however, the findings concerning social effects deserve more scrutiny or refinement in future research. This could also contribute towards greater practical relevance as social influences play a crucial role in manipulating others.

In this article, we treat the external factors as if they were fully independent. However, discriminant validity between the constructs is not guaranteed (e.g. CSE and facilitating conditions). Also complex interaction effects might occur between the factors. Some authors have attempted to unravel the complexity of external factors and found two-way or three-way interaction effects, e.g. Venkatesh et al. (2003) or Morris et al. (2005). For instance, the latter showed that the pattern of gender differences in individual technology adoption varies with age such that gender differences were more pronounced with increasing age. This is consistent with Venkatesh et al. (2000) where a more unisex pattern emerges for younger workers. Also in discussions of results authors refer to (untested) confounding or interacting factors. For instance, Burton-Jones & Hubona (2005) propose that the level of complexity of the system was sufficient in their research to lead to differences across educations levels. Sun & Zhang (2005) posit that in the inconsistent and potentially spurious effects of PEOU on BI are explained by the varying complexity of system.

The contribution of this paper lies in bridging the gap between the current state of knowledge and the managerial practice. Some excellent other (meta-analytical) literature reviews of TAM research are currently available, accommodating a scientific purpose of finding under research areas (e.g. Jeyaraj et al., 2004; Lee et al., 2003; Sun & Zhang, 2005). This paper differentiates from other literature reviews by primarily focusing on factors that can be manipulated in practice. Managers responsible for a technology roll-out can use the insights in this paper for designing targeted interventions. By following the four step approach depicted in Figure 1 and using the identified relations in the tables, managers can make predictions, tailor approaches for different subgroups to target the relevant cognitions and choose effective tools to manipulate these cognitions. The utility of the method and the effectiveness of interventions is currently being researched and initial insights will be shared with the IADIS community.

REFERENCES

Ajzen, I. 1991. The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes,* Vol. 51, No. 2, pp. 179-211.

Agarwal, R. and Prasad, J. 1998. The antecedents and consequents of user perceptions in information technology adoption. *Decision Support Systems*, Vol. 22, pp. 15

Agarwal, R. and Prasad, J. 1999. Are individual differences germane to the acceptance of new information technologies? *Decision Sciences*, Vol. 30, No. 2, pp. 361

Agarwal, R. and Prasad, J. 2000. A Field Study of the Adoption of Software Process Innovations by Information Systems Professionals. *IEEE Transactions on Engineering Management,* Vol. 47, No. 3, pp. 295

Amoako-Gyampah, K and Salam, A. 2004. An extension of the technology acceptance model in an ERP implementation environment. *Information & Management*, Vol. 41, pp. 731

Bandura, A. 1986. *Social Foundations of Thought and Action: A Social Cognitive Theory.* Prentice Hall, Englewood Cliffs, NJ.

Brosnan, M.J. 1999. Modeling technophobia: a case for word processing. *Computers in Human Behavior*, Vol 15, pp. 105

Burton-Jones, A. and Hubona, G. 2005. Individual Differences and Usage Behavior: Revisiting a Technology Acceptance Model Assumption. *Database for Advances in Information Systems*, Vol. 36, No. 2, pp. 58

Chau, P. and Hu, P. 2001. Information technology acceptance by individual professionals: a model comparison approach. *Decision Sciences*, Vol.32, No. 4, pp. 699

Chau, P. and Hu, P. 2002. Investigating healthcare professionals' decisions to accept telemedicine technology: an empirical test of competing theories. *Information & Management*, Vol.39, pp. 297

Compeau, D. R. and Higgins, C.A. 1995. Application of Social Cognitive Theory to Training for Computer Skills. *Information Systems Research,* Vol. 6, No. 2, pp. 118-143.

Davis, F.D. 1989. Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly*, Vol. 13, No. 3, pp. 319-339.

Davis, F.D. et al. 1989. User Acceptance of Computer Technology: A Comparison of Two Theoretical Models. *Management Science*, Vol. 35, No. 8, pp. 982-1002.

Davis, F.D. et al. 1992. Extrinsic and intrinsic motivation to Use Computers in the Workplace. *Journal of Applied Social Psychology*, Vol. 22, No. 14, pp. 1111-1132.

Dishaw, M. and Strong, D. 1999. Extending the technology acceptance model with task-technology fit constructs. *Information & Management*, Vol. 36, pp. 9

Doll, P. et al. 1998. Using Davis's perceived usefulness and ease of use instruments for decision making: A confirmatory and multigroup invariance analysis. *Decision Sciences*, Vol. 29, No. 4, pp. 839

Fishbein, M. and Ajzen, I. 1975. *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research.* Addisson-Wesly, Reading, MA.

Gefen, D and Straub, D, 1997. Gender differences in the perception and use of e-mail: An extension to the technology acceptance model. *MIS Quarterly*, Vol. 21, No. 4, pp.389

Gefen, D. and Keil, M. 1998. The impact of developer responsiveness on perceptions of usefulness and ease of use: An extension of the Technology Acceptance Model. *Database for Advances in Information System*, Vol. 29, No. 2, pp. 35

Goodhue, D.L. and Thompson, R.L. 1995. Task-Technology Fit and Individual Performance. *MIS Quarterly,* Vol. 19, No. 2, pp. 213-236.

Hong, W. et al. 2001. Determinants of user acceptance of digital libraries: an empirical examination of individual differences and system characteristics. *Journal of Management Information Systems*, Vol. 18, No. 3, pp. 97

Hu, P. et al. 2003. Examining technology acceptance by school teachers: a longitudinal study. *Information & Management*, Vol. 41, pp. 227

Igbaria, M. et al. 1995. Testing the determinants of microcomputer usage via a structural equation model. *Journal of Management Information Systems*, Vol. 11, No. 4, pp. 87

Igbaria, M. et al., 1997. Personal computing acceptance factors in small firms: A structural equation model. *MIS Quarterly*, Vol. 21, No. 3, pp.279

Japserson, S. et al. (2005) A Comprehensive Conceptualization of Post-Adoptive Behaviors Associated with Information Technology Enabled Work Systems. *MIS Quarterly,* Vol. 29 (forthcoming)

Jeyaraj, A. et al. 2004. Understanding the Relationship between Organizational and Individual Adoption of IT innovations: Literature Review and Analysis. *Proceedings of the DIGIT workshop, ICIS,* Washington DC, USA.

Karahanna, E. and Straub, D. 1999. The psychological origins of perceived usefulness and ease-of-use. *Information & Management*, Vol. 35, pp. 237

Lederer, A. et al. 2000. The technology acceptance model and the World Wide Web. *Decision Support Systems*, Vol. 29, pp. 269

Lee, Y. et al. 2003. The Technology Acceptance Model: Past, Present, and Future. *Communications of the Association for Information Systems,* Vol. 12, No. 50, pp. 752-780.

Liaw, S. and Huang, H. 2003. An investigation of user attitudes toward search engines as an information retrieval tool. *Computers in Human Behavior*, Vol. 19, pp. 751

Liaw, S. et al. 2004. Attitudes toward search engines as a learning assisted tool: approach of Liaw and Huang's research model. *Computers in Human Behavior*

Lippert, S. and Forman, H. Utilzation of Information Technology: Examining Cognitive and Experiential Factors of Post-Adoption Behavior. *IEEE Transactions on Engineering Management,* Vol. 52, No. 3, pp. 363

Lucas, H. and Spitler, V. 1999. Technology use and performance: A field study of broker workstations. *Decision Sciences*, Vol. 30, No. 2, pp. 291

Mathieson et al., 2001. Extending the technology acceptance model: The influence of Perceived User Resources. *Database for Advances in Information Systems.* Vol. 32, No. 3, pp. 86

McFarland, D. and Hamilton, D. 2004. Adding contextual specificity to the technology acceptance model. *Computer in Human Behavior*

Moore, G.C. and Izak, B. 1991. Development of an instrument to measure the perception of adopting an information technology innovation. *Information Systems Research*, Vol 23, No. 3.

Moore, G.C. and Benbasat, I. 1991. Development of an Instrument to Measure the Perceptions of Adopting an Information Technology. *Innovation, Information Systems Research*, Vol. 2. No. 3, pp. 192

Ong, C et al. 2004. Factors affecting engineers' acceptance of asynchronous e-learning systems in high-tech companies. *Information & Management*, Vol. 41, pp. 795

Ong, C. and Lai, J. 2004. Gender differences in perceptions and relationships among dominants of e-learning acceptance. *Computer in Human Behavior*

Pijpers, A.G.M. (2001) Seniors Executives' Use of Information Technology. *Dissertation Eindhoven* University of Technology.

Straub, D. et al. 1997. Testing the technology acceptance model across cultures: A three country study. *Information & Management,* Vol. 33, pp.1

Sun, H. and Zhang, P. 2005. The role of moderating factors in user technology acceptance. *International Journal of Human-Computer Studies* (forthcoming)

Taylor, S and Todd, P. 1995. Understanding Information Technology Usage: A Test of Competing Models. *Information Systems Research*, Vol.6, No. 1, pp.144

Taylor, S and Todd, P., 1995. Assessing IT usage: The role of prior experience. *MIS Quarterly,* Vol. 19, No. 4, pp. 561

Teo, H. et al. 2003. Evaluating information accessibility and community adaptivity features for sustaining virutal learning communities. *International Journal of Human-Computer Studies*, Vol. 59, pp. 671

Thomson, R. et al. 1991. Personal Computing: Towards a Conceptual Model of Utilization. *MIS Quarterly,* Vol. 15, No. 1, pp. 214 -143.

Thong, J. et al. 2002. Understanding user accpetance of digital libraries: what are the roles of interface characteristics, organizational context and individual differences? *International Journal of Human-Computer Studies*, Vol. 57, pp. 215

Venkatesh, V. 2000. Determinants of Perceived Ease of Use: Integrating Control, Intrinsic Motivation, and Emotion into the Technology Acceptance Model. *Information Systems Research*, Vol. 11, No. 4, pp. 342

Venkatesh, V. and Davis, F. 1996. A model of the antecedents of perceived ease of use: Development and test. *Decision Sciences*, Vol. 27, No. 3 , pp. 451

Venkatesh, V. and Davis, F. 2000. A theoretical extension of the technology acceptance model: Four longitudinal Field Studies. *Management Science,* Vol. 46, No. 2, pp. 186

Venkatesh, V. and Morris, M., 2000. Why don't men ever stop to ask for dirrections? Gender, Social Influence, and Their Role in Technology Acceptance and Usage Behavior. *MIS Quarterly*, Vol. 21, No. 1, pp. 115

Venkatesh, V. et al. 2002. User acceptance enablers in individual decision making about technology: Toward an Integrated Model. *Decision Sciences*, Vol. 33, No. 2, pp. 297

Venkatesh et al. 2003. User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly*, Vol. 27, No. 3, pp.425

Venkatesh, V. et al. 2005. Gender and Age Differences in Employee Decisions About New Technology: An Extension to the Theory of Planned Behavior. IEEE Transactions on Engineering Management, Vol. 52, No. 1, pp.69

Wu, J. et al. 2004. Empirical evaluation of the revised end user computing acceptance model. *Computers in Human Behavior*

Yi, M. and Hwang, Y. 2003. Predicting the use of web-based information systems: self-efficacy, enjoyment, learning goal orientation, and the technology acceptance model. *International Journal of Human-Computer Studies*, Vol. 59, pp. 431

APPENDIX A

Table 1. Journals included in the literature review

Nr.	Journal	Author	Year	Context	System	Step 1	2	3
1	DS	Agarwal & Prasad	1999	organization	GUI interface		x	x
2	IEEE	Agarwal & Prasad	2000	professionals	C language	x	x	x
3	DSS	Agarwal & Prasad	1997	organization	expert system app		x	x
4	IM	Amoaka-Gympah & Salam	2004	large global organization	ERP system			x
5	CHB	Brosnan	1999	undergraduate students	word processing		x	
6	DoAIS	Burton-Jones & Hubona	2005	professionals, admin.	word processing , mail	x	x	
7	DS	Chau & Hu	2001	professionals	telemedicine technology			x
8	IM	Chau & Hu	2002	physicians	telemedicine technology			x
9	IM	Dishaw & Strong	1999	programmers		x	x	
10	DS	Doll et al.	1998	students	word / graphic / DB	x	x	
11	DoAIS	Gefen & Keil	1998	employees	expert system			x
12	MISQ	Gefen & Straub	1997	knowledge workers	e-mail		x	x
13	JMIS	Hong et al.	2001	students	digital library	x	x	x
14	IM	Hu et al.	2003	teachers	Microsoft PowerPoint	x	x	x
15	MISQ	Igbaria et al.	1997	employees	personal computing	x	x	x
16	JMIS	Igbaria et al.	1995	MBA students	microcomputer usage			x
17	IM	Karahanna & Detmar	1999		e-mail			x
18	DSS	Lederer et al.	2000	work newsgroups	www work related tasks			x
19	CHB	Liaw & Huang	2003	students	search engines	x	x	x
20	CHB	Liaw et al.	2004	medical students	search engines		x	
21	IEEE	Lippert & Forman	2005	SC members	collaborative network		x	x
22	DS	Lucas & Spitler	1999	brokers, sales assistants	mainframe subsystems	x		
23	DoAIS	Mathieson et al.	2001	Mgt. Accountants	bulletin board system			x
24	CHB	McFarland & Hamilton	2004	Profit organizations		x	x	x
25	CHB	Ong & Lai	2004	six intern. companies	e-learning		x	
26	IM	Ong et al.	2004	organizational	e-learning		x	x
27	IM	Straub et al.	1997				x	
28	MISQ	Taylor & Todd	1995	students	university computing		x	x
29	ISR	Taylor & Todd	1995	business school students	computing resource		x	x
30	IJHCS	Teo et al.	2003	students	virtual learning			x
31	IJHCS	Thong et al.	2002	students	digital library	x	x	x
32	DS	Venkatesh & Davis	1996	MBA Students	graphics / WP / Lotus	x	x	
33	MS	Venkatesh & Davis	2000	organization	various systems	x	x	x
34	DS	Venkatesh et al.	2002				x	
35	IEEE	Venkatesh et al.	2005	employees	new software app		x	x
36	MISQ	Venkatesh & Morris	2000	employees	data mgt / info retrieval		x	x
37	ISR	Venkatesh	2000	organizations	various systems		x	
38	MISQ	Venkatesh et al.	2003	employees	various systems	x	x	x
39	CHB	Wu et al.	2004	organization	EUC users	x	x	x
40	IJHCS	Yi & Hwang	2003	students	blackboard system		x	

Table 2. External Factors for Step 1: Assess Context & System

Category	External Factor	Source	Predictor PU	Predictor PEOU	SN
Task Technology Fit	Technology Provider versus User	Agarwal & Prasad, 1999	0	+	
	Task Technology Fit	Dishaw & Strong, 1999	0	+	
	High Task Structure	McFarland & Hamilton, 2004	+	+	
	Task Technology Fit	Wu et al., 2004	0	+	
	Staff seniority	Burton-Jones & Hubona, 2005	+	0	
Job Relevance	Job	Lucas & Spitler, 1999	+	0	
	Job Relevance	Venkatesh & Davis, 2000	+		
	Relevance	Hong et al., 2001	+	+	
	Relevance	Thong et al., 2002	+	+	
	Job Relevance	Hu et al., 2003	+		
System Characteristics - Quality	System Quality	Igbaria et al., 1995	+	+	
	Perceived System Quality	Lucas & Spitler, 1999	+	+	
	Quality of Search Engines	Liaw & Huang, 2003		+	
	System Quality	McFarland & Hamilton, 2004	+	+	
System Characteristics - other	Tool functionality	Dishaw & Strong, 1999	0	+	
	Type of application	Doll et al., 1998	+	0	
	Interface characteristics	Thong et al., 2002		+	
	Screen design	Hong et al., 2001	0	+	
	objective usability	Venkatesh & Davis, 1996		+	
	objective usability	Venkatesh, 2000		+	

+ = positively significant at p≤0.05; 0 = non-significant; - = negatively significant at p≤0.05; blank = not studied
* = only after direct experience

Table 3. External Factors for Step 2: Assess Target Population

Category	External Factor	Source	Predictor PU	Predictor PEOU	Predictor SN	Relevance PU	Relevance PEOU	Relevance SN
Age	Younger Workers	Agarwal & Prasad, 1999	0	0				
		Agarwal & Prasad, 2000	+	0				
		Venkatesh et al., 2003				+		
	Older Workers	Venkatesh et al., 2003					+	+
		Burton-Jones & Hubona, 2005	0	+				
Gender	Male	Gefen & Straub, 1997		+				
		Doll et al., 1998	0	+				
		Venkatesh & Morris, 2000				+		
		Venkatesh et al., 2003				+		
		Ong & Lai, 2004	+	+				
		Venkatesh et al., 2005				+		
	Female	Gefen & Straub, 1997	+		+			
		Brosnan, 1999	+			+		
		Venkatesh & Morris, 2000					+	+
		Venkatesh et al., 2003					+	+
		Venkatesh et al., 2005						+
Education	Level of education	Venkatesh et al., 2003						
		Agarwal & Prasad, 1999	0	+				
		Burton-Jones & Hubona, 2005	+	0				
Computer Self-efficacy	Computer Self-efficacy	Venkatesh & Davis, 1996		+				
		Venkatesh, 2000		+				
		Hong et al., 2001		+				
		Thong et al., 2002		+				
		Hu et al., 2003	+					
		McFarland & Hamilton, 2004	+	+				
		Wu et al., 2004		+				
		Ong et al., 2004	+	+				
	Application self-efficacy	Yi & Hwang, 2003		+				
		Liaw et al. 2004						
Computer Anxiety	Computer Anxiety	Brosnan, 1999	+					
		Venkatesh, 2000		+				
		McFarland & Hamilton, 2004	-	-				
Experience	Experience: extended	Igbaria et al., 1995	-	+				
		Venkatesh et al., 2003					+	+
		McFarland & Hamilton, 2004	+	+				
	Experience: limited	Venkatesh & Davis, 2000						+
		Taylor & Todd, 1995				+		0
		Venkatesh & Morris, 2000					+	+
	Prior similar experiences	Lippert & Forman, 2005		+				
		Agarwal & Prasad, 1999	0	+				
	OS experience	Liaw & Huang, 2003		+				
	Gen. experience	Doll et al., 1998	+	0				
	Comp.experience	Thong et al., 2002		+				

Category	External Factor	Source	PU	PEOU	SN	IOU	B
Knowledge	Tool experience	Dishaw & Strong, 1999	+	+			
	Prior technol.	Lippert & Forman, 2005		+			
	knowledge	Agarwal & Prasad, 2000	+	+			
		Hong et al., 2001		+			
	domain Knowledge	Thong et al., 2002		+			
Playfulness	Playfulness	Venkatesh, 2000		+			
	Perceived Enjoyment	Yi & Hwang, 2003	+	+			
		Liaw et al., 2004					
		Liaw & Huang, 2003	+				
Personality	Intrinsic Motiv.	Venkatesh et al., 2002	+	+			
	Personal Innov.	Agarwal & Prasad, 1998			0	0	
Culture	Culture	Straub et al., 1997	+				

+ = positively significant at p≤0.05; 0 = non-significant; - = negatively significant at p≤0.05; blank = not studied

Table 4. External Factors for Step 3: Design Interventions

Category	External Factor	Source	Predictor				
			PU	PEOU	SN	IOU	B
Influence	Superior's influence	Taylor & Todd, 1995			+		
	Peer's Influence	Taylor & Todd, 1995			+		
	Social Influence	Karahanna & Straub, 1999	+				
	Social Presence	Karahanna & Straub, 1999	+				
	Social Presence & Inf. Rich.	Gefen & Straub, 1997	+				
	Image	Venkatesh & Davis, 2000	+				
	Other's use	McFarland & Hamilton, 2004	+	0			
Training	User training	Igbaria et al., 1995	+	+			
	internal training	Igbaria et al., 1997	+	0			
	Participation in Training	Agarwal & Prasad, 1999	+	0			
	external training	Igbaria et al., 1997	0	+			
	Training intervention	Venkatesh et al., 2002	0				
	Training on ERP	Amoaka-Gympah & Salam, 2004		+			
	Training Effectiveness	Lippert & Forman, 2005		+			
	Pre Training environment	Venkatesh et al., 2002	+	+			
	Training environment	Venkatesh et al., 2002	+	+			
Facilitating conditions	Facilitating conditions	Venkatesh et al., 2003					+
	Perceived external control	Venkatesh, 2000		+			
	Perceived Resources	Mathieson et al., 2001	+	+		+	+
	perceived behavioral control	Chau & Hu, 2002				+	
	perceived behavioral control	Taylor & Todd, 1995				+	+
	Accessibility	Karahanna & Straub, 1999		+			
	System accessibility	Thong et al., 2002		+			
	Internet response time	Liaw & Huang, 2003		+			
	Compatibility	Chau & Hu, 2001	+				
	Compatibility	Hu et al., 2003	+				
Facilitating conditions - Support	Availability of T&S	Karahanna & Straub, 1999	0				
	Internal computing S&T	Wu et al., 2004	0	+			
	External computing S&T	Wu et al., 2004	0	0			
	internal computing support	Igbaria et al., 1997	0	0			
	End User comp. support	Igbaria et al., 1995	+	+			
	Developer Responsiveness	Gefen & Keil, 1998	+	+			
	External computing support	Igbaria et al., 1997	+	+			
	Organizational Support	McFarland & Hamilton, 2004	+	+			
	Management Support	Igbaria et al., 1995	+	+			
		Igbaria et al., 1997	+	+			
		Wu et al., 2004	0	0			
Roll-out	Awareness	Agarwal & Prasad, 1998	+	+			
	System Visibility	Thong et al., 2002	+				
	Information accessibility	Teo et al., 2003	+				
	Result demonstrability	Venkatesh & Davis, 2000	+				
	Experimentation	Lippert & Forman, 2005	+	+			
	Job insecurity	Agarwal & Prasad, 2000	+	+			
	network externality	Wu et al., 2004	0	+			
	community adaptivity	Teo et al., 2003	+				
	Information quality	Lederer et al., 2000	+				
	Communication Channel	Agarwal & Prasad, 1998	+	0			
	Perceived Credibility	Ong et al. 2004				+	
	Project communication	Amoaka-Gympah & Salam, 2004	0				
	ease of understand. / finding	Lederer et al., 2000		+			
	Terminology	Hong et al., 2001	0	+			

+ = positively significant at p≤0.05; 0 = non-significant; - = negatively significant at p≤0.05; blank = not studied

THE SPAM PROBLEM – CONSEQUENCES FOR ECOMMERCE AND A MULTI-FACETED SOLUTION APPROACH

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ABSTRACT

The amount of unsolicited commercial email, widely known as spam, has increased dramatically in the past few years. Business has an ambivalent relation to spam. On one hand spam cost companies billions of Euros in lost productivity, on the other hand email has become an essential tool for doing business, and anti-spam measures can reduce eCommerce effectiveness and profitability. Yet, not much work has been done to evaluate the spam topic from different perspectives in respect to eBusiness companies. Therefore the current state of spam and distribution thereof is examined showing the spammers motivation and tactics. A detailed scrutiny of the impact on the economy in terms of costs and social impacts caused by spam shows alarming figures. The issue of spam, of course, is a matter of legislation as well. An overview is provided on the latest techniques used by IT industry in order to curb the problem of clogging up users inboxes.
Finally in this paper we will present an integrated, multi-faceted approach to fight against spam, while ensuring that business and consumer requirements for convenient electronic communications are preserved.

KEYWORDS

eBusiness, spam, economic analysis, unsolicited commercial email

1. INTRODUCTION

Almost every second household in the European Union is connected to the Internet. The rise of accessibility goes along with a lot of advantages from information gathering to E-business. Beside the benefits of connectivity there are severe adverse side effects to the connected environment. Nowadays, the dimensions of Internet abuse have an overriding importance because of their increase in occurrence. In this context, unsolicited commercial email (UCE) widely known as spam is a bottomless pit.

The range of these side effects reaches from chain letters over bulk advertisements to fraud. The European Commission (2004) defines spam as a problem of deception of consumers, a threat to minors, a danger to human dignity, and primarily a threat to the fundamental rights of people's privacy. Also, spam has an annoying and time-consuming effect on individuals, and it costs a lot of money for organisations. They have to increase bandwidth, either investing in techniques to protect themselves against spam, or pay even wages for working hours of individuals tied up by dealing with spam in their inboxes.

From a business point of view, the primarily negative image of spam could have consequences that are not in the interest of business organisations. For instance, strong different legislative measures in several countries increase the risk of illegal behaviour during cross-border electronic business communication, or technical solutions for filtering out spam, which in contrast to their intentions may prevent effective electronic business communication when filtering out legitimate marketing-focused or service-oriented electronic mails.

In the following, an examination and evaluation of the state of spam dissemination, the governmental and industrial approaches to tackle the spam problem, will provide answers to the following questions:

- What does the scope of the problem comprise?
- What are the spamming tactics, and why?
- What damages can be allocated to spam?
- What benefits or disadvantages arise from the legal framework against spam?
- What strategies or technologies are appropriate for stopping spam?

The investigations provide a basis for conclusions as to how effective the different approaches are and how capable of curbing spam. On this basis we will present an integrated approach for fighting spam, with particular emphasis on the role business organizations will have to play.

2. THE SCOPE OF SPAM

Spam needs to be defined, because it can be a matter of bulk advertisements, or chain letters and even viruses spread by using bulk emails. Some users define simply each unwanted email as spam. In literature spam is usually referred to as being sent in bulk, unsolicited and having a commercial aim. Herein we stick to that definition and focus on email, even if other electronic communication suffers from spam-like nuisance as well. The particular relevance becomes clear when considering that in year 2004 on average 73.2% of all emails were identified as spam that is every 1.4th email (MessageLabs, 2005a). The frightening evolution of spam can be seen in Figure 1. Even if the trend is currently slowing down, the absolute number of spam is more likely to rise than to drop. What does spam advertise? Symantec (2005) identified that almost 75% of all spam mails try to sell any products, e.g. miracle cures, adult products, software, or financial services and so on. Also, there is a rising significance on scam and fraud which amounts to 17% worldwide and usually tries to steal personal information like credit card details, widely known as phishing (Jennings, 2004). Within the scope of our study, we have excluded this kind of crime from further investigations.

2.1 The Spammers

Why does spam show such an alarming growth? The reason for this can be found in the financial benefit offered by spam. The spammer himself is usually contracted by the actual vendor and earns up to 50% commission on sales initiated by spam (Jennings, 2004, see figure 1). Grimes (2004) shows an example where these sales reach revenue of US $ 600,000 after one single spam mailing. Strangely, a lot of respondents were identified among top management level.

The destination addresses used by spammers can be gathered very cheaply. Purchasing a list of some 200 million addresses usually costs less than US $ 200 (Jennings, 2004). Also, these lists can be rented or collected on the Internet via software which scans websites and UseNet's, for available email addresses (Cournane and Hunt, 2004). This process is also known as "address harvesting".
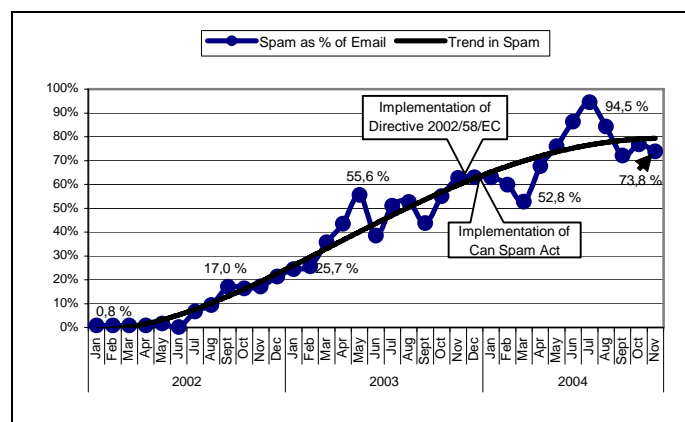

Figure 1. Percentage of Spam to Legitimate Email (MessageLabs, 2005b and Jennings, 2004)

The way the spammers work is very sophisticated in two ways. Firstly, they track their response data with ingenious software. Secondly, they use a lot of techniques not to be identified, filtered or designed to spread the amount of spam by building botnets (network of robots) through virus affected zombie PCs(Jennings, 2004). Spammers do not refrain from fraudulent methods to let the emails appear to be legitimate correspondence, because 95% of the recipients would just delete recognised spam (www.cauce.com). Also sender addresses and origin are altered by relaying messages over foreign innocent mail servers (Cournane and Hunt, 2004). The degree of sophistication might also be responsible, following spamhaus (www.spamhaus.org), that just 200 spammers are responsible for 80% of the generated spam.

2.2 Economic Damages

Through techniques like the mentioned botnets, spammers are able to send 200 million messages a day just by using a cheap dialup connection (Jennings, 2004). The real costs occur on the other side starting with the Internet Service Provider (ISP) who has to broaden the bandwidth and increase the server capacity both in terms of higher processing power and increased storage capacity. The worldwide damage for ISPs was estimated already in 2003 with US $ 500 million per year (Lueg, 2003). Following down the line to the business end user, a Nucleus Research report estimated that in 2004, spam cost Fortune 500 companies 1,934 US$ per employee in lost productivity (Nucleus Research, 2004) and a National Technology Readiness Survey shows that the cost for all US companies to delete spam was US$ 22 billion in 2004 (NTRS, 2004). The last link in the chain is the customer who has to deal with spam and, in addition, has to compensate for the damage caused to upper business levels by increased charges.

Another economic damage, which exists even if hardly measurable, is the reputational damage to non-spamming companies suffering from the misconduct of others. Also, damage especially in business can be caused by false positive messages (incorrectly identified as spam), which are legitimate but have not been delivered. This could also be responsible for diminishing the effectiveness of email as a communication tool in eCommerce (Cournane and Hunt, 2004). Ultimately users may reject the use of email because they are fed up with having their inboxes being always inundated with spam. This fact is reflected in a US survey where Fallows (2003) identified that 25 % of respondents already reduced their use of email due to the increase in spam.

3. THE LEGAL APPROACH

The tremendous damage caused by spam, and especially the infringement of human rights like privacy, and the call for regulation did not stay out of legislative attention (Lugaresi, 2004). Therefore spam specific laws have been developed within the last 3 years. The European Union enacted the Directive on privacy and electronic communications (Directive 2002/58/EC). Whereas the so-called Can Spam Act was implemented in the US in 2003, many other countries have enacted different kinds of laws as well. Despite all these laws in place, the tide of spam has not slowed down. In the following, we do not attempt to provide a complete understanding of all laws enacted; we rather would like to show the spam related distinguishing features of the Directive 2002/58/EC, to comment on its implementation in the UK, to compare international attempts to curb spam and to offer explanations why they missed their curative effects. The US Can Spam Act serves as comparison, because most spam in the world originates in the US (Symantec, 2005).

3.1 Opt-In vs. Opt-Out

The origin of the Directive 2002/58/EC can be seen in the repealed Telecommunication Directive (1997). This was already dealing with the matter of consent based direct marketing, but with a focus rather on telephone and facsimile, than on email. Related to email it reflected no clear rules (Cheng, 2004). To adopt a broader technological definition, including email, telephone but also cookies, traffic and location data, and to reflect customers' privacy protection, the Directive 2002/58/EC was implemented.

Article 13(1) of the Directive 2002/58/EC prohibits the sending of unsolicited email unless prior consent of the subscriber has been obtained, i.e. "opt-in", which includes the customer's right to reject the consent free of charge and in an easy manner ("opt-out") for future emails. An exception is made by stating that marketing of similar products or services is allowed and does not need prior consent, as long as the data used was obtained through a prior sale (so called "soft opt-in"), also the possibility to object must be given (European Commission, 2004).

The EC Directive in the UK mostly reflects these guidelines, but is criticised by Cheng (2004) for broadening the soft opt-in in that sense, that the contact data used for marketing can be obtained within sales OR negotiations. He further criticises that no explicit obligation exists for the sender to provide a simple opt-out possibility within legitimate emails sent under consent. This makes the receiver responsible for the cost of locating and contacting (Cheng, 2004). Critique is also justifiable that there is no definition of "similar products" (Butler, 2003) and no regulation about the legitimate time that the sender needs to respond to the opt-out.

The US Can Spam Act, solely addressing spam, follows a straight opt-out position, hence the sender is allowed to spam, as long as an opt-out mechanism is provided. However many spammers just do so by providing "dummy" opt out links (Grimes, 2004). After objection, it is legitimate to send mails for 10 more business days. It is also criticised that it nullifies earlier state laws which might have followed stricter rules (Cheng, 2004).

Whereas the Can Spam Act makes no distinction between individuals and legal persons, neither the Directive 2002/58/EC, nor the UK implementation of EC Directive provide opt-in "protection" to legal persons (Cheng, 2004), accordingly one can say that they do not tackle the major damages caused to business.

3.2 Sender Identity and Address Harvesting

As stated above, spammers often use botnets to send spam. This is done to broaden their reach, and to change the IP-Information sent within each email. Also other techniques are used to disguise spam origin displayed in the header information of the email. Legislation usually takes this into consideration by prohibiting these techniques, so does the EC Directive (UK) and Directive 2002/58/EC. Article 13(4) prohibits sending electronic mail for purposes of direct marketing disguising or concealing the identity of the sender, or without a valid address to enable objection to such communication (European Parliament and Council, 2002). This can be seen as a contradiction in terms, as unsolicited email is already prohibited by Article 13(1), and someone sending legitimate solicited emails (where the addressee has opt-in) would have not the slightest cause to conceal his identification (Cheng, 2004).

The US Can Spam Act reflects the same approach as it prohibits misleading email header information, IP-addresses, or return addresses to perform the opt-out. Also, misleading subject header information is unlawful in the US (Grimes, 2004).

Address harvesting, as mentioned above, is the process of scanning the web for email addresses which is not within the scope of Directive 2002/58/EC. Addresses may be sold by address directories as well, but then the subscriber needs to be informed free of charge of that aim. The use of addresses derived from address harvesting software or by a random combination, is unlawful under the US Can Spam Act (Cheng, 2004).

3.3 Restraints

Despite all these laws in force, why is there no discernible slow down in the amount of spam? Most literature (e.g. Frosch-Wilke, 2001) claims that the scope of applicability of laws is usually limited to the specific country, and originators are usually found outside that country. This makes jurisdiction impossible (Cheng, 2004). Focusing on the country of origin, one can see that 62,3% (Symantec, 2005) of all spam emails claim to be originated in North America, where the Can Spam Act is in force, albeit, as claimed by legal experts and Internet service providers, a total failure (Grimes, 2004). Obviously this is because it does not render spam illegal when originated and sent in accordance with the less strict rules applicable in the initial phase. Other countries are said to have no legislation on spam at all, like some parts of Asia, or are thinking about - in our opinion - the most absurd rules of all. As an example, "..the South Korean government contemplated imposing an outright ban on unsolicited commercial email sent between 9pm and 9am.." (Cheng, 2004).

Furthermore, enactment of laws often can not keep abreast with technological change because of its slow and rigid nature (Whitworth and Whitworth, 2004). Another reason for the failure of laws can be seen in the low penalties compared to the financial benefit. For instance, the maximum fine in a magistrate's court in the UK is £ 5,000. Even if persistent offenders can be fined an unlimited amount of money under certain circumstances, there is no jail term. In the US, offenders face a fine of US $ 250 per mail capped at US $ 6 million (Cheng, 2004).

4. THE TECHNICAL APPROACH

To avert the tidal wave of spam, many techniques are used to filter spam. The need for a technological solution is recognised by the legislator as well. While advising companies to look for appropriate techniques, they also direct attention to other legal boundaries concerning the free flow of information (European Commission, 2004). Several kinds of software are employed, all following the same goal, providing the highest accuracy with the lowest false positive rate. Therefore a discussion of promising filtering technologies will follow showing advantages and disadvantages from a business perspective.

Initial attempts followed filtering techniques based on keywords or summed up scores for spam like characteristics to decide whether a mail was spam or not. While spam is getting more and more sophisticated and changing in appearance, more emphasis is put on adaptive methods (Levitt and Burke, 2004). These can be used either server based or at the desktop level.

The most promising techniques used by anti-spam providers are currently real time approaches, which scrutinise actions on the Internet and use identifiers to block spam mailings proactively in its first minutes of processing. This is referred to by Jennings (2004) as moving up the SMTP (Simple Mail Transfer Protocol) connection. He substantiates that there is more information available during the process of the connection than after the spam mail is received. The disadvantage of such technique is, that it can only be employed as an costly outsource activity which can be amortised only within bigger organisations, still leaving a gap for those SME's who cannot afford such a solution.

A promising attempt was also the Sender authentication which is also known as SenderID (Microsoft and other companies) or SPF (Sender Policy Framework) invented by Pobox. SenderID is an attempt to identify the sender via Email or IP address provided in the email header information. The receiving mail server would ask a DNS (Domain Name Server) for the IP address behind the domain of the email address. The exact IP address of the permitted sending machine would be provided by the DNS for the enquirer. If the header information is forged and the originating IP address is unequal to the information of the DNS, the mails would be rejected (Jennings, 2004). But the sender authentication is under severe critique: In 2004 first the Internet Engineering Task force rejected Microsoft's SenderID as a standard, because Microsoft claimed to make use of patent rights. Later on, AOL expressed doubt on SPF for technological reasons, one of these being that a mobile user, e.g. connecting up from a different ISP in a hotel, would always find his emails rejected because he is not able to send his email from the mail server listed in the DNS (MessageLabs, 2005a).

Blacklists and whitelists can be used to reject or accept emails based on comparison of the email headers sender information, and the list. These lists are usually available on web sites of ISP's or anti-spam software vendors (Jennings, 2004). Blacklists contain the IP addresses or emails of known spammers and are updated within minutes, while whitelists contain information about subscribed legitimate bulk mailers (Garcia et al., 2004). Well maintained blacklists are increasingly valuable, while whitelists bear the hazard of containing hijacked legitimate domains, and therefore cannot identify spam, because it is received from a known legitimate domain (Levitt and Burke, 2004).

A challenge/response (C/R) system is an authentication approach based on a whitelist. If the sender is not on the list, a response is sent with the "challenge", either a website with a "need for human interaction input", or a specific reply to the system. Once it is assured that the sender is a human and not a machine, he will be listed as legitimate for future mails (Grimes, 2004). These systems are also called "challenger spots" (Microsoft) or "automatic whitelisting". Following Jennings (2004) they lack in popularity because it causes too much inconvenience for senders and potential newsletter recipients. Nevertheless, Microsoft is thinking about establishing this technique, and Ferris Research expects AOL to offer it as an additional anti-spam service to its customers. According to Whitworth (Whitworth and Whitworth, 2004), a C/R system is one

step to a technical solution for a fair social interaction environment, which requires a balance of sender and receiver rights. Currently senders have more rights than receivers, which encourages spam.

A typical desktop filter used in several email clients is the bayesian filter. The filtering rules need to be trained and they adapt to the specific settings of the user based on probability. Once it is trained, the bayesian filtering has a very low false positive rate and is very effective. But as spammers add random legitimate words to their emails, the filter gets the more confused, the more legitimate words end up as spam in the filter (Jennings, 2004). Furthermore, transmission costs for the email are still being incurred because the content of the email gets transferred before emails are blocked.

URL analysis, or Call-to-Action analysis, is used to scan the received email for an appeal. To avoid being blocked by bayesian filters, spammers often use very short emails, sometimes just containing a URL. The Call-to-Action analysis scans emails containing URL's, and compares these with a list, similar to a blacklist containing known spammers (Levitt and Burke, 2004). Also, new techniques scan for embedded phone numbers and compare them in the same way against corresponding blacklists (Jennings, 2004). On one hand, content filtering in general has the inherent advantage that spam can be identified on its first occurrence, while on the other hand spammers adapt very fast to these filtering techniques by means circumventing being blocked (Levitt and Burke, 2004).

5. A MULTI-FACETED ANTI-SPAM APPROACH

Our discussion shows that spam and anti-spam measures have an influence on eCommerce effectiveness and profitability. Therefore the spam topic should attract more attention by industry executives.

As demonstrated above, isolated technical or legislative solutions cannot eliminate the huge amount of unsolicited commercial electronic messages. Therefore we propose the following multi-faceted anti-spam approach:

5.1 Public-Private Partnerships in the Fight against Spam and Definition of eCommunication Codes

Governments and business have the same interest in effective electronic communication. While companies are not interested in strong legislative measures against spam because of the inherent risk of criminalising commercial electronic communication or restricting the use of emails for business communication, governments must prevent unfair and socially destructive kinds of electronic messages.

To find a balance between governmental and business interests, a stronger form of cooperation is necessary. A public-private partnership should also include the education of Internet users and companies on how to avoid and reduce spam, making them aware of acceptable marketing practices. For this reason, the definition of an eCommunication industry code seems to be necessary. Beside its educational initiatives it must include penalties against companies which do not behave compliant with the code.

5.2 Revision and stronger International Harmonisation of Legislative Measures against Spam

Since not all legislative measures address sufficiently the spam problem, a review of existing laws and regulations is necessary.

Spam is a global problem and cannot be solved by isolated national legislation. A diversity of different national laws hampers efficient electronic business communication worldwide. Harmonising legislative measures and the definition of effective procedures for cross-border complaints are to be devised.

5.3 Continuous Enhancement of Anti-Spam Technologies and Definitions of Best-Practices Approaches

As spammers can change their tactics for sending spam very quickly, the answer must be continuous enhancement of anti-spam technologies. This keeping in mind, the legislator should not give preference to specific anti-spam technologies. Governments should ensure that legislative measures against spam are technology-neutral.

Complementary to that, business should concentrate on the continuous definition and diffusion of best practices with the aim to educate companies about the economic significance of spam and on how to avoid negative effects. By recommending this as a continuous approach we are aware of the fact that also spammers use continuous approaches to circumvent anti-spam measures.

5.4 Education of Customers

Business should initiate public relation activities to inform customers about the possibilities they have in reducing spam. They should demonstrate how Internet user's behaviour influences the spam problem and finally spammers' economic profit.

Moreover, the eCommerce industry can further improve their image by demonstrating that they do not leave their customers alone with the spam problem.

6. CONCLUSION

In this paper we discussed the spam topic intensively from different perspectives with the main focus of consequences for eCommerce industry. As it is shown, spam is a worldwide problem for effective e-commerce which should receive more attention by industry executives as by governments. Spam causes high financial damages for business. Furthermore spam has made email users less trusting emails and reduces their email use.

Isolated anti-spam measures of national governments or companies cannot solve the spam problem sufficiently. The two main reasons are:

- Legislation is unlikely to provide a significant change in the occurrence of spam. This can be easily recognised when looking at the evolution of spam since laws have been enacted (see Figure 1). Amongst all their weaknesses, one appears to be outstanding: National law is inapplicable if spam is originated outside the legislator's country.
- IT industry is keeping on track with new technologies used by the spammers with promising techniques. But, as spammers get more and more sophisticated in their work it is mostly just a question of time until they defeat the invented filtering techniques. It is a game of cat and mouse which cats cannot be sure to win.

On this account we presented a multi-faceted approach to deal with the spam problem in e-commerce by the definition of four building blocks which need to be applied as a integrated whole:

1) Public-private partnerships in the fight against spam and definition of eCommunication codes
2) Revision and stronger international harmonisation of legislative measures against spam
3) Continuous enhancements of anti-spam technologies and definitions of best-practices approaches
4) Education of customers

This approach might not represent a final solution to the spam problem. But it is an important milestone on the way to reduce the risk that spam poses to organizations productivity and resources.

REFERENCES

Butler, M., 2003, Spam - the meat of the problem. *Computer Law & Security Report*. 19 (5). pp. 388-391.

Cheng, T.S.L. 2004, Recent international attempts to can spam. *Computer Law & Security Report*. 20 (6). pp. 472-479.

Cournane, A. and Hunt, R, 2004, An analysis of the tools used for the generation and prevention of spam. *Computers & Security*. 23 (2). pp. 154-166

European Commission - Commission of the European Communities, 2004, *Communication on unsolicited commercial communications or "spam"*. Available from: <http://europa.eu.int/information_society/topics/ecomm/useful_information/library/communic_reports/index_en.htm>.

European Union, European Parliament and Council, 2002, *Directive 2002/58/EC of the European Parliament and of the Council of 12 July 2002 concerning the processing of personal data and the protection of privacy in the electronic communications sector (Directive on privacy and electronic communications)*. Available from: http://europa.eu.int/eur-lex/pri/en/oj/dat/2002/l_201/l_20120020731en00370047.pdf

Frosch-Wilke, D., 2001, Are E-Privacy and E-Commerce a Contradiction in Terms ? - An Economic Examination. *Proceedings of the 4th Annual Informing Science Conference*, Krakow, Poland, pp 191-197.

Garcia, F.D., Hoepman, J.-H. and Nieuwenhuizen, J.v.,2004, *Spam Filter Analysis*. Available from: <http://arxiv.org/PS_cache/cs/pdf/0402/0402046.pdf>

Grimes, G.A., 2004, Issues with spam. *Computer Fraud & Security*. Vol.5. pp. 12-16

Jennings, R., 2004, *New Trends in Spam*. Ferris Research. (463)

Levitt, M. and Burke, B.E., 2004, *Choosing the Best. Technology to Fight Spam*. [Whitepaper] Available from: <http://www.commtouch.com/documents/040429_IDC_Choosing%20_the%20_Best%20_AS_Technology.pdf>

Lueg, C., 2003, "Sie haben schon wieder Post": Spam als Forschungsgebiet der Wirtschaftsinformatik. *Proceedings of the Sixth International Conference on Wirtschaftsinformatik___.* Available from: <http://wwilc.wiwi.tu-dresden.de/wi2003/vk/viewtopic.php?t=45>

Lugaresi, N., 2004, European Union vs. Spam: A Legal Response. *Proceedings of the First Conference on Email and Anti-Spam. Mountain View* Available from: <http://www.ceas.cc/papers-2004/papersbytopic.htm>

MessageLabs, 2005a, *MessageLabs Intelligence Annual Report 2004*. [Report] Available from: <http://www.messagelabs.com/binaries/LAB480_endofyear_UK_v3.pdf>

MessageLabs, 2005b, *Average global ratio of spam in email scanned by MessageLabs*. [Graph] Available from: < http://www.messagelabs.com/emailthreats/graphdownloads/spam_UK.pdf >

Nucleus Research, 2004, *Spam: The Serial ROI Killer*. Available from: <http://www.nucleusresearch.com/press_releases/prspam2.html>

NTRS – National Technology Readiness Survey, 2004,. Available from: http://www.rhsmith.umd.edu/ntrs/

Symantec (2005), *Personal communication regarding statistics relating to Spam.*

Whitworth, B., Whitworth, E., 2004, Spam and the Social-Technical Gap. *IEEE Computer*. 37(10). pp. 38-45

www.cauce.com (No date) *Spam: about the problem*. Available from: <http://www.cauce.org/about/problem.shtml>

www.spamhaus.org (No Date) *The Spamhaus Project*. Available from: <www.spamhaus.org> [22. January 2005]

PERSONALIZATION OF USER INTERFACES IN E-COMMERCE AND M-COMMERCE APPLICATIONS

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ABSTRACT

E-commerce and m-commerce consist of transactions conducted over (wired or wireless) computer networks, either by users purchasing goods, information and services, or directly between organizations. Given the existing limitations and enhancements on the mobile Internet, the preferences of users are noticeably affected. Among other factors, context-sensitivity of mobile devices emphasizes the importance of personalization technology. Personalization involves software that learns behaviors, inclinations, and patterns. It is an important step in the direction of alleviating information overload, creating a friendlier environment for each individual user and thus establishing trustworthy relationships between organizations and users. In our work we focus on the customization factor of e-/m-commerce interfaces and we outline how the main interface design choices (related to content, presentation, community and commerce), can be personalized.

KEYWORDS

Personalization, m-commerce, e-commerce, user interfaces, context-awareness, customization.

1. INTRODUCTION

Electronic commerce (e-commerce) and mobile commerce (m-commerce) consist of transactions conducted over wireless or wired computer networks, either by users purchasing goods, information and services, or directly between organizations. Today's computers are satisfactorily powerful to support the multipart software that drives e-commerce, and communication networks are now fast enough to send/receive the large volumes of the required information between communicating computers in almost real time conditions [Davis and Benamati, 2003].

In m-commerce environments however, things are different: First, m-commerce is not just e-commerce using cell phones. There is no doubt that both e- and m-commerce are network-enabled and computer-assisted activities. Moreover, both of them are for the most part technologically driven trends which rely on Internet and Web technologies. Consequently, each of them shares features of the other. But there are also distinctive qualities that are capable to define their diverse status and functionality. E-commerce is mostly about supporting and realizing transactions, while nowadays m-commerce focuses on the facilitation of enhanced information network access [Stafford and Gillenson, 2003]. Second, there are seriously dissimilar underlying infrastructure components. Typical m-commerce client devices such as mobile phones or personal digital assistants (PDAs), are certainly provide limited capabilities compared to e-commerce clients.

These constraints elevate the importance of complementary technologies. Among them, personalization technology holds a key role. Personalization is the use of information about a particular user, to provide tailored user experiences for that user. In Web environments, personalization involves automatic customization of browser-type interfaces to accommodate individual users' needs, interests, knowledge, tasks, or goals [Alpert et al., 2003]. User interfaces in e-commerce and m-commerce applications need primarily to be efficiently and properly accessible for each individual. In our work we study e-commerce and m-commerce interfaces and we outline how the main interface design choices (related to content, presentation, community and commerce), can be personalized.

2. WIRED INTERNET AND E-COMMERCE

E-commerce applications are rapidly expanded. One reason was the development of new networks, protocols, software, and specifications. The Internet (mostly the World Wide Web) created a new, inexpensive, public infrastructure that quickly replaced the private, proprietary networks used by early inter-organizational applications. The other reason was the increase in competition and other business pressures [Turban et al., 2002]. Thus, defining e-commerce as simply buying/obtaining and selling/offering services, information and products on the Internet and the Web, is not giving the right dimensions of the whole situation. The real potential of e-commerce is improved efficiency, not revenue generation [Davis and Benamati, 2003].

E-commerce applications are continually developing and evolving as people identify new uses for increasingly complex and flexible networks of computerized organizational systems. In general, e-commerce applications tend to have the following characteristics [Carter, 2002]:

- They cross organizational boundaries (both within an organization and even with other organizations).
- They involve multiple distinct groups of users (each with their own distinct sets of requirements).
- They adapt to changes (both within the competitive marketplace and in technology in general).
- They include information from external sources (which may be freely obtainable, may be rewarded, may be bought or may require special efforts to obtain).
- They recognize information as a commodity (to which value can be added and from which value can be extracted).

As e-commerce matures and its tools and applications improve, greater attention is given to its use to improve the quality of services. Sophisticated business computing applications (e.g. customer relationship management systems, supply chain management systems or enterprise-wide computing systems), are actually build as complementary software engineering technologies upon the core of e-commerce, and are capable to provide new ways of transacting business. Among the several dimensions of e-commerce technology [Laudon and Traver, 2004], we underline the following, because these features are related to m-commerce issues discussed in the next paragraphs:

- *Ubiquity* – e-commerce is available just about everywhere, at all times. A direct consequence is e-commerce '**global reach**' characteristic, regarding the total number of users an e-commerce business can obtain.
- *Universal standards* – the technical standards for conducting e-commerce are shared by all nations around the world.
- *Information richness and density* – Web can deliver complex (with text, video and audio) messages and can increase the accuracy, currency and timeliness of information (thus prices, costs and user preferences become transparent).
- *Interactivity* – technology that allows for online, two-way communications between organizations and users.
- *Personalization/Customization* – technologies that permit changes on delivered information, service or product, based on a user's preferences or prior behavior.

3. MOBILE INTERNET AND M-COMMERCE

3.1 Mobile Internet

Traditionally separate technologies of the Internet and mobile telephony have now started to converge, bringing promises of a new era of portable networking. Keys to this convergence are sophisticated wireless data services providing mobile access to the Internet. Mobile Internet (or the Internet "in your pocket") has many potential applications, including email, games, shopping, banking and real-time news [Barnes and Huff, 2003]. Mobile Internet is emerging even faster than e-commerce, in part because providers, content partners, customers, and investors are leveraging lessons from wired Internet. So, *universal standards* characteristic is an uncontested topic in mobile Internet environments, a goal in which all participating parts are dedicated.

Mobile devices are opening up new design challenges, new conveniences for users, and new business opportunities. As new technology becomes mainstream, designs and business models that work for the target user population are a critical success factor. Mobile Internet limited computing and communicating platforms, challenge application developers to reinvent design methods and principles. The physical capabilities of the different devices are varied: screens of different aspect ratios and sizes; soft buttons (one, two or three); a menu button (or none); one font size (or several); directional buttons (four-way, two-way, or none) [Holtzblatt, 2005].

On the other hand, mobile devices may be used from a variety of locations and places [Deitel et al., 2002]. *Ubiquity* and *global reach* characteristics are emphasized in mobile Internet environments. Hence, mobile new platforms create the possibility for new applications to support and enhance user lives. Because of their mobility, many researchers ([Chae and Kim, 2003], [Lee and Benbasat, 2004], [Pascoe et al., 2000]) underline two facts: First, mobile Internet users have limited attention as they operate their mobile devices. This is because mobile users usually are involved at the same time in other tasks (e.g. car driving). Second, they emphasize the fact that mobile users treat their mobile devices in a quite personal way.

3.2 Mobile Commerce

Cellular carriers have made significant advances to enable next generation data (or wireless Web services) and m-commerce. Broadly defined, m-commerce involves an emerging set of applications and services people can access from their Web enabled mobile devices [Venkatesh et al., 2003].

According to the level of perceived risk during an electronic transaction, m-commerce users always favor to acquire low-risk more willingly than high-risk products or services [Chae and Kim, 2003]. The main reason is that there is no need for extra information when someone orders a simple product. This leads to minimal search cost for users. On the other hand, when acquiring high-risk products, the requirements of essential related information (for comparing prices, characteristics etc.) are bigger [Bhatnagar et al., 2000]. In many cases limited capabilities of mobile devices lead to restrictions on all previously referred necessities. In addition, the usual limited user concentration during mobile devices operations increases the "uncertainty" associated with most high-risk products/services.

Besides, m-commerce users prefer low-intensity content (e.g. ring tones, weather reports and screen icons). This is not only because of the limitations of mobile computing platforms. Users demand further individually customized content on the mobile Internet because its personalization level is higher than that of the wired Internet [Chae and Kim, 2003]. That makes the *personalization/customization* characteristic more significant in m-commerce area than in e-commerce.

4. PERSONALIZATION AND USER INTERFACES

4.1 Personalization Issues

Web users have vastly different needs and their skills and cognitive abilities are also vary widely. As a result, one-size does not fit all its users on the Web, either wireless or wired. Personalization is a particular e-commerce and m-commerce technology which aims to tailor Web-based applications to provide the users what they want and how they want it, instead of providing the same content in the same style to all diverse range of users [Murugesan and Ramanathan, 2001]. It is a large area, also covering recommendation systems, customization, and adaptive Web sites [Cingil et al., 2000], [Mulvenna et al., 2000].

Personalization comprises a variety of functions ranging from simple user recognition to more advanced functionalities such as performing certain tasks on behalf of the user. These functionalities are offered according to a personalization policy that specifies the manner in which personalization benefits will be delivered to the final user [Pierrakos et al., 2003]. Key features of Web-based applications which influence their effectiveness in providing expected services to users are: the content provided and its "sense" or "look and feel". The structure itself of the entire Web site is an additional important aspect [Mulvenna et al., 2000]. It is defined by the layout of the individual pages and the existence of links between them. In the following paragraphs we will examine these issues in more detail.

4.2 Personalization Tasks and Approaches

In last years, we have experienced considerable development in sites that can personalize content delivered to individual users. Using rich profile information, they are capable to provide valuable services. **Data collection** is considered as the backbone task of personalization, because customization will be based on the collected data, either explicitly or implicitly.

In *explicit user profiling*, users know what information they provide about themselves. Explicit methods include Web forms, surveys, interview, and users' rating on certain services. On the other side, *implicit* methods for *user profiling* include click-stream analysis, cookies, Web log data and Web site stay time [Murugesan and Ramanathan, 2001]. Third-party legacy data sources, such as demographic data and previous purchases data of people, are also used besides to the information collected or inferred from the users.

Data analysis is the main task of personalization. Using a variety of methods, the goal is to infer user needs and preferences. The most influential data analysis approaches regarding personalization are [Chiu, 2001], [Pierrakos et al., 2003], [Murugesan and Ramanathan, 2001]:

1. *Rule-based filtering* is based on a domain-specific rule-base. User's action triggers the rules that their conditions meet. Typically, static user models are obtained through a user registration procedure and a number of rules are specified manually concerning the Web content that is provided to users with different models. The disadvantage of this approach is that rule engines do not handle dynamic data or they can not be made flexible to fit into the future use.

2. *Content-based filtering* is done by grouping all the contents of a Web site/application into categories and then matching the users' interest against these categories. It offers tailored contents of Web, by applying machine learning methods to Web content, in order to discover the personal preferences of a user. Predictions of this approach are the best when the content can be easily categorized and when the users' interest is without difficulty matched against these categories.

3. *Collaborative filtering* aims to provide personalization functionality without requiring the analysis of the actual content. Personalization is achieved by searching for common features in the preferences of different users. Collaborative filtering works by building a database of preferences for items by users. Each new user is matched against the database to discover "neighbors", which are other users who have historically had similar taste to him [Sarwar et al., 2001].

4.3 User Interfaces for E-Commerce and M-Commerce

User interfaces in e-commerce and m-commerce applications focus on the elements provided on Web pages in order to support navigation and information acquirement. To take advantage of the full potential of Internet, Web interfaces and Web applications, either wired or wireless, have to be customized to suit an individual user or a group of users [Murugesan and Ramanathan, 2001]. The importance of interface design has been commonly acknowledged, especially regarding mobile devices adoption: interfaces characteristics had been identified as one of the two broad factors (along with network capabilities), affecting the implementation and acceptance of mobile phones emerged [Sarker & Wells, 2003]. Devices adoption is considered as a critical aspect for the future of m-commerce, because without widespread proliferation of mobile devices, m-commerce can not fulfill its potential.

5. DESIGNING PERSONALIZED USER INTERFACES IN E-COMMERCE AND M-COMMERCE APPLICATIONS

5.1 The 7C Framework

In [Rayport and Jaworski, 2004], a detailed framework is presented for e-commerce customer interfaces (the 7C framework). It studies the design of e-commerce user interfaces, based on certain factors. This paper focuses on *Customization, Content, Context* (meaning presentation), *Community* and *Commerce* factors. Future extension of our work will include the remaining factors of the 7C framework:

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- *Connection* refers to the degree of formal linkage from the site to other sites. Different kinds of connections are:
  - o *Outside links* - Links that open in the same browser window but users need to leave the source site and to enter into another one.
  - o *Framed links* – The same browser window is also used (like the outside links). The difference is that the new site is exactly framed in some way by the source site.
  - o *Pop-up windows* – Links that open up the new site in another browse window while the original site stays in the background.
  - o *Outsourced content* – Users do not leave the source site in order to view the content.

Based on the type of connections they feature, sites can be classified as destinations, portals or hubs (combining self-generated content and selective links to related sites). Given the importance of the interoperable distributed systems and the constant dissemination of Web service-oriented approaches, we believe that the connection factor is a well-promising personalization factor.

- *Communication* focuses on the type of dialogues (interactivity) between sites and their users. *Interactivity* characteristic of e-commerce technology is amplified in m-commerce, because after all mobile phones are devices constructed principally for online communication and interaction. For that reason, customized communication is expected to attract researchers' attention in the near future, both for wired and wireless Internet.

5.2 Personalization Aspects for E-Commerce and M-Commerce User Interfaces

We are concerned mainly for customizing e-commerce and m-commerce interfaces. We believe that personalization demands a more holistic approach: it is not just a simple factor among the others. We use personalization as the crucial perspective for analyzing the interface's influence on application effectiveness. Two higher-order design principles are particularly helpful in understanding how to combine successfully the 5Cs. Fit (or consistency) refers to how well each of the 5Cs individually supports the organization's model. Complementarity (or reinforcement) refers to the degree of consistency between each of the 5Cs.

Regarding m-commerce, standardized directions for interfaces' design, have not been established so far. But several research studies ([Chae and Kim, 2003], [Elliot and Phillips, 2004]) acknowledge that the design rules of wired Internet interfaces should not be directly adopted in m-commerce area, because of the considerably different user requirements and device constraints. Thus, we have to identify what does not apply to m-commerce of the existing e-commerce practices. Significant influences of mobile Internet environment to the 7C framework can be found in [Lee and Benbasat, 2004], and they are also taken into consideration in our work. Let us reconsider the main factors (content, presentation, community and commerce) of the 7C framework from a customization viewpoint:

- **Customized Content:** Content includes all digital information, including video, images, audio and text, and according to 7C framework, the following approaches can be used to evaluate it:
  - o *Multimedia Mix* is the designer's choice of how to combine the multimedia components.
  - o *Offering Mix* refers to the importance given to each type of content: product, information and services.
  - o *Timeliness Mix* refers to the designer's preference of time-sensitive material.
  - o *Appeal Mix* refers to the organization's promotional message (cognitive or emotional).

A site provides customized content when it uses a recommendation engine to adapt to each user's profile and to vary it's *offering mix* (of products, information and services), or any of the previously referred content approaches. It must be noticed that in both cognitive and emotional appeals, personalization factor is critical: cognitive appeals focus on functional factors (such as low price, availability, reliability, customer support, etc.) and the degree of personalization is considered as one important functional factor; emotional appeals focus differently (using e.g. humor, novelties or stories) on personal ties to the product or brand [Rayport and Jaworski, 2004].

In m-commerce interfaces, one of the greatest challenges is the absolute lack of screen space. M-commerce interfaces can not present the same amount of content as the e-commerce ones, because of the device constraints or because it costs too much. However, mobile devices may offer task-relevant information and services. They are capable to detect the user's setting (such as location and resources nearby)

and consequently to offer this information to the application in order to adapt the interface. This capability, namely context-awareness, and especially its dimension of proactive context-aware retrieval (e.g. detecting user's location and providing maps relevant to it) may have noteworthy impact in building mostly the content (but not only that) of a personalized m-commerce interface. Personalization can be seen as a filtering mechanism which allows the delivery of low-intensity and low-risk content that mobile Internet users appreciate.

- **Customized Presentation:** Presentation can be evaluated by both usability and aesthetics criteria.
  - o *Usability*: A well-designed interface is capable of organizing massive amount of information into sets of pages and helps users navigate naturally among topics. Relative design and performance elements of great importance can be categorized as navigation tools, section breakdown, linking structure, reliability, speed, media accessibility and platform independence.
  - o *Aesthetics:* Visual (graphics, colors, fonts, etc.) and audio (sounds, melodies, etc.) designer's choices are responsible for the atmosphere that interfaces create.

The aesthetic nature of interfaces is an obvious personalization parameter. But also usability design and performance elements can be customized for more personalized interfaces. Very popular among Web site designers are presentation enrichment tools, able to create multimedia effects such as video, animation, audio and images [Lee and Benbasat, 2003]. The effectiveness of these interface enhancements is, however, open to discussion, especially in the mobile environment.

Visual and audio characteristics of low-intensity content (such as color schemes, screen icons, ring melodies etc.) have been proved for mobile users as a favorite way of making their phones more personal. But, frequently users are disappointed by the performance of Internet applications over wireless links [Hung et al., 2003]. Probable causes for this situation include unreliable connections, high costs, slow speeds, burdensome applications and awkward interfaces [Schultz, 2001]. This discussion also stands for the *multimedia mix* approach of customized content. Fulfilling multimedia requirements is not as simple as it seems. An effective multimedia personalization technique is considered the dynamic adaptation of the media quality to the level admitted by the network and user's mobile device [Georgiadis et al., 2005].

- **Customized Community:** Community builds a sense of membership through shared common interests. The following aspects of communities, according to 7C framework, can be used to evaluate its importance:
  - o *Motivation* – Community members have in general different reasons for joining online communities. Sometimes the motivation is specific, e.g. joining an auction site. On several occasions, users just want to lightly socialize with others. Also, several times, users are seeking emotional support by joining such groups.
  - o *Benefits* – Participants frequently receive emotional (and not only) benefits such as inclusion in plans and activities, mutual influence, better prices (sites with demand-sensitive pricing policies), need fulfillment, and shared information and experiences [Adler and Christopher, 1999].
  - o *Level of Participation* – Members can be classified as passives (those who just attend a community), actives (those who take part in conversations), motivators (those who plan activities, initiate conversations and set conversation topics), and caretakers (those who act as intermediaries between members).
  - o *Interaction Tools* - The development of the community is greatly influenced by community's decision whether to use interactive or non-interactive communication.
  - o *Characteristics* – The more advanced the community, the more likely it is to have features such as effectiveness (the group has an impact on members' lives), language (members develop specialized abbreviations that have a unique meaning within the community), consistency (individuals feel a sense of belonging), help (members feel comfortable asking for help from other members), self-regulation (community develops a system for policing itself and sets rules for its communication) and relationships (interaction between individuals leads to friendships) [Adler and Christopher, 1999].

Supporting communities is an advantageous personalization mechanism. Mature communities will generally include members at all levels, with different motivations and with various characteristics. Interface assistance that facilitates the creation of customized communities and the interaction among users in a similar wired setting surely will be appreciated by certain users and it will increase their satisfaction. Furthermore, in m-commerce environments the context-sensitive nature of mobile devices may support personalized interfaces that improve the perception of quality of the interaction tools, the level of participation, the benefits, the consistency and almost all of the previously mentioned aspects of communities.

- **Customized Commerce:** Commerce features can be characterized e-commerce functional tools such as shopping cart, credit card approval, one-click shopping, orders through affiliates, registration, security (encryption and authentication technologies), order tracking, delivery options and configuration technology (helping users to line up products and services together in a variety of ways, which allows for analysis of performance/price tradeoffs and interoperability among complex components within a system [Rayport and Jaworski, 2004].

Customized commerce features depend on security issues related to the **data collection** personalization task. *Explicit profiling* is considered a tough task because users should have to be convinced to provide the required information about themselves and that their privacy would be protected [Murugesan and Ramanathan, 2001]. Furthermore, users should always be aware of the way in which personal information is being collected and used [Pierrakos et al., 2003]. Hence, when implicit profiling methods are used, though the users are not aware of the data collection, they should be properly told about what, how and why this information is obtained and used. Another example of security-oriented considerations related to customized commerce features is the promotion (to each individual user, if possible) of the most suitable for him method to use any of the existing electronic cash systems and the approaches to model check their atomicity properties (money atomicity, goods atomicity and certified delivery) in the presence of potential site or communication failures and all possible unilateral transaction abort cases [Katsaros et al., 2005].

In m-commerce environments, all these features must be designed taking additionally into account not only the different conditions of mobile Internet, but also the preferences of mobile users for low-intensity content and low-risk transactions. Also, given the distracting user setting in mobile Internet, the interface should call for only minimal attention in order to complete successfully critical transaction steps (such as the checkout process or the choice of the payment method).

6. CONCLUSIONS – FUTURE WORK

The mobile Internet has exclusive strong points over the wired Internet: users can access the Internet content wherever and whenever they want; mobile devices are used, which are context-sensitive to users' environment. But there are also certain disadvantages: low-resources of devices and mobile setting's distracting environment. Another aspect is related to the more personal characteristics of the mobile Internet: users prefer to access more personalized services when are involved in mobile operations.

According to our analysis, all previous considerations argue for the importance of personalization technology both in e-commerce and m-commerce systems. Especially the user interface design process should be considered as a privileged application sector of personalization technology. Based on the 7C framework, a well-accepted set of design guidelines for customers' interfaces, we analyze the implications of personalization mechanisms on it, in order to achieve effective and convenient user interfaces in e-commerce and m-commerce applications.

Future work includes analyzing the influences of security issues on designing personalized user interfaces. Additionally, we plan to focus more on issues concerning advanced filtering mechanisms for m-commerce user interfaces.

REFERENCES

Adler, R. and Christopher, A., 1999. Virtual Communities. In L. Muscarella et al. (eds.) *Net Success,* Adams Media Corporation, Holbrook, USA.

Alpert, S.R. et al., 2003. User Attitudes Regarding a User-Adaptive eCommece Web Site. *In User Modeling and User-Adapted Interaction (Kluwer Academic)*, 13: pp. 373-396.

Barnes, S. J. and Huff, S. L. 2003. Rising Sun: Imode and the Wireless Internet. *In Communications of the ACM*, Vol. 46, No. 11, pp. 79–84.

Bhatnagar, A. et al., 2000. On Risk Convenience, and Internet Shopping Behaviour. *In Communications of the ACM*, Vol. 43, No. 11, pp. 98–105.

Carter, J., 2002. *Developing E-commerce Systems*. Prentice Hall, Pearson Education Inc., New Jersey, USA.

Chae, M. and Kim, J., 2003. What's so Different about the Mobile Internet? *In Communications of the ACM*, Vol. 46, No.12ve, pp.240-247.

Chiu, W., 2001. Web site personalization. *Websphere Documentation (IBM white paper)*, http://www.ibm.com.

Cingil, I. et al., 2000. A Broader Approach to Personalization. *In Communications of the ACM*, Vol. 43, No.8, pp. 136-141.

Davis, W. and Benamati, J., 2003. *E-commerce Basics: Technology Foundations & E-business Applications.* Pearson Addison-Wesley, USA.

Deitel, M.H. et al., 2002. *Wireless Internet and Mobile Business.* Prentice-Hall, Pearson Education Inc., New jersey, USA.

Elliot, G. and Phillips, N., 2004. *Mobile Commerce and Wireless Computing Systems.* Pearson Addison-Wesley, Essex, England.

Georgiadis, C.K. and Manitsaris, A., 2005. Personalization in Mobile Commerce Environments: Multimedia Challenges. *In Cutter Information Technology Journal,* Vol. 18, No. 8, pp.36-43.

Holtzblat, K., 2005. Designing for the Mobile Device: Experiences, Challenges, and Methods. *In Communications of the ACM*, Vol. 48, No.7, pp. 33-35.

Hung, S. Y., et al., 2003. Critical Factors of WAP Services Adoption: an Empirical Study. *In Electronic Commerce Research and Applications* 2, Elsevier Science, pp. 42–60.

Katsaros, P., et al., 2005. Colored Petri Net Based Model Checking and Failure Analysis for E-commerce Protocols. *In Proceedings of the Sixth Workshop and Tutorial on Practical Use of Coloured Petri Nets and the CPN Tools (CPN'05)*, DAIMI PB-576, Dept. of Computer Science, University of Aarhus, Denmark, pp. 267-283.

Laudon, K.C. and Traver, C.G., 2004. *E-commerce: Business, Technology, Society (2nd ed.).* Pearson Addison-Wesley, Boston, USA.

Lee, W., and Benbasat, I., 2003. Designing an Electronic Commerce Interface: Attention and Product Memory as Elicited by Web Design. *In Electronic Commerce Research and Applications* 2, Elsevier Science, pp. 240–253.

Lee, Y.E. and Benbasat, I., 2004. A Framework for the Study of Customer Interface Design for Mobile Commerce. *In International Journal of Electronic Commerce* (1086-4415/2004), Vol. 8, No. 3, pp. 79–102.

Mobasher, B. et al., 2000. Integrating Web Usage and Content Mining for More Effective Personalization. *Proceedings of the International Conference on E-Commerce and Web Technologies (ECWeb 2000),* Greenwich, UK, pp.165-176.

Mulvenna, D.M. et al., 2000. Personalization on the Net using Web Mining. *In Communications of the ACM*, Vol. 43. No.8, pp. 123-125.

Murugesan, S. and Ramanathan, A., 2001. Web Personalization – An Overview. In J. Liu et al. (eds.): AMT 2001, *Active Media Technology: 6th International Computer Science Conference*, LNCS 2252, Springer-Verlag Berlin Heidelberg, Germany, pp. 65-76.

Pascoe, J. et al., 2000. Using while Moving: HCI Issues in Fieldwork Environment. *In ACM Transactions on Computer-Human Interaction*, Vol. 7, Iss. 3, pp. 417–437.

Pierrakos, D. et al., 2003. Web Usage Mining as a Tool for Personalization: A Survey. *In User Modeling and User-Adapted Interaction (Kluwer Academic),* 13: pp. 311-372.

Rayport, J. and Jaworski, B., 2004. *Introduction to E-Commerce (2nd ed.).* McGraw-Hill Publishers, New York, USA.

Sarker, S. and Wells, J.D., 2003. Understanding Mobile Handheld Device Use and Adoption. *In Communications of the ACM*, Vol. 46, No.12, pp. 35-40.

Sarwar, B.M. et al., 2001. Item-based Collaborative Filtering Recommendation Algorithms. *ACM Proceedings of the 10th International World Wide Web Conference (WWW10)*, Hong Kong, pp. 285--295.

Schultz, B., 2001. The M-commerce Fallacy, *In Network World* 18 (9), pp. 77–82.

Stafford, F.T. and Gillenson, L.M., 2003. Mobile Commerce: What Is and What It Could Be. *In Communications of the ACM*, Vol.46, No.12, pp. 33-34.

Turban, E., et al., 2002. *Electronic Commerce. A Managerial Perspective (2nd ed.).* Pearson Addison-Wesley, New Jersey, USA.

Venkatesh, V. et al., 2003. Understanding Usability in Mobile Commerce. *In Communications of the ACM*, Vol.46, No.12, pp. 53-56.

RESHAPING THE FRAMEWORK FOR ANALYSING SUCCESS OF MOBILE PAYMENT SOLUTIONS

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ABSTRACT

Despite the potential and expectations, mobile payments have not reached expected adoption levels. Establishing success factors in m-payments has become an important research goal. Traditional acceptance models focus on characteristics of new technologies (innovations) that the user perceives. According to Damsgaard and Gao (2004), what is missing in the traditional models is the discussion of infrastructure traits of an innovation. A qualitative study has been used to measure the validity of these assumptions in the mobile payments field. Experts that represented key stakeholders were asked to draw from their experience and explain reasons for the lack of success of m-payments. Based on the study, this paper proposes a holistic framework for analysing m-payment success factors.

KEYWORDS

mobile payments, mobile commerce, acceptance models, success factors

1. INTRODUCTION

Mobile payments (or m-payments) are payments for goods and services in which at least one part of the transaction is conducted using a mobile device (such as a mobile phone, smartphone, or Personal Digital Assistant) and wireless technologies (such as mobile telecommunications networks, or proximity technologies). Examples of mobile payments include payment for digital content (e.g. ring tones, logos, news, or music), concert or flight tickets, parking fees, and taxi fares; payments for physical goods are possible as well, both at vending machines, and manned Point-of-Sale terminals. Mobile payment is seen as an important building block of mobile commerce – for any m-commerce transaction there must be a way to pay.

Over the past years, there have been numerous reports predicting huge growth of mobile payments as there is an enormous potential with 1.7 billion of mobile phone users in the world (mForma, 2005). Arthur D Little's report predicts the volume of m-payment transactions to be worth $37.1 billion in 2008 (Armitt, 2004). Mobile phones possess a number of features that could make them an ideal payment device: they are small, personal, familiar, and with their own display, input, and various connectivity options. Most importantly, many people never leave home without them.

Despite the potential and expectations, the uptake so far has been disappointing. Mobile payments have not reached the expected adoption levels. There is still much work needed before mobile payments become truly successful worldwide, and widely adapted by consumers. Establishing success factors therefore is an important research goal and underpins the work of the authors.

The significance of such research that aims to improve success of mobile payments is evident. According to Smart Card Alliance (2005), a mobile payment application could attract new customers for mobile operators, reduce customer turnover, and add revenues from data services related to payment. Financial service providers could offer new, differentiated payment services to their customers and increase their credit and debit card transaction volume. Merchants can benefit from faster transactions and improved customer convenience. Customers would gain a new, better way to pay.

2. THEORETICAL FRAMEWORK

Traditionally, in literature, acceptance models have been used to explain adoption of information systems. Numerous acceptance models have been utilized and validated on many occasions. Adoption literature reveals that the models used include Rogers's (1995) Diffusion of Innovation (DoI), Moore & Benbasat's (1991) Perceived Characteristics of Innovating (PCI), and a number of behavioural models: Fishbein & Ajzen's (1975) Theory of Reasoned Action (TRA) , Technology Acceptance Model (TAM) by Davis (1989), and Theory of Planned Behaviour (TPB) proposed by Ajzen (1991).

Researchers have also developed hybrid models that have unified existing acceptance theories to draw from their best features: Decomposed Theory of Planned Behaviour (TPB), and Unified Theory of Acceptance and Use of Technology (UTAUT) by Venkatesh et al. (2003). A more detailed explanation of these models is beyond the scope of this paper, however an excellent overview of such models and their suitability to mobile payments is provided by Mallat (2004).

A common feature of the abovementioned models is their focus on characteristics of new technologies (innovations) that the user perceives. Such models propose specific factors, for example ease of use, usefulness, or compatibility that a new technology must have to become widely adopted by users. Some of these models also take into account the effect of characteristics of the user - such as gender, age, or experience with similar systems.

Damsgaard & Gao (2004) however argue that in more complex, networked technology, these models do not provide enough explanatory power. In their study of mobile telecommunications market, the authors observe that the presence of desired adoption characteristics in the service is not enough to explain successful diffusion of innovations.

According to their theory, what is missing in the traditional models is the discussion of infrastructure traits of an innovation. The existing acceptance models focus on end-users only, but not on other key players. Infrastructural features of new technology are not taken into account in traditional models. The authors of this theory argue that apart from traditional user acceptance studies, researchers also need to focus on such issues as roles of other stakeholders in promoting innovation, social network around the technology, business models, role of institutions such as legislative and regulatory bodies, or effects of network economics (the value of new technology increases with the number of adopters).

This study attempts to evaluate this proposition to the mobile payments field. There have been some studies on mobile payments using traditional acceptance models, such as TAM or UTAUT (including the authors' research). If the innovation diffusion framework proposed by Damsgaard & Gao (2004) is shown to apply to mobile payments field, this does not suggest that the traditional acceptance models should not be studied and applied to mobile payments. Customer-centric adoption studies are still a valuable and necessary analysis tool. This would rather suggest that researchers need to be aware that the very useful acceptance model studies provide just partial explanation of mobile payments success or the lack of it, and there is also a need (possibly in combined studies) to focus on infrastructure innovation theories.

It seems that in the mobile payments context, this additional dimension, proposed by Damsgaard & Gao (2004) for mobile telecommunications services, can prove to be valid as well. The traditional models were better suited to organizational context where an innovation was introduced by management, and the adoption by individual employees was measured. Mobile payments in their everyday life domain are different. They are more complex than new IS in organizations, as key players include mobile operators, banks, and third-party providers, who do not necessarily work together. There are more regulatory and legal issues that need to be taken into account. There is a huge diversity of mobile devices, which indicates the importance of standards. Network effects may have an important role in mobile payments, as the more customers use the system, the more merchants adopt it; this in turn provides more value to each user.

An empirical study has been used to measure the validity of these assumptions. Forty-six (46) experts that represented various key stakeholders were asked to draw from their experience and explain reasons for the lack of success of mobile payments. This paper reveals whether the issues discussed by the experts indeed cover not only the characteristics of mobile payments systems that affect individual users' adoption, but also the infrastructure traits necessary for success. Furthermore, the study outlines which factors specifically matter in mobile payments success, from both perspectives. Section Three describes the research methodology and section Four provides an analysis of the results. Section Five presents the proposed holistic

model for m-payment success factors studies while section six provides a conclusion and points the way to further research.

3. RESEARCH METHODOLOGY

The study draws on the expertise of people involved in mobile payments projects. Selected people were invited to provide their opinions in a qualitative web-based survey. The survey consisted of three open-ended questions that focused on discovering the barriers to success of mobile payments, and the most critical issues that need to be tackled so that full potential of mobile payments can be realized.

This research was based on stratified purposive sampling, which means that cases were selected from previously identified subgroups (Gorman & Clayton, 2005). Unlike in quantitative studies, this sampling does not need to be statistically representative, since it is not going to be used to generalize to the large population. This technique not only makes it possible to gather a variety of perspectives on the research problem, but it also enhances credibility of the data that can be confirmed by several sources. Purposive sampling aims to create rich, in-depth information (Liamputtong, 2005).

The following groups of people were targeted. Researchers were seen as an important source of knowledge as their work requires familiarity with all the developments in the field. To identify the m-payment researchers, extensive review of literature was conducted, focusing on the most relevant conferences, including Mobility Roundtable, MOBIS, and International Conferences on Mobile Business. Access to other references was gained by using IEEE Explore, Proquest, and other academic databases. The most relevant journals included International Journal of Mobile Communications, and Mobile Information Systems. The selection criterion for researchers was the minimum of two peer reviewed publications regarding mobile payments.

Finally, a number of practitioners were approached to shed more light on the problem area. This group of participants consisted of representatives from companies providing, considering, or being involved in mobile payment solutions. Their experience with practical solutions was hoped to help reveal a number of issues and challenges that they have to cope with. Such stakeholders were likely to know exactly what it is that hinders successful diffusion of mobile payments. The companies were identified using search engines and relevant portals.

The forty-six (46) respondents who completed the web survey included representatives of financial and banking institutions, mobile operators, third-party mobile payment system providers, phone manufacturers, mobile application developers, mobile technology consultants, usability consultants, and mobile payment researchers. The participants came from Asia/Pacific region, Europe, Asia, North America, and South America. The respondents revealed the barriers to success in mobile payments, and what is necessary for the success to happen. Many participants not only provided rich, in-depth responses, but also agreed to be contacted with further questions.

In terms of the sample size, in qualitative research the number of participants is less important than the richness of data. Purposive sampling should be used to the point of redundancy (Liamputtong, 2005). The sampling should be concluded when no new information is forthcoming from new units; accordingly, redundancy was a primary criterion that determined when the sampling in this study should terminate.

To obtain as broad coverage of issues as possible, and because of a limited number of local initiatives in Australia, web-based surveys with open questions were used in this research instead of face-to-face interviews. This ensured independence of time and place, and enabled the authors to get responses from people from all around the world. It also meant that different time zones were not a problem, since the respondent could fill in surveys at any time. It also provided the respondents with more convenience. More importantly, some of the contacts preferred to provide their answers anonymously, and the web survey was a way to ensure this. The selected stakeholders were emailed the link to the survey with an invitation to participate.

During data analysis, a procedure proposed by Pare (2002) was applied to ensure the reliability of the coding process, and therefore the reliability of this study. Two coders individually assigned the issues discussed by the respondents to a suitable category. The results were subsequently compared, and the few differences discussed and resolved.

Furthermore, a strategy suggested to promote validity of qualitative research such as this one is using low inference descriptors, which are description phrased very close to the participants' accounts and researchers' field notes (Johnson, 1997). Verbatims (direct quotes) are a commonly used type of low inference descriptors, and therefore this paper utilizes direct quotes from the subjects extensively to improve validity of the research. Such examples of data not only validate the conclusions, but also provide rich illustrations of the topic.

4. ANALYSIS OF THE RESULTS

4.1 Traditional User Acceptance Factors (Technology Features)

A number of factors discussed by the respondents included technology's characteristics, which are the basis of traditional acceptance models. Security and trust issues, lack of ease of use, limited usefulness, and cost were seen as the main barriers preventing success of mobile payments.

Security/Trust

Security of mobile payment solutions needs to be increased in order to increase their adoption. Problems reported included "*lack of trust*", "*user security not being up to scratch*", "*consumer's fear of a lack of security*", "*perceptions of security and trust*", "*trust and risk issues, especially in consumer sector*", and "*maintaining data integrity*". Customers are reluctant to "*pay with a device they consider less secure and affordable than Internet (or a wallet)*". For mobile payments to be successful, we must "*find out how can we replicate (and improve on) the 'good' features of money in the mobile payments environment*". Security measures are necessary to ensure that "*no one can use my payment account (i.e. use my funds).*" Customers need to believe that the system is secure - what matters to one expert is "*customer psychology - people need to feel confident that their form is a secure way to make payments*". Trust also has a broader sense, as "*probably the primary concern is all about confidence - confidence in security of personal information, and confidence in the capabilities of the technology to deliver reliable and accurate results.*" The problem specific to mobile payments is that there is "*limited capacity of providing evidence like receipts and other physical things the people are used to*". Developing a system and brand that people will trust is a necessary determinant of success.

Security or trust factors are missing in traditional acceptance models. Some researchers in fields related to mobile payments however have expanded traditional models with this construct, validating it in their empirical studies. Gefen et al. (2003) proposed trust as another factor in e-commerce adoption. Serenko & Bontis (2004) used trust in their mobile portals adoption study. Constantiou et al. (2004) propose that security is one of success determinant for mobile data services. Based on the participants' responses, this seems to be an important success factor in mobile payments as well.

Ease of Use

Ease of use and convenience were seen as necessary conditions for success. The issues discussed included general "*problems in usability, ease of use, speed, etc*", "*usability*", "*convenience*", as well as the necessity for a solution that would be "*easy to use, cheap, and versatile*". A success determinant is "*developing a system which is simple and people can understand and use it*". As one respondent sums it up, a barrier is "*ease of use of the feature - they are sometimes just complicated*".

Mobile payments are believed to be "*not convenient and easy enough comparing to other payment methods*". Specifically, inability to type on small keyboards was mentioned, and it was noted that "*using the keypad on a mobile phone, it is very cumbersome to go through the login procedure as well as the actual mobile payment procedure*". Another important factor for lack of adoption was "*poor user interfaces that don't follow the workflows of other channels*". As one participant concludes, "*produce a scheme which is easier/cheaper/safer/faster or whatever than the stuff we've had for hundreds of years!*".

The findings from this survey fit in exactly with the existing theories of adoption, such as the Perceived Characteristics of Innovation (Moore & Benbasat, 1991), the Technology Acceptance Model (Davis, 1989), and the Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2003), which all place ease of use of a new technology as a necessary factor for its adoption.

Usefulness

Traditional acceptance models often include criteria relating to usefulness of the new technology, i.e. how it fulfils customers' needs and provides additional value. The respondents also realized the importance of this factor. One expert argues that "*if you look to the UK experience of Mondex (a stored value cash card) this failed because it didn't give the consumer anything*". Other respondents claim that "*for applications outside mobile commerce, there is no real need to replace existing means of payment*", and similarly, "*no need for m-payments in the offline world*".

It seems that existing m-payment systems "*don't offer any advantages over existing forms of payment, especially credit cards and cash, so people won't see any reason to switch to them*". Another respondent holds a similar view: "C*ash and cards cover the majority of payment transactions: there may not be enough need for mobile payments to make the consumers familiar with using the m-payments and to make the m-payments profitable to merchants and service providers*". To sum up, an m-payment solution needs to "*bring more value to the merchants and the consumers, compared to existing solutions*".

Usefulness is one of the two original acceptance factors in TAM (Davis, 1989). Diffusion of Innovation (Rogers, 1995) includes the Relative Advantage criterion, too, and Performance Expectancy is part of the UTAUT (Venkatesh et al., 2003) model. Based on our findings, usefulness of a new mobile payment system seems to be a necessary condition for its acceptance.

Cost

Cost of mobile payments proves to be another factor affecting their adoption. The problem is "*high fees and commissions of the mobile payments for both merchants and consumers*". The important question is "*How much will the mobile payment service cost?*". As one participant explains, "*cost of these transactions is also an inhibitive factor*". Systems must have "*very low merchant transaction fees so that it is viable for micro-payments, such as ringtones, web content*". Cost both for merchants and customers was discussed in the study, as "*it is difficult to provide a low cost solution that will suit the largest number of mobile merchants. Critical to bringing down the cost to the user is the availability of viable technology*".

Cost has not been included as an acceptance factor in the original models, such as TAM, UTAUT, or Diffusion of Innovation. In mobile fields however the situation is different. Amberg et al (2003) did propose Cost as and acceptance factor for mobile data services, while Ling et al. (2004) added Financial Resources to the original TAM factors for mobile commerce. In mobile payments, cost seems to play an important role in their successful adoption, as revealed by the participants' responses.

4.2 Infrastructure Factors

The analysis of the participants' responses revealed that apart from the issues discussed in Section 4.1, there are also a number of concerns that do not deal with technology characteristics. These topics indicate that apart from the features that a new technology must have for a user to start using it, such as security, ease of use, usefulness, or cost, other success factors relate to the whole infrastructure that makes it possible and profitable to offer the technology to the user. These issues belong to the infrastructure perspective, and have been divided into sections according to some topics proposed by Damsgaard & Gao (2004).

Cooperation between Actors

The majority of issues reported by the respondents concerned the need of cooperation between various players. "*Collaboration between the financial institutions and the telcos*" is necessary, and the banks and operators need to "*find a way to commercially work together to provide an industry wide service*". What is needed is "*bank and telco cooperation to create a single set of interoperable cross-bank and cross-telco scheme rules*". Currently, this issue is believed to be a significant barrier to success, especially the "*behaviour of (potential) mobile payment service providers, especially mobile operators and banks*". There is also "*a lack of market support from network operators and financial institutions*". One respondent puts it simply: "*the main barrier to success in mobile payments is the banks and the telcos*". Another expert claims that "*the strong position of banks and credit card organisations, who rule the market, hinder success of new market entrants*".

Not only banks and operators are believed to play a role in preventing success of mobile payments, but also "*protectionist practices by the established providers of Networks (carriers), Terminals (Mobiles & EFTPOS), Banks (National and International) and Card schemes. Each party seeks to grow their market share by providing 'entry' to their contributing or owned partners. Technical and commercial initiatives are discouraged by the list of barriers within each industry grou*p". There is a need to "*demonstrate value for banks, telco and merchants so that they do not end up eating each others lunch*".

The findings illustrate that roles of various key players in promoting the diffusion of mobile payments need to be studied to ensure the success of such systems. The social network around the technology cannot be overlooked. Cooperation between the main actors is a necessary condition for an m-payment success.

Regulatory/Legislative Issues

Regulatory matters are another important issue. "*Regulatory questions (and the optimized behaviour to these)*" become an important factor. There is "*an absence of government/ regulatory authority support.*" The reluctance of governments may be "*due to un-traceability of fund transfer of some kind of payments*". There are regulations issues in specific regions, such as "*current political and bank business situation in the European Union*". Another regional issue is "*regulated market situation by different EU directives like ELMI (Electronic Money Institute) etc.*" Because of these issues, "*most m-payment schemes tried to adopt to the existing laws and marketing situations and don't care for the needs of their customer*s".

Another issue is that of "*liability within the system (customer, vendor, transaction processor, billing issuer)*". Legal issues need to be solved: "*the same way many new issues appeared with e-commerce, new laws had to be created or expanded or interpreted*" for mobile payments.

It seems important to analyse the necessary involvement of institutions in promoting infrastructure innovation and the market transformation in mobile payments. Such institutions involve legislative and regulatory bodies.

Business Models

The issue of "business models" has been brought up by a number of participants. "*Finding the right business mode*l" is necessary for widespread adoption. In mobile payments field, there exist "*complicated revenue models involving more than one business entity*". New business models need to be created for tangible products, as the existing business models for the sales of intangible products, like ring tones or games mean that "*the carriers are used to have a profit margin that is totally unrealistic for tangible products (i.e. 50% of the transaction).*" Another third-party provider from Australia notes that the "*problem to be overcome is the current revenue share model for premium SMS services. Telcos take far too much of a revenue share (approx 35%) which does not allow significant margin for applications to be sold via this channe*l".

Finding the most suitable business model for mobile payments seems to be one the crucial success factors and an important research question.

Network Externalities

Another significant problem is "*low acceptability and use of the current mobile payment solutions among merchants and consumers*". "*It is a 'network' challenge, that until there is critical mass of users and merchants and network capability and then trust, then it will not take off.*" Moreover, "*payment platform needs to be supported by enough merchants to enable critical mass of user in order that the payment system is viable".* Another respondent observes that it is "*the chicken and egg problem: how to manage the network externalities or lack of them in mobile payment diffusion process*". Coverage is a necessary success factor, as is "*what can I buy with m-payment. If the service does not have coverage, it will be next to useless".*

To sum up, "*you need to persuade a huge number of buyers and a huge number of sellers to all adopt the same mechanism. What you really have is an eMoney System that replaces cash. It took centuries for cash to become accepted. You need to reach that level of acceptance*".

Finding ways to manage such network externalities in mobile payments is an important research challenge that can greatly improve mobile payments diffusion.

Standardization

Another issue brought up in the study was the lack of "standardization". Standards concern cross-industry business issues and possibly policy issues in some countries. "*Standard protocols and standard mobile*

devices" would make mobile payments success easier to achieve. What is needed is *"standardized processes, as occurs today in credit card payments or in ATM withdrawals: it's always the same steps no matter where you are"*. Standardization could help *"achieve a seamless ecosystem"*. Clearly, *s*tandardization issue should not be overlooked by researchers studying success factors of mobile payments.

5. MULTI-PERSPECTIVE FRAMEWORK

This study has shown that the broader framework proposed for analysing success of mobile telecommunications market by Damsgaard & Gao (2004) applies to the mobile payments field as well. System providers and other stakeholders in our study clearly believe that barriers to success of mobile payments belong to both perspectives, so to discover success factors in mobile payments both user adoption criteria, and infrastructure traits need to studied.

As the respondents' responses revealed, the user adoption perspective concerns not only customers, but also merchants who need to start using the new m-payment system. When the adoption factors are discovered, it seems important to look for ways of fulfilling them with available technologies. In the infrastructure perspective, important research questions include ways of collaboration between key players, regulatory and legislative issues, successful business models, managing network effects, as well as standardization challenges.

Damsgaard & Gao (2004) further recommend that research should aim to examine the interrelation between the two perspectives' determinants, and how they co-depend. The model in Figure 1 represents the specific issues that need to be studied in both perspectives; furthermore, it also depicts this possible interrelation and co-dependence of the individual issues, combining them in one holistic framework.
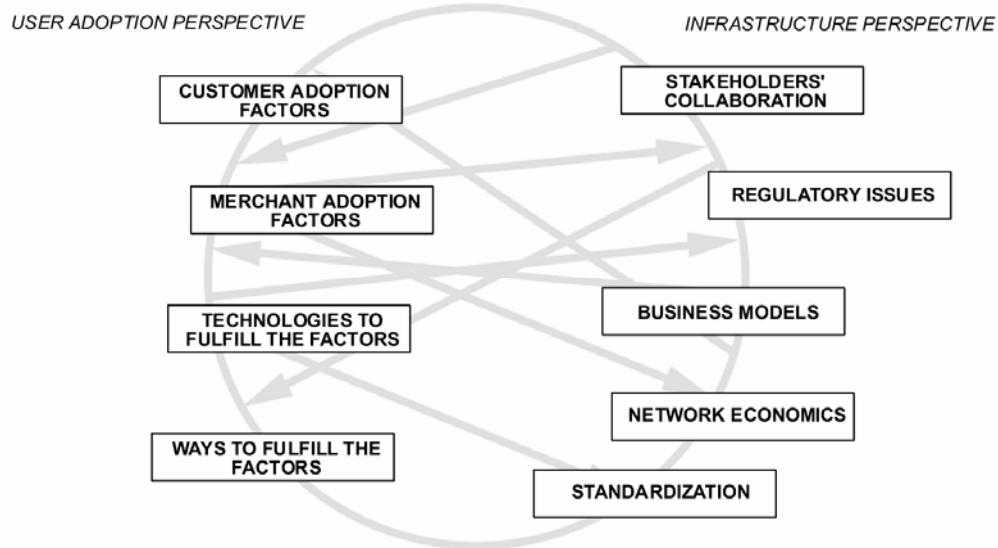

Figure 1. Multi-perspective framework for mobile payments success studies

6. CONCLUSIONS

This study has revealed that a broader framework is necessary to analyse the success of mobile payments. Our qualitative research, based on the experts' experience, confirmed that success of mobile payments is determined by both a) technology features affecting potential users' decisions to use or not use the new service, and b) other success determinants concerning the infrastructure. A quantitative study could be used in the future to either confirm or augment the proposed framework. As represented in Figure 1, future research needs to focus on factors affecting individual users' and merchants' adoption of mobile payments, as

well as on ways to fulfil the factors; furthermore, ways of collaboration between key players, successful business models, regulatory and legislative issues, standardization challenges, as well as managing network effects need to be studied as well. Either the two perspectives could be combined in further studies, or researchers need to be aware of the findings and challenges in the other perspective while focusing on one of them. Research should also aim to examine the interrelation between the two perspectives' determinants. Further studies should therefore focus not only on the success issues, but also on linkages between them, and how they depend on one another.

Both perspectives are believed to be equally important, as even if the service is easy to use, useful, secure, and able to meet customer's needs, it will not last if regulatory matters are not solved, revenue models do not provide value to stakeholders, and network effect is not fulfilled; on the other hand, even the best business models and successful partnerships will not be enough if the technology lacks the desired features, and the customer will not be willing to use it. Future research clearly needs to focus on both perspectives. Further studies should also aim to discover how mobile payments user adoption influences growth of infrastructure innovation, and, at the same time, how infrastructure innovation influences the service characteristics that increase individual users' adoption.

REFERENCES

Amberg, M., Hirschmeier, M. & Wehrmann, J. (2003) The Compass Acceptance Model for the Analysis and Evaluation of Mobile Services. *International Journal for Mobile Communications (IJMC).*

Armitt, C. (2004) M-payments Predicted to Be Worth £20bn by 2008. Available online at: http://www2.newmediazero.com/data/story.asp?id=249086, accessed on 24. Aug, 2005.

Ajzen, I. (1991) Attitudes, Personality and Behavior. Open University Press, Milton Keynes.

Constantiou, I. D., Damsgaard, J. & Knutsen, L. (2004) Strategic Planning for Mobile Services Adoption and Diffusion. *Proceedings of IFIP TC8 Working Conference on Mobile Information Systems (MOBIS)*, Oslo, September 2004.

Damsgaard, J. & Gao, P. (2004) A Framework For Analyzing Mobile Telecommunications Market Development. *Proceedings of IFIP TC8 Working Conference on Mobile Information Systems (MOBIS)*, Oslo, September 2004.

Davis, F. (1989) Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly*, Vol. 13, Iss. 3, pp. 319-339.

Fishbein, M. & Ajzen, I. (1975) Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research. Addison-Wesley, Reading, MA.

Gefen, D., Karahanna, E. & Straub, D. (2003) Trust and TAM in Online Shopping: An Integrated Model. *MIS Quarterly* 27(1), 51-90.

Gorman, G. E. & Clayton, P. (2005) Qualitative Research for the Information Professional: A Professional Handbook. London: Facet Publishing.

Johnson, R. B. (1997) Examining the Validity Structure of Qualitative Research. *Education,* 118(2): p. 282-290.

Liamputtong, P. (2005) Qualitative Research Methods, 2nd ed. Oxford University Press

Mallat, N. (2004) Theoretical Constructs of Mobile Payment Adoption. *IRIS 27,* Falkenberg, August 2004.

mForma (2005) Mobile Entertainment Industry Fact Sheet. Available online at: http://www.mforma.com/mediaroom/mobile_entertainment_factsheet.php, accessed on 24. Aug, 2005.

Moore, G. C. & Benbasat, I. (1991) Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation. *Information Systems Research*, Vol. 2, No. 3, pp. 192-222.

Pare, G. (2002) Enhancing the Rigor of Qualitative Research: Application of a Case Methodology to Build Theories of IT Implementation. *The Qualitative Report*, Volume 7, Number 4.

Rogers, E.M. (1995) Diffusion of Innovations, 4th ed. Free Press, New York.

Serenko, A. & Bontis, N. (2004) A Model of User Adoption of Mobile Portals. Available online at: http://www.business.mcmaster.ca/mktg/nbontis//ic/publications/SerenkoBontisMobile.pdf , accessed on 24. Aug, 2005.

Smart Card Alliance (2005) Mobile Payments at the Physical Point-of-Sale: Assessing U.S. Market Drivers and Industry Direction. Available online at: http://www.smartcardalliance.org/ alliance_activities/ mobile_payments_pos_report.cfm, accessed on 24. Aug, 2005

Venkatesh, V., Morris, M. G., Davis G. B. & Davis, F. D. (2003) User Acceptance of Information Technology: Toward a unified view. *MIS Quarterly,* Vol. 27, No. 3, pp. 425-478.

USER REQUIREMENTS FOR LOCATION BASED SERVICES

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ABSTRACT

The high global penetration of mobile telephony provides a strong basis for the development and diffusion of mobile business applications. Especially for location based services, i.e. mobile services that consider the user's current location to add value to the service provided, a high potential is seen. Nevertheless the development of mobile business and location based services has so far been lagging behind expectations. One of the reasons for this disappointing development is the failure of application developers to center their efforts on potential users and their needs and demands. The following paper therefore reviews the existing literature on user requirements in mobile business and location based services. A definition and characterization of location based services is given and a framework to categorize existing location based services is developed. Usefulness and usability are identified as the main determinants of end-user acceptance of location based services and are therefore put in concrete terms. In addition, security concerns are discussed as they are among the main factors restraining consumers from using location based services.

KEYWORDS

Location Based Services, User Orientation, User Requirements.

1. USER ORIENTATION IN MOBILE BUSINESS

The rapid growth of mobile telephony has provided a solid foundation for the development of mobile business applications. In Western Europe the penetration of mobile telephony reached 84% in 2003. In 2004 according to the European Information Technology Observatory (EITO) 95% of the British people owned a mobile phone. In Spain (97%) and Italy (100%) almost full penetration was reached.

Inspired by these numbers many experts have proclaimed that the growth and scale of mobile business will exceed that of electronic business. Nevertheless the uptake of mobile business has so far been lagging behind expectations. Among the most important reasons for this disappointing development is the failure of application providers to center the application development on the user and his needs and requirements (Lee, Benbasat 2003, p. 49). Instead application developers have based their efforts on existing technology and striven to create what is technologically possible instead of what is needed or wanted by potential users (Kleijnen et al 2004, p. 52). To make use of the great potential assigned to mobile business applications it will be essential for application providers to turn their focus away from technology towards the needs and desires of potential users of mobile business (Crisler et al 2004, p. 56). The following paper therefore summarizes the results of a review of existing literature on mobile business applications and location based services that addresses the needs and requirements of potential users.

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2. LOCATION BASED SERVICES

2.1 Characteristics of Location Based Services

Location based services can be defined "as services that integrate a mobile device's location or position with other information so as to provide added value to a user" (Spiekerman 2004, p. 10). The main characteristic of location based services thus is the localization feature. As location based services are a subset of mobile business applications they are additionally qualified by the other main characteristics of mobile business, i.e. mobility, ubiquity and personalization. The mobility of mobile devices allows the user to avail mobile business applications from anywhere. As most mobile users also have their device in stand-by mode most of the time and are thus permanently reachable, ubiquity is another valuable feature of mobile business applications (Wiedmann et al 2000, p. 10). Finally personalization is considered an important attribute of mobile business applications. Mobile devices are rarely used by several persons and through its SIM-card each device is clearly attributable to its owner (Wirtz and Mathieu 2001, p. 617).

Personalization also is the main goal of another type of mobile business applications, which is usually referred to as context-aware services. Location based services can be regarded as a subset of context-aware services. Applications that are context-aware can not only customize themselves based on where a user is, but also on other elements of the user's personal context (Jagoe 2003, p. 2). Context is information used to deliver a service, which is not explicitly input by the user, but is used to add value to the service by adapting it to the user's current situation. The most basic context information is the user's location. However, to be able to precisely adapt services to the user's current needs and preferences it is necessary to account for further types of context data, such as environmental, activity, temporal or personal context. Adapting a service to the user's current context is important as people have different needs in different usage contexts (Scheer et al, p. 100). Hence, it is not sufficient to just adapt services to the user's location, but it needs to be tuned to the user's personal preferences and usage situation, i.e. his context (Kaasinen 2003, pp. 70). If the service is implemented with reference to the user's context, the user's search and information costs are reduced and his acceptance and wiliness-to-pay for the service is increased (Buellingen and Woerter 2004, p. 1407; Figge 2004, p. 1417; Link and Schmidt 2002, pp. 146).

2.2 Types of Location Based Services

A commonly accepted classification framework for location based services has not yet been established. Several authors have developed different schemes to systemize existing and potential location based services (e.g. Faggion and Tracheris 2004; Barnes 2003; Schilcher and Deking 2002; Mitchell and Whitmore 2003). We, however, found none of these frameworks adequately covering the range of existing and potential location based services. In this paper we therefore propose another possible system of classifying location based services according to the main value they offer potential users (see Table 1).

Tracking services are services that monitor the exact whereabouts of people or objects. An example of a people tracking service in a private context is the tracking of children or elder people. People tracking in the business context can be performed to locate field personnel. Object tracking is especially interesting in the corporate market to, for example, track products within a supply chain. Special types of tracking service are emergency services. Emergency services locate an individual who is unaware of his location or is unable to reveal it because of an emergency situation. In existing frameworks emergency services have often formed a separate category. We, however, find tracking to be the core value of emergency services and therefore categorize them as tracking services (Giaglis et al 2003, p. 69).

Navigation services address mobile users' needs for directions within their current geographical location. Within navigation services we distinguish regular and specialized routing services. "Regular routing services" let the user locate any fixed destination and provide him with detailed directions toward it. "Specialized routing services" are services that navigate the user to a particular type of product or service provider. Both types of navigation services may be extended to take into account the current traffic conditions and propose alternative routes. Navigation services can also be implemented as services for indoor navigation (Giaglis et al 2003, p. 70).

When using information services the user requests his location to be determined in order to receive precise information relating to his immediate environment (Dru and Saada 2001, p. 71). Some of these services offer the user to directly reply to the information provided. E.g. a service offering information about local events may allow for direct ticket ordering. We label these types of services "interactive information services". Information services that only provide location-aware information without the opportunity for a direct reply, we name "regular information service".

Another promising application field of mobile business is the ease of communication between distributed people. Especially in a business context mobile communication services can help colleagues to constantly stay connected even if they are working in different locations. Facilitating connectivity can also be a service of interest for private groups of people, such as a family or a circle of friends (Coursaris and Hassanein 2002, p. 261; Jarvenpaa et al 2003, p. 43).

Entertainment services are services that provide an entertainment value to the user. Examples of location based entertainment services are location based games or location based storytelling services. By including the current position of a player as a component of a game or a story it is no longer abstract but becomes a part of the user's life making the game or the story much more thrilling (Samsioe and Samsioe 2002, p. 421). Flirting or dating applications can also be classified as entertainment services since they also provide hedonic value.

Lastly we define transaction services as all services that initiate and/or execute economic transactions. We integrate location based advertising as well as location based billing into this category. The opportunity to localize consumers offers advertisers the opportunity to engage in location based advertising, i.e. to target consumers depending on their current environment and to adapt the advertising message according to their current context. Location based billing refers to the opportunity of service providers to dynamically charge users of a particular service depending on their location when using the service (Giaglis, et al 2003, p. 71).

Table 1. Categories of Location Based Services

Category	Sub-category	Main value
Tracking services	People tracking	Tracking private people or personnel
	Object tracking	Tracking objects (products, vehicles, material etc.)
Navigation services	Regular routing services	Localizing and navigating towards fixed objects
	Specialized routing services	Localizing and navigating towards specialized product and services providers
	Indoor routing services	Localizing and navigating indoors
Information services	Regular information services	Delivering local information
	Interactive information services	Delivering local information including direct reply mechanisms
Communication services	Private communication services	Easing communication of distributed friends, family members and unknown others with same interests
	Business communication services	Easing communication of distributed employees
Entertainment services		Providing added entertainment value by adapting to location
Transaction services	Location based advertising	Location based initiation of economic transactions
	Location based billing	Location based execution of economic transactions

3. USER REQUIREMENTS

3.1 Usefulness

One of the reasons for the slow diffusion of mobile business and location based service applications is their failure to provide added value to the user (Wirtz et al 2003, p. 74). According to *Rogers'* Theory of the Diffusion of Innovations users only show willingness to adopt innovations if these clearly provide an additional value compared to already existing offerings (Rogers 2003, p. 229). To accelerate the adoption and diffusion of mobile business and location based service applications it is therefore necessary to precisely analyze what makes innovative mobile services useful to consumers. Generally usefulness of mobile services is generated by the main characteristics arising from the use of mobile devices as transaction medium. Ubiqiuity and mobility allow for the permanent use of the service and make the user independent of location and time. His flexibility and efficiency are increased. Additionally it gives him the opportunity to satisfy spontaneous needs while on the move (Anckar, D'Incau 2002). As location based services show a high degree of personalization they can help users to filter relevant information and overcome the constant information overload (Bieber et al 2001, p. 565).

In order to successfully implement location based services it is necessary to understand what type of content is valuable for the user to be provided by these services. The type of content that can most valuably be delivered through mobile business or location based service applications is dynamic content, i.e. content that frequently changes and therefore needs to be permanently actualized (Kaasinen 2003, p. 74). Content is also highly valuable to the user if it is comprehensive. Users dislike having to collect pieces of content from different sources. They prefer having all necessary information ready in one place (Enichlmaier and Staufer-Steinocher 2002, p. 42). Additionally users only want the information they really desire. The information generated by other users can be especially valuable as it often better suits the information needs of users than the more general information provided by service providers (Kaasinen 2003, p. 76). The main challenge concerning this type of information service is to balance the trade-off between creating an open information space and still enabling users to find relevant information in that vast space (Espinoza et al 2001, p. 1).

3.2 Usability

3.2.1 User Interface

In addition to usefulness usability is an important determinant of end user acceptance of location based services (Davis 1986). Only if users find an application easy and comfortable to use will they employ it. Generally novice users find an application more approachable if they perceive it as polite and friendly (Cheverst et al 2000). Users also wish for a low installation time and want to devote minimal time to getting familiar with the application. According to *Rogers'* Theory of the Diffusion of Innovations newly developed services should therefore not only be compatible to existing technology, but also to potential users' existing knowledge and experience with similar services (Rogers 2003, p. 243). It is therefore advisable to align the usage practices of mobile business applications with existing practices of mobile communications and electronic business applications.

However, while it is certainly reasonable to be geared to electronic business applications when developing mobile business applications, it is also necessary to adapt the application to the special conditions of the mobile framework (Hess et al 2005, p. 12). It is essential to analyze and question whether what has successfully been implemented for electronic business applications can easily be transferred to mobile business. Especially the mobile setting of the application and the constraints of mobile devices significantly affect the requirements for mobile interface design (Lee and Benbasat 2004). Constraints of mobile devices are mainly their small display, screen and limited input facilities (Venkatesh et al 2003, p. 55). The mobile setting, for instance, causes the user to devote only partial attention to the operation of the service. He might be distracted by surrounding noise and other actions. The ability to operate a service with only a few keystrokes therefore is essential for location based services to be usable (Al-Hawamdeh 2004, p. 253).

3.2.2 Search Functions

There are also high demands on search functions. Empirical studies found that users of small screens follow links less frequently (Buyukkokten et al 2000, p. 430). It is therefore essential for mobile business applications to provide effective search functions that demand low clicking-effort. As typing in text is still cumbersome on mobile devices, the application should also assist the user when typing in search requests by offering one-click-requests or customized pull-down menus (Yom 2002, p. 178). Automatic keyword entry supports (Buyukokkten et al 2000) as well as the opportunity to enter keywords by voice are also desirable features that can ease searching for the user (Al-Hawamdeh 2004, p. 253). Besides demanding effective search support users also want searches to be executed quickly. The features of mobile business applications should therefore be limited, if the capacity of transmission rates and mobile devices is not sufficient to perform the service in a timely manner (Manber et al 2000, p. 36; Buellingen and Woerter 2004, p. 1407).

3.2.3 Result Presentation

Due to the limitations of mobile devices the presentation of search results should also be implemented in an effective way (Jones 1999). Especially if results are drawn from different providers, consistency in the display of offers needs to be ensured. As scrolling on mobile devices is rather laborious all necessary information referring to a service should be provided in a single view (Kaasinen 2003, p. 77). In case of multiple search results accordion summarization can be an effective way of display. Accordion summarization first provides only basic information, but allows expanding the result list to provide further information (Buyukkokten et al 2001, p. 213; Kaasinen 2003, p. 75). Once the information has been requested and downloaded it should remain available to the user even when being offline. If users have to reconnect every time they want to review information, they won't perceive the service as very valuable (Coursaris and Hassanein 2002, p. 261).

3.3 Security

Among the main barriers for the diffusion of mobile business and location based service applications are the concerns of users referring to these applications. When addressing these concerns it is necessary to realize that objective technical security is not the decisive factor. Instead the user's personal perception of the security of an application needs to be focused (Schindler 2002, p. 63). The following chapter highlights some of the major concerns users hold towards mobile business and location based service applications.

3.3.1 Protection of Personal Data

Consumers generally hesitate to release personal data. They mainly fear that their personal data is used for commercial purposes they not explicitly gave permission to (Diezmann 2001, p. 159; Möhlenbruch and Schmieder 2002, p. 76). Some users also fear their personal data being given to governmental institutions and see the "Big Brother"-vision coming partly true (Pflug and Meyer 2002, p. 413). Nevertheless the value of services can greatly be enhanced through personalization, for which the providers need personal data from the user. There will thus always be a trade-off between the value of personalized services and the uneasiness of providing personal data (Manber et al 2000, p. 37). It will be decisive for service providers to stress the value of personalization. If users acknowledge the added value of personalized services, they will have a valid incentive to release personal data (Müller et al 2002, p. 368; Spiekerman 2004, p. 16).

Additionally, a mutual basis of trust has to be established for mobile business applications by all members of the mobile business value chain (Buellingen and Woerter 2004, p. 1407). In this context trusted third party, trust-intermediates and branding may be effective instruments to reduce the global risk perception of mobile business applications (Gerpott 2002, p. 64; Henkel 2002, p. 330). It is also recommended to inform the user about the terms and conditions of the requested service, completely list all costs at an early stage, and provide comprehensive information about the service provider (Strobborn et al 2004, p. 1435). Finally consumers are concerned with the fact that mobile phones are more likely to be stolen than fixed-installed systems. For data security this means that not only the personal data stored in the databases of the service provider is subject to protection. The information stored on the mobile phone also needs to be protected (May 2001, p. 229).

3.3.2 Protection of Privacy

Another major concern of users is the fear of their privacy being invaded (Dean 2002, p. 258). Spamming is an intrusion into an individual's privacy as it dispatches unwanted messages to the user's personal mailbox and thus enters his personal space. Users fear that the diffusion of mobile commerce applications will also introduce the spamming problem to the mobile phone (Coursaris and Hassanein 2002, p. 261). As the mobile phone is an even more personal device than regular or electronic mailboxes, mobile spamming will be regarded as an even stronger intrusion into the individual's privacy (Jarvenpaa et al 2003, p. 42). Furthermore the small display size of a mobile phone forces the user to notice every incoming message, i.e. even unwanted messages, which will offend him even more (Bliemel and Fassott 2002, p. 15; Spiekerman 2004, p. 16). Another common user concern is that spamming will lead to an overloading of the application and result in a denial of service (Turowski and Pousttchi 2004, p. 103).

3.3.3 Transaction Security

As for mobile commerce applications it will be necessary to perform transactions over the mobile phone, transaction security is another major concern of potential users (Mustafa et al 2002, p. 367) This is especially true for transactions involving matters the user does not in any case want to get lost or be visible to unauthorized others. Generally users prefer easy and fast processing for smaller amounts and are willing to accept a lower level of security. For larger amounts, however, their main concern clearly is the security of the payment (Entenmann 2001, p. 274; Diezmann 2001, p. 159). In this case they are also willing to accept more complex and slower transaction procedures. Concerning transaction security users mainly fear the interference of third parties. They are afraid of unauthorized parties intercepting the transaction process to copy, delete or alter data (Turowski and Pousttchi 2004, p. 100). Generally users perceive security risks rising with the degree of interaction and the sensitivity of information exchanged (Coursaris and Hassanein 2002, p. 260). To increase users' trust in payment over the mobile phone it is recommended to allow for an easy handling of the payment procedure as well as for the reversal of payment transaction and reimbursement guarantees (Henkel 2002, p. 329).

3.3.4 Sense of Control

Lastly consumers also have a great fear that is not connected to any technological concerns or the application itself. It is rather rooted in the user's perception of the overall technological advancement that more and more enters his personal life. Many users feel a loss of control of what is happening with and around them and this feeling evokes great uneasiness (Jarvenpaa et al 2003, p. 43). The mobile business user should therefore not be regarded as a rational economic man, who will greatly appreciate the highest degree of personalization. Instead it is to be considered that he will develop a feeling of complete control, if the application is "too intelligent". Users do not want the applications to lead to a predestined and over-controlled environment, in which they are completely managed and controlled by their mobile devices (Kaasinen 2003, p. 76).

It will therefore be necessary to develop a context-aware application that personalizes services as much as possible without letting the user feel out of control. Only if the compilation of personal data clearly relates to a specific service request and is controlled by the user, will he accept this component of mobile business applications in general and location based services in particular (Wimmer 2001, p. 213). To address the user's concern of losing control of his environment he should always be given the opportunity to overrule the system's suggestions (Wimmer 2001, p. 213; Arbanowski et al 2004, p. 65; Kaasinen 2003, p. 75).

4. SUMMARY AND IMPLICATIONS

As the remarks of this paper indicate, there are many different issues to be addressed when accounting for the user perspective during the development of mobile business applications. The user concerns as well as the lack of trust and confidence in the concept of mobile business certainly are the major obstacles that need to be overcome in order for mobile business and location based service applications to diffuse. One way to overcome these issues is to provide services that offer a high value to the user. In order to be able to implement such a service it is necessary to address user requirements from the very beginning on. However, little sophisticated empirical research has so far been conducted on this issue. The remarks of this paper are

mainly based on conceptual papers and partly on research results that were transferable from the electronic business context. Future research should therefore aim at gaining further insights on user needs and requirements for mobile business. For this purpose more empirical research should be conducted. This paper may serve as a starting point to identify and conceptualize specific research topics that are to be investigated by empirical research.

REFERENCES

Al-Hawamdeh, S., 2004. Usability Issues and Limitations of Mobile Devices. In Shi, N. (ed.): *Wireless Communications and Mobile Commerce*, Hershey 2004.

Anckar, B. and D'Incau, D., 2002. Value-Added Services in Mobile Commerce: An Analytical Framework and Empirical Findings from a National Consumer Survey. In *Proceedings of the 35th Hawaii International Conference on System Sciences*, 2002.

Arbanowski, S. et al, 2004. I-centric Communications: Personalization, Ambient Awareness, and Adaptability for Future Mobile Services. In *IEEE Communications Magazine*, Sept. 2004, p. 63-69.

Barnes, S. J., 2003. Location-Based Services - The State of the Art. In *E-Service Journal*, Vol. 2, No. 3.

Bieber, G. et al, 2001. Personal Mobile Navigation Systems - Design Considerations and Experiences. In *Computers & Graphics*, Vol. 25, p. 563-570.

Bliemel, F. and Fassott, G., 2002. Kundenfokus im M-Commerce. In Silberer et al (eds.): *Mobile Commerce – Grundlagen, Geschäftsmodelle, Erfolgsfaktoren*, Wiesbaden 2002, p. 3- 23.

Buellingen, F. and Woerter, M., 2004. Development perspectives, firm strategies and applications in mobile commerce. In *Journal of Business Research*, Vol. 57, No. 12, p. 1402-1408.

Buyukkokten, O. et al 2000. Power Browser: Efficient Web Browsing for PDAs. In *CHI Letters*, Vol. 2., No. 1, p. 430-437.

Buyukkokten, O. et al 2001. Accordion Summarization for End-Game Browsing on PDAs and Cellular Phones. In *CHI 2001 Conference Proceedings ACM*, p. 213- 220.

Cheverst, K. et al 2000. Developing a Context-aware Electronc Tourist Guide: Some Issues and Experiences. In *CHI 2000 Conference Proceedings ACM*.

Coursaris, C. and Hassanein, K., 2002. Understanding M-Commerce: A consumer-centric model. In *Quarterly Journal of Electronic Commerce*, Vol. 3, No. 3, p. 247-271.

Crisler, K. et al 2004. Considering the User in the Wireless World. In *IEEE Communications Magazine*, Sept. 2004, p. 56-62.

Davis, F., 1986. A technology acceptance model for empirically testing new end-user information systems: theory and results, Sloan School of Management, M.I.T. 1986.

Dean, D. R., 2002. Wie man den "M-Commerce"-Kunden gewinnt. In Reichwald, R. (ed.): *Mobile Kommunikation*, Wiesbaden 2002, p. 247-261.

Diezmann, N., 2001. Payment – Sicherheit und Zahlung per Handy. In Kahmann, M. (ed.): *Report Mobile Business – Neue Wege zum mobilen Kunden*, Düsseldorf 2001, p. 155-178.

Dru, M.-A. and Saada, S., 2001. Location-based mobile services: the essentials. In *Alcatel Telecommunications Review*, 1st quarter 2001, p. 71-76.

Entenmann, M., 2001. Das Geschäftsmodell von Paybox. In Nicolai, A. T. and Petersmann, T. (eds.): *Strategien im M-Commerce*, Stuttgart 2001, p. 269-281.

Enichlmaier, C. and Staufer-Steinnocher, P., 2002. Location Based Services – marktrelevante Inhalte als Erfolgsfaktor für mobile GIS- und Telekomtechnologien. In Zipf, A. and Strobl, J. (eds.): *Geoinformation mobil*, Heidelberg, p. 36-44.

Espinoza, F. et al, 2001. GeoNotes: Social and Navigational Aspects of Location-Based Information Systems. In *Proceedings of the 3rd International Conference on Ubiquitous Computing*, Atlanta, Georgia, USA.

Faggion, N. and Tracheris, A., 2004. Location-Based Services strengthen the strategic position of mobile operators. In *Alcatel Telecommunication Review*, 4th quarter 2003/1st quarter 2004.

Figge, S., 2004. Situation-dependent services – a challenge for mobile network operators. In *Journal of Business Research*, Vol. 57, No. 12, p. 1416-1422.

Gerpott, T. J., 2002. Wettbewerbsstrategische Positionierung von Mobilfunknetzbetreibern. In Silberer et al (eds.): *Mobile Commerce – Grundlagen, Geschäftsmodelle, Erfolgsfaktoren*, Wiesbaden 2002, p. 45-65.

Giaglis, G. M. et al 2003. Towards a Classification Framework for Mobile Location Services. In Mennecke, B. E. and Strader, T. J. (eds.): *Mobile Commerce*, Hershey 2003, p. 67-85.

Henkel, J., 2002. Mobile Payment. In Silberer et al (eds.): *Mobile Commerce – Grundlagen, Geschäftsmodelle, Erfolgsfaktoren*, Wiesbaden 2002, p. 327-351.

Hess, T. et al 2005. Technische Möglichkeiten und Akzeptanz mobiler Anwendungen – Eine interdisziplinäre Betrachtung. In *Wirtschaftsinformatik*, Vol. 47, No. 1, p. 6-16.

Jagoe, A., 2003. Mobile Location Services, Upper Saddle River 2003.

Jarvenpaa, S. L. et al, 2003. Mobile Commerce at Crossroads. In *Communications of the ACM*, Vol. 46, No. 12, p. 41-44.

Jones, M. et al, 1999. Improving Web Interaction on Small Displays. In *Proceedings of the 8th World Wide Web Conference 1999*, p. 51-59.

Kaasinen, E., 2003. User need for location-aware mobile services. In *Personal and Ubiquitous Computing*, Vol. 7, No. 1, p. 70-79.

Kleijnen, M. et al, 2004. Consumer Adoption of Wireless Services: Discovering the Rules, while playing the game. In *Journal of Interactive Marketing*, Vol. 18, No. 2, p. 51-61.

Lee, Y. E. and Benbasat, I., 2004. A Framework for the Study of Customer Interface Design for Mobile Commerce. In International Journal of Electronic Commerce, Vol. 8, No. 3, p. 79-102.

Lee, Y. E. and Benbasat, I., 2003. Interface Design for Mobile Commerce. In *Communications of the ACM*, Vol. 46, No. 12, p. 49-52.

Link, J. and Schmidt, S., 2002. Erfolgsplanung und –kontrolle. In Silberer et al (eds.): *Mobile Commerce – Grundlagen, Geschäftsmodelle, Erfolgsfaktoren*, Wiesbaden 2002, p. 131-152.

May, P., 2001. Mobile Commerce: Opportunities, Applications, and Technologies of Wireless Business, Cambridge 2001.

Manber, U. et al, 2000. Experience with personalization on Yahoo! In *Communications of the ACM*, Vol. 43, No. 8, p. 35-39.

Mitchell, K. and Whitmore, M., 2003. Location Based Services: Locating the Money. In Mennecke, B. and Strader, T. J. (eds.): *Mobile Commerce - technology, theory, and applications*, Hershey 2003, p. 51-66.

Möhlenbruch, D. and Schmieder, U.-M., 2002. Mobile Marketing als Schlüsselgröße für Multichannel-Commerce. In Silberer et al (eds.): *Mobile Commerce – Grundlagen, Geschäftsmodelle, Erfolgsfaktoren*, Wiesbaden 2002, p. 67-89.

Müller, C. D. et al, 2002. Der Einfluss von "Mobile" auf das Management von Kundenbeziehungen. In Reichwald, R. (ed.): *Mobile Kommunikation - Wertschöpfung, Technologien, neue Dienste*, Wiesbaden 2002, p. 353-377.

Mustafa, N. et al, 2002. Mobile Banking und Sicherheit im Mobile Commerce. In Silberer, et al (eds.): *Mobile Commerce – Grundlagen, Geschäftsmodelle, Erfolgsfaktoren*, Wiesbaden 2002, p. 353-372.

Pflug, V. and Meyer, F., 2002. Ortsbezogene Dienste - Kernelemente zur Wertschöpfung in mobilen Prozessen. In Reichwald, R. (ed.): *Mobile Kommunikation - Wertschöpfung, Technologien, neue Dienste*, Wiesbaden, p. 399-415.

Rogers, E., 2003. Diffusion of Innovations, New York et al 2003.

Samsioe, J. and Samsioe, A., 2002. Introduction to Location Based Services - Markets and Technologies. In Reichwald, R. (ed.): *Mobile Kommunikation - Wertschöpfung, Technologien, neue Dienste*, Wiesbaden 2002, p. 417-427.

Scheer, A.-W. et al, 2002. Das mobile Unternehmen. In Silberer et al (eds.): *Mobile Commerce – Grundlagen, Geschäftsmodelle, Erfolgsfaktoren*, Wiesbaden 2002, p. 91-110.

Schilcher, M. and Deking, I., 2002. Geoinformationen als Basisbausteine für mobile Services. In Reichwald, R. (ed.): *Mobile Kommunikation - Wertschöpfung, Technologien, neue Dienste*, Wiesbaden 2002, p. 381-398.

Schindler, S., 2002. Mobile Business in der Versicherungswirtschaft, Karlsruhe 2002.

Spiekerman, S., 2004. General Aspects of Location-Based Services. In Schiller, J. and Voisard, A. (eds.): *Location-Based Services*, San Francisco 2004, p. 9-39.

Stroborn, K. et al, 2004. Internet payments in Germany: a classificatory framework and empirical evidence. In *Journal of Business Research*, Vol. 57, No. 12.

Turowski, J. and Pousttchi, K., 2004. Mobile Commerce – Grundlagen und Techniken, Berlin, Heidelberg 2004.

Venkatesh, V. et al, 2003. Understanding Usability in Mobile Commerce. In *Communications of the ACM*, Vol. 46, No. 12, p. 53-56.

Wiedmann, K.-P. et al, 2000. Mobile Commerce – Chancenpotentiale einer neuen Stufe des E-Commerce, Hannover.

Wimmer, E., 2001. Dem mobilen Nutzer ein Zuhause schaffen – Überlegungen zu mobile Portalen. In Nicolai, A. T. and Petersmann, T. (eds.): *Strategien im M-Commerce*, Stuttgart 2001, p. 203-219.

Wirtz, B. W. and Mathieu, A., 2001. Mobile Commerce. In *DBW*, Vol. 61, No. 5, p. 615-618.

Wirtz et al, 2003. Präferenzen und Zahlungsbereitschaften für Anwendungen und Dienste im Mobilen Internet und deren Implikationen für die Diffusion. In *ZfB*, Vol. 73, No. 1, p. 73-98.

Yom, M., 2002. Utility and Usability im Mobile Commerce. In Silberer et al (eds.): *Mobile Commerce – Grundlagen, Geschäftsmodelle, Erfolgsfaktoren*, Wiesbaden 2002, p. 173-184.

DIGITAL DIVIDE AND INTERNET DIFFUSION IN ITALY AMONG FIRMS

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ABSTRACT

The digital divide can occur either as a "local" (within a given country) or a "global" (between developing and industrialized countries) phenomenon. Our study intends to offer an important contribution by analyzing the digital divide in Italy and the factors contributing to this situation at territorial level (i.e., macroareas: North, Center, South and at the provincial level) To do this, we used the registration of Internet domains under the ".it" ccTLD as a proxy. In particular, we analyzed domain names registered by firms. The analysis produced interesting results: the distribution of domains registered by firms in Italian provinces is more concentrated than the distribution according to income and number of firms, suggesting a diffusive effect. Furthermore, when analyzing the factors that contribute to the presence of a digital divide at the regional level, regression analysis was performed using demographic, social, economic and infrastructure indicators. Results show that Italian regions that have good productive efficiency measured of the added value per employee and a high educational level measured by the number of firms specialized in the ICT service sale (Internet Service Provider) and by number of employees devoted to research and development are the best candidates for the utilization of Internet.

1. INTRODUCTION

Internet growth has captured the imagination of users, policymakers, entrepreneurs, corporate managers, military strategists, social commentators, scholars and journalists (Guillèn & Suarèz, 2004). The Internet is seen by some researchers as a new technological means that will lead to a "smaller, more open world" (Tapscott & Caston, 1993). According to some researchers the Internet symbolizes "the triumph over time and space" the rise of the "netizen", and the crowing of the "customer as sovereign" (Gilder, 2000).

According to Coffman, Odlyzko (2001) the Internet is a means of communication that is expanding very rapidly. Studies carried out by the Network User Association (NUA Ltd) estimates the worldwide on-line population in 1999 and in 2002 and shows that in Europe the number of individuals on-line came to 190.91 million in 2002, compared to 47.15 million in 1999.

Companies as well as individuals also turn to the Internet to exploit its communication potential. Today, information infrastructures are reaching out to the individual consumer, and telematic networks reduce the cost of communications. This statement agrees with economics literature (Hoffman & Novak, 1996), which confirms that the Web is becoming a dynamic and personal means of communication.

According to other authors (Bassi, 2002) the spread of the Internet and the functions of electronic commerce will permit individual clients to choose from a wide array of products and reduce costs, selecting and buying goods directly from the source and allowing companies to sell while by passing traditional channels. Scandinavia, at 8.6%, leads the region with the highest percentage of on-line sales, usually computers and related products, travel, video and music, and books.

This situation could prove to be quite worrisome for traditional businesses, as emerges from a survey carried out by the Syndicate Agents Union and representatives of the Italian Commerce in November 2000.

However, companies must adopt entirely new forms of commercial activity so that online sales will be successful.

The advantages for businesses provided by the Internet are not only linked to the sale of products and services (direct advantages) but can also be indirect (Hansons, 2000). For example, among the most important of these are reduced costs, image consolidation, greater customer loyalty, and a wider diffusion of products offered by the company. They are referred to as "indirect" since they do not lead directly to sales and do not generate immediate profits; however, they are important since they will probably be the greatest benefits offered to businesses by the Internet.

The gradual confirmation of the Internet as a means of communication also permits companies access data and a variety of other information; for example, it is possible to rapidly obtain information about the market in which one operates by visiting websites specialized in economic information or areas that furnish updates on laws, price changes, the appearance of any new operators in the field, fairs, competitive bidding, and other news of interest to operators. One can also identify the competition and analyze them by means of information published on company websites, etc.

Our study analyzes the spread of the Internet among Italian firms utilizing as metrics the number of domain names registered under the ccTLD ".it". We took into consideration domain names, names that are associated to IP addresses in the net, because we believe it to be really important for a firm to have a domain name, as through this name an Italian firm can exploit the above mentioned direct and/or indirect advantages. Moreover, it is helpful for a firm to register a domain name not only to have its own web site, but also to benefit from the advantages related to on-line means of communications (for example e-mails, FTP and so on). As a matter of fact, on-line means of communications unlike traditional ones (for example call-center services or telemarketing) are more effective as they allow firms to reach, for example, several customers at the same time, and more flexible, as some of them allow customers to solve problems on their own (for example with the FAQs). In this way, a twenty-four hours a day access to resources is granted. On the contrary, traditional customer care methods require intensive work and a considerable engagement of resources to ensure prompt and accessible assistance.

Besides, the analysis of the Internet presence in various social activities and economic and political areas indicates a critical issue: the existence of a "digital divide" between those who possess the material and the cultural conditions to exploit the new technologies, and those who do not, or those who lack the crucial ability to adapt to the rapid continual change that characterizes the Internet today (Warschauer, 2001; OECD, 2001, Kirkam et al. 2002; Norris, 2001; Rogers, 2001). Therefore, it is not surprising that the announcement of the Internet potential as "a liberty, productivity and communication instrument, goes hand in hand with the digital divide exposure" caused by the uneven Internet diffusion (Castells, 2001). The 1999 World Human Development Report written by the United Nations organization considers the number of Internet users one of the most widely used indicators that show the divide between rich and poor countries. Statistics compiled by the International Telecommunication Union indicate that by the end of 2002 Internet users represent in countries such as Africa, Central America and South America only 1% of the population while this percentage goes up of 50-60% in countries such as Iceland, United States, Scandinavia, Singapore or South Korea (ITU, 2003).

In this paper we are going to analyze the factors contributing to the existence of the digital divide in Italy, taking into consideration not only economic variables, but also educational, cultural, demographic and in the end, technological variables.

2. METHODS

Several metrics are available for measuring Internet diffusion. The most convenient are the so-called endogenous metrics which can be "obtained in an automatic or semiautomatic way from the Internet itself" (Diez-Picazo, 1999). These metrics have the undeniable advantage of accuracy, being based on automatic data collection and retrieval; in addition they allow good geographical characterization of the phenomenon being based on data that allow differentiation of users on a national, regional and provincial level. Among the endogenous metrics, according to literature, the most frequently used ones to evaluate Internet diffusion analysis are Internet hosts based on host count procedures (see studies published by Internet Software Consortium or by RIPE-NCC) and second-level domain names (Naldi, 1997; Zook, 1999; Bauer, Berne and

Maitland, 2002). Despite the advantages offered by endogenous measures, there are also a few disadvantages, since in some cases they tend to underestimate and in others to overestimate the phenomenon being studied (Zook, 1999, 2000, 2001). Overestimation can occur when the number of hosts is used, often associated with IP addresses, while if we consider the number of domains registered, more than one domain may be associated with the same registrant. Underestimation can occur because not all Internet users register a domain name under their own ccTLD, and in many countries the regulations allow foreign citizens to register under their own ccTLD (for example, Italy allows organizations and citizens of in the European Union countries to register under the ".it" ccTLD).

In the case of hosts, underestimation may be due to the growing presence of firewalls and private networks (Intranet) and the use of dynamic IP addresses, increasingly accompanied by new tools for access to the Net (for example, mobile phones). In spite of these disadvantages, the numbers of hosts and Internet domains are the principal means utilized for analyzing Internet diffusion.

To measure Internet diffusion in Italy among firms, we used the endogenous measure of second-level domain names registered under the ".it" ccTLD, managed by the Institute of Informatics and Telematics of CNR, Pisa, using data that were extracted from the databases of registrations, using automatic and semi-automatic procedures. We created a new database for analyzing Internet diffusion by initially consulting the WHOIS database (the latter contains information regarding the domain names registered under the ".it" ccTLD, applicants who have signed a contract with IIT-CNR and technical and administrative contacts) using an automatic procedure; for example in order to determine the category of the applicant, the automatic procedure verified whether a ORG field (organization name) and a DESCR field (description of the organization registering the domain name) were present and if there were, depending on values of these fields, classified it as a firm. If the ORG or DESCR fields were wrong, the LAR (is a Letter of Assumption of Responsibility through which the applicant assumes full civil and penal responsibility for the use of the domain name requested) database (semi-automatic procedure) was consulted. Finally, where LAR information was not enough accurate, the Italian Chamber of Commerce database was consulted.

Approximately 1,000,000 domain names were analyzed and grouped into several categories (individuals, firms, universities, associations, public groups and other registrants). In this paper particular attention, as mentioned above, was paid to the registration of domain names by firms. To be able to register a domain name under the "it." ccTLD, firms must send to the Italian Registry a LAR. The LARs currently available differ according to the type of the applicant (individual ,association/foundation, public administration, professionals, companies).

Moreover, to reduce the aforementioned disadvantages regarding the overestimation of Internet diffusion when using domain names as a yardstick (in other words, if an organization has registered multiple domain names) in this paper only the first one registered in the order of data has been taken into account.
From this research performed up to December 31, 2004, it was established that the number of domains registered by firms came to 411,339 of which 407,030 were registered by Italian firms and 4,309 by foreign firms. Furthermore, 1,944 domains registered by Italian firms were not classified since it was impossible to discover the province of origin.

3. RESULTS

To measure the digital divide among Italian regions (Italy is divided into 20 regions) we utilized as metrics the number of domain names registered by firms under the ccTLD ".it", the penetration rate calculated every 100 firms, the index calculated by Zook and the Gini index (Gini, 1960).

The Zook index "Domain name Specialization Ratio" is "a useful technique for comparing regions which indicates the extent to which a region is specialized in domain names compared to the United States as a whole" (Zook, 1999).

That index has been used by Mattew Zook to define the digital divide in the United States

utilizing as metrics the number of domains registered by the firms under the ccTLD ."com" (Zook, 1999, 2000, 2001) and it is calculated in the following way:

Domain name Specialization Ratio =

(Number of .it domains in a region / Number of firms in that region) divided by

(Number of .it domains in a country/ Number of firms in a country)

An index value greater than one indicates a higher specialization than the national average and an index value less than one indicates a lack of specialization.

The penetration rate formula is as follows:

Penetration rate = (Number of .it domains in a region* 100)/Number of firms in that region

Our research shows and as literature suggests, even if some regions have a high specialization rate compared to the national average (for example Lombardy, Trentino Alto Adige, Tuscany, Latium) the variance among the analyzed regions could be extreme (Zook, 1999).

As mentioned before, an additional measure that was adopted in order to verify the existence of digital divide in Italy is the Gini concentration index. The Gini index assumes values equal to 1 and 0. Value 0 indicates a situation of equidistribution and 1 signifies the maximum concentration. The aim of the so-called "statistical theory of concentration" is to furnish tools and techniques for measuring the concentration in concrete situations or for comparing the degree of concentration among heterogeneous situations.

The Gini index calculated on the number of registered domains (that number should not be confused with the above mentioned penetration rate) confirms the above mentioned results. Only firms with head offices in some provinces of Italy register a high number of domains while firms with head offices in other provinces (especially in the South of Italy) shows scarcely significant percentages. The first ten Italian firms with head offices in a particular province (over 103) register nearly half of the domains compared to the national totality (43.74%).

The study also compares the number of domains registered by firms with the total income of the province itself and with the number of firms of the province this analysis allow to verify if the distribution of the registered domains is similar to the number of the existing firms and income distribution. In other words we wanted to verify if the Italian areas that are the richest and the most industrialized are also the most inclined to use the Internet.

Table 1 shows that the Gini index, calculated on the number of the registered domains is higher than the index calculated according to income and number of firms; this to signify that in Italy the most industrialized and richest provinces not always come first in the registration of domain names.

Table 1. Gini concentration ratio

Gini index	
No. of registered domains	0.543
Number of firms	0.468
Total income provinces	0.466

A first conclusion, that comes from the observation of the above mentioned results, is that the Internet cannot be considered as a spreading phenomenon capable of closing the gap among Italian regions and provinces: domain names distributions proves to be more concentrated than the income level and the number of firms, this to signify that the Internet is far from being an equalizer, it rather intensifies the differences among Italian areas.

3.1 Factors that cause the digital divide

To identify the key factors contributing to the existence of the digital divide at a regional level (the survey has been conducted at a regional level and not at a provincial level as many variables were available only at a regional level) we identified five models:

Model 1: stepwise regression taking as dependent variable the penetration rate calculated every 100 firms and as independent variables economic indicators;

Model 2: stepwise regression taking as independent variables indicators that express the cultural liveliness of a given region;

Model 3: stepwise regression taking as independent variables indicators that express the educational attainment of a given region;

Model 4: stepwise regression that takes into consideration demographic indicators;

Model 5: stepwise regression that takes into consideration as independent variables indicators connected to the ICT.

In the stepwise regression the independent variables are inserted in the equation if the F probability is of <= 0.050 while they are removed from the equation if the F probability is of >= 0.100.

Nevertheless the models 1, 2, 3 ,4, 5 show the multicollinearity problem: the variables studied in each model could be correlated to the independent variables examined in the other models generating an evaluation distortion. For example the independent variable number of registered patents of model 1 could be correlated in a positive or negative way to the independent variable number of employees devoted to research and development of model 3.

3.1.1 Model 1

Model 1's purpose is to verify if the disadvantaged areas in terms of economic development are also disadvantaged in terms of Internet diffusion.

In this model the only significant variable that expresses the variance for the 64.4% of Internet diffusion among Italian regions is the added value per employee (see table 2). The rest of the variables analyzed in the model (see table 3) prove to be scantly significant as they do not reflect the literature(Chinn and Fairlie, 2004; Hargittai, 1999; Guillèn & Suarèz, 2001, Maitland & Bauer, 2001, Norris, 2001). Besides, although the above mentioned variables prove to be little significant in expressing variance at a regional level, the economic indicators such as total income, per capita income, number of registered patents every 100 firms and the percentage of big firms are positively correlated to the penetration rate. Table 3 indicates the above described trend.

Table 2. Coefficients (a) F= 32.62 SIG. = 0.000 R2 = 0.644

Model		Non standardized coefficients		Standardized coefficients		
		B	Standard Error	Beta	t	Sig.
1	(Constant)	-13.383	3.909		-3.423	.003
	added value per employee.	.000	.000	.803	5.711	.000

a dependent variable: Penetration rate

Table 3. Pearson's correlation matrix

	Penetration	added value per employee.	Percentage big firms	Total income	Per capita income	Registered patents every 100 firms
Penetration	1.000					
Added value per employee.	0.803**	1.000				
Percentage big firms	0.539*	0.637**	1.000			
Total income	0.480*	0.510*	0.921**	1.000		
Per capita income	0.737**	0.828**	0.314	0.166	1.000	
Registered patents every 100 firms	0.702*	0.717**	0.701**	0.611**	0.478*	1.000

** the correlation is significant at the 0.01 level; * the correlation is significant at the 0.05 level

3.1.2 Model 2

The model 2 seems to confirm to a slight extent the combination between technological indicators and cultural indicators (Florida, 2002).The results are shown in table 4.

Table 4. Coefficients (a) – R2 = 0.34 F = 9.442

Model		Non standardized coefficients		Standardized coefficients	t	sig.
		B	Standard Error	Beta		
2	(Constant)	7.464	.663		11.266	.000
	spending in theatres and music	3.557E-05	.000	.587	3.073	.007

a dependent variable: Penetration rate

Although the model is rather plain, it expresses only the 34% of the ICT diffusion variance among Italian regions, the independent variable have a statistically significant positive effect in the ICT diffusion.
The H5 hypothesis is confirmed: the Internet is diffused in Italy among regions with a higher spending in theatres and music (Beta is equal to 0.587).

3.1.3 Model 3

Table 5 shows that the educational attainment plays an important role in the ICT diffusion among firms, the model expresses the 93.4% of the Internet variance diffusion among Italian regions: regions with a number of employees devoted to research and development and with a higher number of Providers/Maintainers (the Providers/Maintainers are the companies registering a .it domain name for somebody else, offering connection to the Internet services, managing electronic mail and so on - in practice they are the companies specialized in the ICT services) are more inclined to utilize the new technology.

Table 5. Coefficients (a) - R2=0.938 F=56.58 Sig.=0.000

Model		Non standardized coefficients		Standardized coefficients	t	Sig.
		B	Standard Error	Beta		
3	(Constant)	8.422	1.015		8.294	.000
	Providers/Maintainers every 1000 firms	29.844	3.663	.702	8.148	.000
	graduates in technical scientific subjects	-.086	.015	-.430	-5.849	.000
	number of graduates every 1000 inhabitants	-.033	.011	-.232	-2.884	.011
	number of employees devoted to research and development	.442	.175	.195	2.518	.024

a dependent variable: Penetration rate

Besides, a worth mentioning result according to us, is that the number of graduate people, unlike the other variables expressing the educational attainment level at a regional level, cannot be considered as a factor that affects Internet diffusion among firms, the beta tanking into consideration the number of graduates every 1000 inhabitants proves to be negative and significantly different from zero (the beta is equal to -0.232 at a significance level 0.01) (see table 5). This means that regions with a high level of educational attainment calculated in terms of graduates, register a lower penetration rate. This trend is explained by the fact that in less industrialized areas and where job opportunities are scanty, 19 years old youngsters continue their studies and tend to graduate with the hope of finding a job more easily (usually they find jobs in the North or in the Center of Italy anyway) while in the northern and central regions that are more industrialized and where there are wider job opportunities young individuals tend no to continue their studies and start working usually soon after secondary-school diploma.

3.1.4   Model 4

Model 4 shows that there exist a linear relation between the demographic indicator and the registered penetration rate (that model expresses the variance of the 68% of the Internet diffusion).

Regions with a high jobless rate are less inclined to utilize the new technology, the correlation between the penetration rate and the jobless rate proves to be negative and significantly different from zero, the beta is equal to -0754 (see table 6).

Table 6. Coefficients (a) - R2 = 0.680 F = 18.079 Sig. 0.000

Model		Non standardized coefficients		Standardized coefficients	t	Sig.
		B	Standard Error.	Beta		
4	(Constant)	10.239	.719		14.231	.000
	Jobless rate	-.263	.048	-.754	-5.488	.000
	Residing population	4.154E-07	.000	.375	2.731	.014

a dependent variable: Penetration rate

3.1.5 Model 5

As it could be expected even the model 5 is confirmed: the infrastructure supply is a good magnitude to measure the existence of the digital divide: the technological indicator has also a statistically significant positive effect on the ICT diffusion (see table 7), in addition the correlation between the penetration rate and the indicator that expresses infrastructures in ICT proves to be positive and significant to a 0.001 level, (the beta is equal to 0.673) this means that some regions with a high investment in IT register also a high penetration rate.

Besides, even the above mentioned model expresses a variance of only 45% of ICT diffusion among Italian regions.

A first conclusion is that even if in Italy, as literature suggest (Guillén and Suaréz, 2001; Kiiski and Pohjola, 2002; Chinn and Fairlie, 2004), infrastructures play an important role in determining the digital divide; economic indicators and indicators related to the educational attainment are also important to explain the differences about Internet use among Italian regions.

Table 7. Coefficients (a) - R2=0.45 F=14.878 Sig. = 0.001

Model		Non standardized coefficients		Standardized coefficients	t	Sig.
		B	Standard Error.	Beta		
5		4.705	1.162		4.047	.001
	Ratio of IT expenditure in each region and number of firm in that region	1.077	.279	.673	3.857	.001

a dependent variable: Penetration rate

4.   CONCLUSION

Our paper aimed to analyze the factors causing the existence of the digital divide in Italy. The econometric analysis shows that the indicators related to education, in particular the number of firms specialized in the ICT services sale, substantially contributes to the existence of the digital divide among firms that have their head offices in a given region and, as economic literature suggests (De Arcangelis et al., 2002), also the number of employees devoted to research and development becomes a crucial element.

Another key factor causing the existence of a digital divide in Italy, according to the results obtained by other researches (Kiiski and Pohjola, 2002) is determined by economic indicators. Especially in Italy the added value per employee is a variable that significantly expresses Internet diffusion among Italian firms variance. Although the technological indicator, calculated according to investments in IT among Italian regions, is an important factor contributing to the existence of the digital divide in Italy, it does not express significantly the variance of Internet diffusion at a regional level. This result disagree with some researchers.: Chen, Boase e Wellman 2002, and UCLA, 2000, 2003, for example, finds that, in addition to income, access costs are strong predictors of Internet use.

Finally, according to the results obtained we want to highlight that in Italy in disagreement with other researchers (U.S. Department of Commerce, 1999 and Chinn and Fairlie, 2004), even if the variable showing the educational attainment at a regional level (i.e. the number of graduates calculated every 1000 individuals) has also a statistically significant effect in the ICT diffusion, the correlation between this variable and the penetration rate registered by firms in a given region prove to be highly negative. This means that the regions with a high number of graduates, in proportion to the residing population, are the less inclined regions to utilize the new technology.

However, the results obtained in this paper illustrates the factors contributing to the existence of the digital divide at a regional level, utilizing as metrics the number of domains registered by firms. It is obvious that dealing with firms, instead of the number of graduates, economic and educational indicators, such as the number of employees devoted to research and development or the providers/maintainers number are the best elements contributing to the existence of the digital divide among firms. On this point, in a future research, it would be desirable to analyze Internet diffusion in Italy among individuals and to compare the results obtained with the analysis carried out in this paper. In conclusion, the digital divide in Italy depends on the educational attainment level on regions that are productively efficient (that efficiency is calculated in terms of added value per employee) and with a low jobless rate.

Besides, in this paper not only we identified the factors contributing to the existence of the digital divide, but also, analyzing data, we observed the presence of a serious issue: Italian regions with a low economic development and regions with a wide jobless rate appear to be underdeveloped even from a technological point of view. The difference between those who use the Internet and those who do not is another factor that contributes to the widening of the gap that makes geographical areas uneven (Northern and Central areas of Italy not only are more industrialized, richer with a high productive efficiency and in the forefront compared to Southern ones, but are also the areas that have higher penetration rates). In the first instance the Internet could be a pervasive phenomenon justified by the decentralized, non-hierarchical, immaterial nature of the Internet technology (Negroponte, 1995), which in principle should not have strong barriers to entry as it happens in manufacturing (for example if a new manufacturing company decides to enter a highly competitive sector of the market, barriers could be represented by big companies with strong contractual powers or by high investments costs required to enter the market). This to mean that everyone in Italy could use the Internet to exploit its potentials seeing due to its low access costs. Besides Internet is a resource that if used by an individual, this does not reduce the possibilities of being used by someone else (immaterial nature), but on the contrary it brings benefit not only to that individual but also to all the users (net externality, Metcalfe law) (Hansons, 2000). Data show that this effect does not take place at all at a provincial level. Domains are even more concentrated than the number of firms and income. A ranking of provinces by penetration rate, shows that the distribution of Internet follows large differences in the level of income: even if some provinces have a high number of firms and high income, not always they are also the first in terms of registered penetration rate. Before drawing conclusions, these data should be compared to those on the use of domains by individuals, and this comparison is currently in progress. Our preliminary conclusion is that, far from being an "equalizer", Internet technology follows and possibly sharpens existing differences in economic opportunities within industrialized countries like Italy.

REFERENCES

Bassi, M.C. (2002) "La Catalogazione delle Risorse Informative in Internet", Prefazione di Riccardo Ridi.

Bauer, Johannes M., Michel Berne, and Carleen F. Maitland. (2002). "Internet Access in the European Union and in the United States. " Telematics and Informatics 19:117-137.

Beilock, Richard, and Daniela V. Dimitrova. (2003). "An Exploratory Model of Inter-Country Internet Diffusion." Telecommunications Policy 27:237-252.

Castells Manuel. 2001. The Internet Galaxy. New York: Oxford University Press.

Chinn, M. D. and R.W. Fairlie. (2004). The determinants of the Global Digital Divide: A Cross-Country Analysis of Computer And Internet Penetration. Madison, WI, University of Wisconsis, Madison and NBER.

Coffman K.G. and Odlyzko A.M. (2001). Internet growth. AT&T Labs report.

De Arcangelis, Jona-Lasinio C., Manzocchi S. (2002) "Sectoral Determinants and Dynamics Of ICT Investment in Italy"- EEA 2002 Annual Meeting, Venice, 22-24 August 2002.

Diez-Picazo G.F. (1999). An Analysis of International Internet Diffusion. Ph.D. Thesis, MIT.

Florida R. (2002). "The rise of the creative class". Basic Books, New York, NY.

Gilder, George. (2000). Telecosm: How Infinite Bandwidth will Revolutionize the World. New York: Free Press.

Gini, C. (1960), Statistics, Edizioni Metron, Roma.

Guillén, Mauro F., and Sandra L. Suárez. (2001). "Developing the Internet: Entrepreneurship and Public Policy in Ireland, Singapore, Argentina, and Spain." Telecommunications Policy 25:349-371.

Guillèn, Mauro F., and Sandra L. Suaréz. (2004). "Explaining the global digital divide: Economic, Political, and Sociological drivers of cross-national Internet use". The Wharton School, University Of Pennsylvania, Philadelphia.

Hansons W. (2000). "Internet marketing" ed. Tecniche Nuove, Milano.

Hargittai, E. (1999) "Weaving the Western Web: Explaining differences in Internet connectivity among OECD countries. " Telecommunication Policy 23:701-718.

Hoffman, D. & Novak, T. (1999). Building contrust online. Communications of the ACM, 42 (april),80-85.

ITU, International Telecommunication Union. (2003). World Telecomunications Indicators: Database. http://www.itu.int/ti/pubblications/world/world.htm.

Kirkman, Geoffrey S., Peter K. Cornelius, Jeffrey D. Sachs, and Klaus Schwab. eds. (2002). Global Information Technology Report 2001-2002 . New York: Oxford University Press.

Kiiski, Sampsa, and Matti Pohjola. (2002). "Cross-Country diffusion of the Internet." Information Economics and Policy 14:297-310.

Naldi M. (1997). Size estimation and growth forecast of the Internet. Centro Volterra, Tor Vergata.

Negroponte. (1995). "Being Digital" Knopf,k New York, NJ, USA.

Norris, P. (2001). Digital divide: Civic Engagement, Information Poverty, and the Internet Worldwide. New York: Cambridge University Press.

NUA, Network Users Association. (2002). How Many Online? Accessed on September, 2002, http://www.nua.com/surveys/how_many_online/index.html.

RIPE-NCC, RIPE Network Coordination Centre, http://www.ripe.net.

Rogers. (2001). "The digital divide". New York: Free Press

Tapscott, Don, and Art Caston. (1993). Paradigm Shift: The New Promise of Information Technology. New York: McGraw-Hill.

UCLA. (2000). Surveying the Digital Future. Los Angeles, CA: UCLA Center for Communication Policy. www.ccp.ucla.edu

UCLA. (2003). Surveying the Digital Future: Year Three. Los Angeles: UCLA Center for Communication Policy. www.ccp.ucla.edu

U.S. Department of Commerce. (1999). Falling through the Net: Defining the Digital Divide. Washington, DC: U.S. Department of Commerce.

Warschauer M. (2001), What is the digital divide?, University of California

Zook M.A. (1999). The Web of Consumption: Spatial Organization of the Internet Industry in the United States. American Behavioral Scientist (forthcoming).

Zook, M.A. (2000) Internet metrics: using host and domain counts to map the Internet Telecommunications Policy 24:6-7.

Zook M. A. (2001). Old hierarchies or new network of Centrality? - The Global Geography of the Internet Content Market. American Behavioral Scientists, 44 (Special Issue: Mapping the global Web).

DEVELOPING AN e-SATISFACTION SCALE FOR INTERNET SERVICES (WEBSAT)– A COMPARATIVE STUDY WITH SERVQUAL SCALE

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ABSTRACT

Internet customer satisfaction measurement is an area of growing interest to researchers and e-marketers. This paper presents an alternative scale of customer satisfaction with Internet service - WEBSAT. A multidimensional measure of perceived Internet service satisfaction was developed and applied to an online survey, and was administered to a sample of Internet customers. Based on e-satisfaction antecedents, the critical dimensions and items were organized to find the best correspondence and relative importance with SERVQUAL scale. The factorial analysis results demonstrate a six-factor structure representative of Internet customer satisfaction. Contrarily to the SERVQUAL dimensions, the new measures became less reliant on interpersonal interactions and more technologically relevant. A new dimension also emerged that reflects customers' concerns for the absence of real environment and personal contact (facelessness). The study conclusions and recommendations suggest that e-satisfaction scale must be improved and validated in future researches, to become a standard measure of customer satisfaction of Internet services.

KEYWORDS

Internet services, customer satisfaction, SERVQUAL, e-Satisfaction scale.

1. INTRODUCTION

Internet intensive use is driving commerce and services to another market space: advantages related to the cost reduction of information search at Web (i.e. economy, time travel, speed, accessibility, convenience), without barriers (i.e. geographical, language or time), with access to a virtually unlimited market at virtually zero cost, are the principal drivers of the Internet information search and purchase. Consequently, services and products are increasingly being delivered in a non-traditional fashion, via Internet, without an in-person interaction with personal sails. Moreover, information search and purchasing on the Internet require a level of computer literacy not required in a traditional services or retail. Without this level of technical literacy, consumers can become frustrated and purchases intentions can be aborted (critical incident technique: technological or client failure, Meuter et al, 2000). Online retailing also entails new and different security and privacy problems for the consumer, such as credit card fraud by hackers and, the use of unauthorized personal information in promotional targeting.

Service quality has frequently been evaluated in terms of five dimensions: tangibility, reliability, responsiveness, assurance, and empathy using the SERVQUAL scale (Parasuraman et al., 1988). Some researchers observe that the majority of the scale items used to measure these dimensions are related to the human interaction aspect of service delivery (Bitner, 1990), and are not adapted to other services industries. Without this human interaction component in the electronic delivery of services, consumers must either evaluate these dimensions differently or rely upon different dimensions. For example, consumers may not be

able to discern the attitude of the service provider in an Internet encounter in the same way they would in a person-to-person interaction. In addition, retail Web pages do business 24 hours a day, seven days a week without the bounds of geography while, the traditional retail stores has specific operating hours and usually attracts local customers. Finally, the electronic problems of heavy traffic and advertising contents can slow down the search and purchase process, and affect customer purchase intention.

The relation between customer satisfaction and service quality has been a large discussion on marketing literature. Studies show that perceived quality is an antecedent of satisfaction, and satisfaction is a more powerful predictor of future customer behaviour. (Cronin & Taylor, 1992, 1994; Taylor & Baker, 1994) and firms that achieve high customer satisfaction enjoy high profitability (Anderson et al., 1994). Thus, is crucial to understand the critical dimensions of Internet customers' satisfaction, in order to achieve the customer retention; online firms need loyal customers who will make multiple purchase over time, and make profits. It is also an area characterized by debate concerning the need for measuring customer satisfaction and how to measure it. It is acknowledged that, observing and tracking individuals during web site visits (i.e. time spent online, frequency of web sites visits, favourites, aborted purchase decisions, etc.) are a limited way to measure purchase behaviour, consumer satisfaction or Web sites performances (Szymanski & Hise, 2000).

Based upon the problematic and investigation relevance of Internet services, the main purpose of this study is to identify the perceptual dimensions and elements of customer satisfaction with Internet services, adapted to the electronic services context, strongly intangible, using a virtual environment which excludes any kind of human contact. Specifically, we analyse the antecedents of e-satisfaction more relevant, focused on Web sites characteristics and attributes, with more impact on customer satisfaction. Then we use the newly developed items to create a measure of customer satisfaction, appropriate for online services, organized and compared to the SERVQUAL structure dimensions. Following, the background issues relevant to measure customer satisfaction with Internet services are briefly presented.

1.1. The SERVQUAL measures

The original SERVQUAL scale developed by Parasuraman et al. (1988) consists in 22 items representing 5 dimensions of service quality: *tangibles* (physical facilities, equipment and appearance of personnel), *reliability* (ability to perform the promised service dependably and accurately), *responsiveness* (willingness to help customers and provide the prompt service), *assurance* (knowledge and courtesy of employees and their ability to inspire trust and confidence) and *empathy* (caring, individualized attention the firm provides its customers). The SERVQUAL scale has been used in several studies and tested in different services industries. Parasuraman et al. (1991) recognize that service quality must be adapted to other services environments and the scale items refined. The SERVQUAL scale revised demonstrates a different relative importance of each service quality dimension: *reliability* and *responsiveness* appears as the most important dimensions, followed by *assurance* and *tangibles*. Additionally, they find a dichotomy of the *tangibles* elements into "facilities and equipments" and "employees" suggesting a six-factor structure.

More recently, Parasuraman et al. (1994) conclude that SERVQUAL scale is an appropriate instrument to measure both, service quality and costumer satisfaction and, since SERVQUAL reveals consumers' global perceptions of a firm's service quality, future modifications of the scale could take transaction-specific service quality into account. Notice, that different researchers consider that, it is possible to adapt the scale, to a high degree of customer participation in services delivery (Bitner, 1990), or to a self-service based on new technology (Dabholkar, 1996), since they represent a unique way of service delivery, and the classical models dimensions of service quality may be not applied. Mehta et al. (2000) use SERVQUAL scale in a study, applied to retail stores (i.e. pure product), resulting in a considerable change of the original items and dimensions equilibrium. Parasuraman et al. (1994) recognize that service quality is a multifaceted construct and no agreement exits as to the number of dimensions or their interrelationships. These argues basically sustains the need to develop multiple scale items that adequately capture a particular study context.

SERVQUAL scale is comprised two sets of matched items measuring customer expectations and perceptions of service quality, using a seven points scale (Strongly disagree ….. Strongly agree). Although, Cronin and Taylor (1992, 1994) argue that measuring customer perceptions is sufficient, and SERVPERF model (unweighed) has a better performance in measuring both, service quality and customer satisfaction. Also they conclude that customer satisfaction strongly predicts customer behaviour, than service quality, confirming the hypothesis that service quality is an antecedent of customer satisfaction.

1.2 Antecedents of e-Satisfaction

Internet customer satisfaction is a recently area of investigation. Much of the research concentrates on challenge to identify the drivers of customer satisfaction, that is, in this context the "e-satisfaction" within online services. On Table 1 we present a review of prior researches, which investigated customers´ e-satisfaction and have developed scales to measure online service quality and customer satisfaction with Internet shopping.

Table 1. Antecedents drivers of e-satisfaction

Authors / Dependent Variable	Drivers	Comments
Zeithaml et al. (2000) e-Service Quality	Perceived convenience (access, ease of navigation, efficiency, flexibility). Perceived control (reliability, personalization, security/privacy).	Paper was conceptual. Capture the new elements of the online environment witch underlie acceptance and adoption of Internet.
Szymanski and Hise (2000) e-Satisfaction	Convenience Site design Financial security Product information	The authors consider that other relevant variables should be included as predictors of e-satisfaction in future researches.
Kim and Lim (2001) Satisfaction with Web Site Attributes	Entertainment Speed Information quality Reliability	Consumers' perceived importance of Web site attributes includes "Convenience".
Yoo and Donthu (2001) SITEQUAL (Internet Shopping Quality)	Site-related factors (ease of use, aesthetic design, processing speed, security) Vendor-related factors (competitive values, clarity of ordering, corporate and brand equity, product uniqueness, product quality assurance)	A validation study indicated that SITEQUAL was directly correlated to shopping likelihood, attitude and loyalty.
Francis and White (2002) PIRQUAL (Perceived Internet Retail Quality Model)	Web store functionality Product attribute description Ownership conditions Delivered products Customer service Security	Results confirm the proposition that online satisfaction was function of the purchase experience, the delivery experience and the customer service (e.g. responsiveness, fix problems) / security experience.
Loiacono et al. (2002) WebQual ™ (Web site Quality)	Ease of use (ease of understanding, operations) Usefulness (informational fit-to-task, interactivity, trust, response time) Entertainment (visual appeal, innovativeness, flow emotional appeal) Complementary relationship (consistent image, online completeness, better than other channels)	Measures used to evaluate Web site quality are based on web site characteristics and attributes. Web site quality predicts Web site reuse.
Yang et al. (2003) Internet Purchasing Service Quality	Responsiveness Credibility Ease of use Reliability Convenience	The authors identify a total of 14 dimensions and 42 sub-dimensions of Internet service quality. Although only five are the principal drivers of customer satisfaction.
Bansal et al. (2004) Web Site Overall Satisfaction	Web site characteristics (ease of use, information available, product selection, price, transaction duration) Customer service (shipping & handling)	Web site characteristics were the major driver of overall Web site satisfaction while customer service played a significant but lesser role.
Long and McMellon (2004) Retail Internet Site Overall Quality	Tangibility (easy to navigate, to find the products, presented the information you needed and clear) Assurance (secure for transactions, gave privacy) Reliability (provides service at the time they say) Purchasing process (return policy, order cancellation easy, variety of shipping options) Responsiveness (technical support online to help customers).	Based on SERVQUAL scale, these study identifies broad themes that cut across online service and retail shopping encounters. Only 19 items were reliable using Cronbach's alpha.

2. THE STUDY

2.1 The variables, measures and inquiry process

In a first stage, we analyze the more critical drivers to e-satisfaction (more quoted on literature reviewed – Table 1) in order to identify and reproduce the more relevant Internet specific dimensions, which potentially affect Internet costumer's e-satisfaction. The newly 22 items were organized and compared to SERVQUAL dimensions, resulting totally different because they are specific from an electronic service environment (i.e. customer-machine interaction without any employee assistance in service delivery process).

To assist in organizing the items, we use the revised SERVQUAL battery (Parasuraman et al., 1994), with the purpose to reflect the same structure constructs and equilibrium of items (see Table 2), instead a perfect match of scale items, because they are not industry specific. The initial framework results in three dimensions that fit in SERVQUAL (i.e. reliability, assurance and empathy); the two others label dimensions are specific to Web site characteristics and convenience of Internet use (cited in the majority of the studies), and they correspond respectively to "tangibles" and "responsiveness". These five dimensions would also serve as comparison to the final scale developed in order to aid understanding of the differences between face-to-face and Internet customer satisfaction (as discussed further on).

Table 2. e-Satisfaction scale adapted to Servqual scale – an initial framework

Panel 1 – SERVQUAL scale	Panel 2 – e-Satisfaction scale
Reliability	**Reliability**
1. Providing services as promised	1. Information diversity
2. Dependability in handling customer's service problems	2. Information depth
3. Performing services right the first time	3. Up-to-date information
4. Providing services at the promised time	4. Search result
5. Maintaining error-free records	5. Easy browsing
	6. Easiness in comparing information
Responsiveness	**Convenience**
6. Keeping customers informed about when services will be performed	7. Easy access
7. Prompt service to customers	8. Economy of time spent
8. Willingness to help customers	9. Effort spent
9. Readiness to respond to customers´ requests	10. Fast information transmission
	11. Personal contact absence
Assurance	**Assurance**
10. Employees who instill confidence in customers	12. Data transmission assurance
11. Making customers feel safe in their transactions	13. Privacy
12. Employees who are consistently courteous	
13. Employees who have the knowledge to answer customer questions	
Empathy	**Empathy**
14. Giving customers individual attention	14. Pleasant browsing
15. Employees who deal with customers in a caring fashion	15. Interesting places to visit
16. Having the customer´s best interest at heart	16. Entertainment and leisure
17. Employees who understand the needs of their customers	17. Capacity of simulating reality
18. Convenient business hours	
Tangibles	**Site Design**
19. Modern equipment	18. Uncluttered web pages
20. Visually appealing facilities	19. Easy search paths
21. Employees who have a neat, professional appearance	20. Attractive presentation
22. Visually appealing materials associated with the service	21. Advertising contents
	22. Interaction capacity

Panel 1 - Source: Parasuraman et al. (1994).

The resulting scale items (Table 2 – Panel 2) were applied to an electronic survey (to be consistent with the research objective) and than, tested with Internet customers examining their satisfactory experiences. Values on satisfaction are interpreted directly as performance measures (as proposed in unweighted Servperf model due to its claimed superior performance, Cronin & Taylor, 1992, 1994). A Likert scale of five points

reversed is used (5=High Satisfaction….1= Low Satisfaction), which is referred on marketing literature, as an appropriate metric and easy to answer too.

The sampling method consists on a simple random sample extraction of 1318 individuals (e.mails), clients from an Internet service provider - Telepac (Portugal Continental and Islands).

Inquiry process consisted on a pre-contact message send to the 1318 e-mails addresses, including a hyperlink to Faculty web page, which permitted a direct and private access to the survey, and excluded any random access of non-selected individuals. Data survey was automatically entered in a database (programmed to exclude unrecognized e-mails and multiple or incomplete queries) minimizing missing data and doing a validation and depuration job. Finally 115 valid queries were received, between June-July 2002.

Respondents, in its majority, are males, aged between 30-49, married, with high level education and professional degree, residing in urban centers, and have a significant experience of Internet use (5-15 hours per week). About 67% of the individuals have Internet purchase experience, mainly, books, magazines, newspapers, CD´s, videos, Pc´s software, traveling and financial products and services. Notice that these products categories are more frequently referenced on literature, as the most purchased via Internet.

2.2 Factorial analysis results

Factorial analysis (using SPSS principal components method) applied to the 22 initial variables representing customer satisfaction with Internet service, were used to examine the dimensionality of the scale. After a Varimax rotation for clearer interpretation of the components, the results allows to identify the following ranked 6 significant factors, extracted by a decreasing quantity of explained variance and, eigen value $\geq$ 1 criteria (Kaiser, 1951): Information reliability (6 items), Convenience (5 items), Entertainment (5 items), Assurance (2 items), Site Design (2 items) and Virtual Environment (2 items). We use a 0.5 cutoff value for loading scores (Sharma, 1996) to identify the component. The six-component solution accounted for 64,1% of variance. As a second check, we also examined a five-component solution, to better fit in SERVQUAL structure, but the loss of the explained variance (59%), allows to accept the six-component results. The varimax rotated scale items and component loadings are presented on Table 3.

Table 3. Factor analysis results of e-Satisfaction scale

Factor	Survey Item	Loading	Eigen value	Variance (%)
Information Reliability	1- Up-to-date information	0.834	6.015	27.340
	2- Information depth	0.768		
	3- Search result	0.736		
	4- Uncluttered web pages	0.568		
	5- Easy search paths	0.511		
	6- Easiness in comparing information.	0.484*		
Convenience	7- Economy of time spent	0.829	2.440	11.092
	8- Effort spent	0.761		
	9- Easy access	0.710		
	10- Fast information transmission	0.684		
	11- Interaction capacity	0.535		
Entertainment	12- Interesting places to visit	0.789	1.684	7.655
	13- Pleasant browsing	0.774		
	14- Entertainment and leisure	0.606		
	15- Easy browsing	0.612		
	16- Information diversity	0.472*		
Assurance	17- Data transmission assurance	0.903	1.505	6.825
	18- Privacy	0.887		
Site Design	19-Advertising contents	0.751	1.382	6.282
	20-Attractive presentation	0.713		
Virtual Environment	21- Capacity of simulating reality	0.715	1.083	4.922
	22- Personal contact absence	0.679		

Method: Varimax rotation. *Loadings < 0.5.
Total Variance 64,117 %; KMO 0,768 and Bartlett's Test (p-value) 1003,148 (0.000).

2.3 Discussion

The newly developed scale consists on six dimensions that are now more context specific to Internet service satisfaction. Contrarily to the initial framework a new dimension "virtual environment" emerged revealing the potential consumers constraints and insecurities that may grow out of a faceless, without a physical evidence of service or products and geographically distant purchase process, versus the local store where a consumer enter and see the salesperson, facilities and can see or experiment the product. Consequently, the intangible nature of electronic environment is very critical to e-satisfaction because it is related to the absence of personal contact and the capacity to reproduce real environment. It was also founded that the increases of "virtual environment" on Internet service has a negative impact on e-satisfaction (Torres and Martins, 2004). Parasuraman et al. (1994) also find a six-factor dimension in their revised SERVQUAL model, suggesting a dichotomy of the "tangibles" dimension. According to this finding we consider that our scale fit well this dichotomy: "site design" is related to the tangibles characteristics of web sites and "virtual environment" capture the intangibles elements of Internet service.

The other four dimensions reflect (in the same order) the relative importance proposed on SERVQUAL revised (Parasuraman et al., 1994): "reliability", the principal component representing e-satisfaction, is related to confidence of information contents (depth and up-to-date information), search results and perceived ease of use of Internet service, putting more emphasis on customer participation self-service delivery process, than on employees performances. Most of the search results are dependent on individuals capacity of Internet use and affects customer's satisfaction. As the Internet information search precedes the intention to buy at the Internet, consequently information reliability plays a strategic role on Internet purchase process.

"Convenience" corresponds in SERVQUAL scale to responsiveness, in delivering service. On consumers' perceptions, "convenience" is more related to Internet service facilities and advantages, compared to traditional retail (reducing total search costs, as time, effort and displacement). Convenience in using Internet services is also perceived by a satisfactory interaction capacity, reflecting the need of consumers to obtain feedback immediately to their questions, replacing the loss of contact with employees.

We change the proposed "empathy" to a new label dimension "entertainment" because we consider that Internet contents related to entertainment and leisure are the principal cause of attractiveness, creating some empathy with Internet use. We also suspect this "affective" component, tend to replace the need of human contact and the depersonalisation of the electronic services and retail. Notice that in prior research "entertainment" is the principal driver of e-satisfaction (Torres and Martins, 2004).

"Assurance" matches with SERVQUAL and, is strongly related with the new concerns and risks of Internet service use (i.e. privacy assurance and websites security policies, p.e. personal data transmission, credit card information), replacing the emphasis on customers' confidence on employees. A majority of the studies suggest "customer security" as an important driver of e-satisfaction and forcibly of future behaviour.

These dimensions reflect aspects of the Internet critical drivers of e-satisfaction, which are mostly dependent on Internet technology advances (i.e. speed, browsers and search engines efficiency, user control, security etc.) and web sites characteristics and offer.
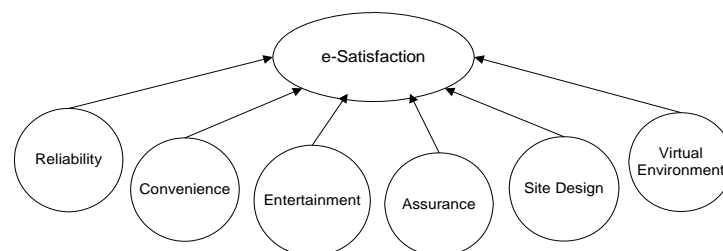

Figure 1. – «WEBSAT» e-Satisfaction scale dimensions

3. CONCLUSION

The new e-satisfaction scale dimensions are strongly related with web sites attributes and Internet technology. While SERVQUAL scale put more emphasis on capacities and performances of employees, the new scale items introduce other elements more relevant of human interaction with computer and self-service technology perceived control, witch affect customer participation results in an electronic service delivery process (Meuter et. al., 2000).

While some of the original SERVQUAL dimensions remained in the online environment, the items used to measure them became less reliant on interpersonal interactions. In addition a new dimension emerged "virtual environment" replacing the tangibles elements importance of traditional services evaluation. Notice, that different researchers consider that, it is possible to adapt the SERVQUAL scale, to a high degree of customer participation in services delivery (Bitner, 1990), or to a self-service based on new technology (Dabholkar, 1996), since they represent a unique way of service delivery, and the classical models dimensions of service quality may be not applied.

We conclude that the results of this study offer support for the associated constructs proposed in antecedents models that examined e-satisfaction (Szymanski and Hise, 2000; Zeithaml et al., 2000; Kim and Lim; 2001; Loiacono et al., 2002). However, the results do highlight the need to improve the scale introducing other critical items of e-satisfaction (i.e. complaining behaviour, customer service) because the absence of person-to-person interaction.

Further research is needed to refine the scale measures and test their reliability and validity, in order to develop a standard measure of customer e-satisfaction that, managers can use to assess their sites and improve the online environment.

Because online customers don't have switching costs is critical to e-marketers to meet customer satisfaction that will be able to maintain customer loyalty and firms' profitability.

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REFERENCES

Sharma, Subhash, 1996. *Applied Multivariate Techniques.* John Wiley & Sons, Inc., U.S.A.

Anderson et al., 1994. Customer Satisfaction, market share and profitability: Findings from Sweden. . *In Journal of Marketing*, Vol. 58, January, pp. 53-66.

Bansal, Harvir S. et al., 2004. Relating e-Satisfaction to Behavioral Outcomes: An Emprical Study. *In Journal of Services Marketing*, Vol. 18 Nº 4, pp. 290-302.

Bitner et al., 1990. The Service Encounter: Diagnosing Favorable and Unfavorable Incidents. *In Journal of Marketing*, Vol. 54, pp.71-84.

Cronin, J. Jr. and S. Taylor, 1992. Measuring Service Quality: A Reexamination and Extension. *In Journal of Marketing*, Vol. 56, Nº 3, pp. 55-68.

_____, 1994. SERVPERF versus SERVQUAL: Reconciling Performance-Based and Perceptions-Minus-Expectations Measurement of Service Quality. *In Journal of Marketing*, Vol. 58, Nº 1, pp. 125-131.

Dabholkar, P. A., 1996. Consumer Evaluations of New Technologies-Based Self-Service Options: An Investigation of Alternative Models of Service Quality. *In International Journal of Research in Marketing*, Vol.13 Nº 1, pp. 29-51.

Donthu N., 2001. Does Your Web Site Measure Up? *In Marketing Management*, November/December, pp. 29-32.

Long, Mary and C. McMellon,, 2004. Exploring the Determinants of Retail Service Quality on the Internet. *In Journal of Services Marketing*, Vol. 18, Nº 1, pp. 78-90.

Mehta, Subhash C. et al., 2000. Service Quality in Retailing: Relative Efficiency of Alternative Measurement Scales for Different Product-Service Environments. *In International Journal of Retail & Distribution Management*, Vol. 28, Nº 2, pp.62-72.

Meuter, M. et al., 2000. Self Service Technologies: Understanding Customer Satisfaction with Technology-Based Service Encounters. *In Journal of Marketing*, Vol. 64, Nº 3, pp. 50-64.

Parasuraman, A. et al., 1988. SERVQUAL: A Multiple-Item Scale for Measuring Customer Perceptions of Service Quality. *In Journal of Retailing*, Vol. 64, Spring, pp. 12-40.

_____ 1991. Refinement and Reassessment of the SERVQUAL Scale. *In Journal of Retailing*, Vol. 67, Nº 4, pp. 420-450.

_____ 1994. Alternative Scales for Measuring Service Quality: A Comparative Assessment Based on Psychometric and Diagnostic Criteria. *In Journal of Retailing*, Vol. 70, Nº 3, pp. 201-230.

Szymanski, D. and R. Hise, 2000. e-Satisfaction: An Initial Examination. *In Journal of Retailing*, Vol. 3 Nº 76, pp. 309-322.

Taylor, S. and T. Baker, 1994. An Assessment of the Relationship Between Service Quality and Customer Satisfaction in the Formation of Consumers' Purchase Intentions. *In Journal of Retailing*, Vol.70, Nº 2, pp. 163-178.

Yang, Z. et al., 2003. Services Quality Dimensions of Internet Retailing: an Exploratory Analysis. *In Journal of Services Marketing*, Vol. 17 Nº 7, pp. 685-700.

Yoo, B, and Donthu, N. 2001. Developing a scale to measure the Perceived Quality of an Internet Shopping Site (SITEQUAL). *In Quarterly Journal of Electronic Commerce*, Vol. 2 Nº 1, pp. 31-45.

Zeithaml et al., 2000. A Conceptual Framework for Understanding e-Service Quality: Implications for Future Research and Managerial Practice. *In working paper, Marketing Science Institute*, Cambridge, MA.

Francis J. L. and White, L., 2002. PIRQUAL: a Scale for Measuring Customer Expectations and Perceptions of Quality in Internet Retailing. *In Proceedings of the Winter Educator's Conference*, American Marketing Association, Chicago, IL, pp.438-443.

Loiacono et al., 2002. WebQual: a Measure of Web Site Quality. *In Proceedings of the Winter Educator's Conference*, American Marketing Association, Chicago, IL, pp.432-437.

Kim, S. Young and Young J. Lim, 2001, Consumers' Perceived Importance of and Satisfaction With Internet Shopping. in Lee, J.K., Schmid, Beat F. Buchet, Brigette: *EM - International Conference on Electronic Commerce -* Special Issue. EM Electronic Markets, Vol.11, Nº 3.

Torres, A. I. and F. V. Martins, 2004. An e-Satisfaction Model – Application to Internet Information Search and Purchase. *Proceedings of the IADIS International Conference e-Commerce*, Lisbon, Portugal, pp. 313- 319.

DRIVERS OF SHOPPING ONLINE: A LITERATURE REVIEW

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ABSTRACT

Consumers are increasingly adopting electronic channels for purchasing. Explaining online consumer behavior is still a major issue as studies available focus on a multiple set of variables and relied on different approaches and theoretical foundations.

Based on previous research two main drivers of online behavior are identified: perceived benefits of online shopping related to utilitarian and hedonic characteristics and perceived risk. Additionally exogenous factors are presented as moderating variables of the relationship between perceived advantages and disadvantages of internet shopping and online consumer behavior.

KEYWORDS

e-commerce; online shopping behavior; perceived benefits; perceived risk; exogenous factors

1. INTRODUCTION

The increasing dependence of firms on e-commerce activities and the recent failure of a large number of dot-com companies stress the challenges of operating through virtual channels and also highlight the need to better understand consumer behavior in online market channels in order to attract and retain consumers.

While performing all the functions of a traditional consumer, in Internet shopping the consumer is simultaneously a computer use as he or she interacts with a system, i.e., a commercial Web site. On the other hand, the physical store has been transformed into Web-based stores that use networks and Internet technology for communications and transactions.

In this sense, there seems to be an understanding that online shopping behavior is fundamentally different from that in conventional retail environment, (Peterson *et al.*, 1997) as e-commerce relies on hypertext Computer Mediated Environments (CMEs) and the interaction customer-supplier is ruled by totally different principles.

Understanding the factors that explain how the consumers interact with the technology, their purchase behavior in electronic channels and their preferences to transact with an electronic vendor on a repeat basis is crucial to identify the main drivers of consumer behavior in online market channels.

Online consumer behavior research is a young and dynamic academic domain that is characterized by a diverse set of variables studied from multiple theoretical perspectives.

Researchers have relied on the Technology Acceptance Model (Davis, 1989: Davis *et al.*, 1989), the Theory of Reasoned Action (Fisbein and Ajzen, 1975), the Theory of Planned Behavior (Ajzen, 1991), Innovation Diffusion Theory (Rogers, 1995), Flow Theory (Czikszentmihalyi, 1998), Marketing, Information Systems and Human Computer Interaction Literature in investigating consumer's adoption and use of electronic commerce.

While these studies individually provide meaningful insights on online consumer behavior, the empirical research in this area is sparse and the lack of a comprehensive understanding of online consumer behavior is still a major issue (Saeed *et al.*, 2003).

Previous research on consumer adoption of Internet shopping (Childers *et al.*, 2001; Dabholkar and Bagozzi, 2002; Doolin *et al.*, 2005; Monsuwé *et al.*; 2004; O´Cass and Fenech, 2002) suggests that

consumers' attitude toward Internet shopping and intention to shop online depends primarily on the perceived features of online shopping and on the perceived risk associated with online purchase. These relationships are moderated by exogenous factors like "consumer traits", "situational factors", "product characteristics" and "previous online shopping experiences".

The outline of this paper is as follow. In the next section an assessment of the basic determinants that positively affect consumers' intention to buy on the Internet is carried out. Second, the main perceived risks of shopping online are identified as factors that have a negative impact on the intention to buy from Internet vendors. Third, since it has been argued that the relationship between consumers' attitude and intentions to buy online is moderate by independent factors, an examination of the influence of these factors is presented. Finally, the main findings, the importance to professionals and researchers and limitations are summarized.

2. PERCEIVED BENEFITS IN ONLINE SHOPPING

According to several authors (Childers *et al*., 2001; Mathwick *et al*., 2001; Menon and Kahn, 2002;) online shopping features can be either consumers' perceptions of functional or utilitarian dimensions, or their perceptions of emotional and hedonic dimensions.

Functional or utilitarian perceptions relates to how effective shopping on the Internet is in helping consumers to accomplish their task, and how easy the Internet as a shopping medium is to use. Implicit to these perceptions is the perceived convenience offered by Internet vendor whereas convenience includes the time and effort saved by consumers when engaging in online shopping (Doolin, 2005; Monsuwé, 2004).

Emotional or hedonic dimensions reflects consumers' perceptions regarding the potential enjoyment or entertainment of Internet shopping (Doolin, 2005; Monsuwé, 2004).

Venkatesh (2000) reported that perceived convenience offered by Internet Vendors has a positive impact on consumers' attitude towards online shopping, as they perceive Internet as a medium that enhances the outcome of their shopping experience in an easy way.

Childers *et al*. (2001) found "enjoyment" to be a consistent and strong predictor of attitude toward online shopping. If consumers enjoy their online shopping experience, they have a more positive attitude toward online shopping, and are more likely to adopt the Internet as a shopping medium.

Vijayasarathy and Jones (2000) showed that Internet shopping convenience, lifestyle compatibility and fun positively influence attitude towards Internet shopping and intention to shop online.

Despite the perceived benefits in online shopping mainly associated with convenience and enjoyment, there a number of possible negative factors associated with the Internet shopping experience. These include the loss of sensory shopping or the loss of social benefits associated with shopping (Vijayasarathy and Jones, 2000).

In their research, Swaminathan *et al*. (1999) found that the lack of social interaction in Internet shopping deterred consumers from purchase online who preferred dealing with people or who treated shopping as a social experience.

3. PERCEIVED RISK IN ONLINE SHOPPING

Although most of the purchase decisions are perceived with some degree of risk, Internet shopping is associated with higher risk by consumers due to its newness and intrinsic characteristics associated to virtual stores where there is no human contact and consumers cannot physically check the quality of a product or monitor the safety and security of sending sensitive personal and financial information while shopping on the Internet (Lee and Turban, 2001).

Several studies reported similar findings that perceived risk negatively influenced consumers' attitude or intention to purchase online (Doolin, 2005; Liu and Wei, 2003; Van der Heidjen *et al*., 2003).

Opposing results were reported in two studies (Corbitt *et al*., 2003; Jarvenpaa *et al*., 1999). The authors found that perceived risk of Internet shopping did not affect willingness to buy from an online store. One of the reasons for this contradictory conclusion might be due to the countries analyzed respectively New Zeeland and Australia where individuals could be more risk-taken or more Internet heavy-users.

In examining the influences on the perceived risk of purchasing online, Pires at al. (2004) stated that no association was found between the frequency of online purchasing and perceived risk, although satisfaction with prior Internet purchases was negatively associated with the perceived risk of intended purchases, but only for low-involvement products. Differences in perceived risk were associated with whether the intended purchase was a good or service and whether it was a high or low-involvement product. The perceived risk of purchasing goods through the Internet is higher than for services. Perceived risk was found to be higher for high-involvement than for low-involvement-products, be they goods or services.

Various types of risk are perceived in purchase decisions, including product risk, security risk and privacy risk.

Product risk is the risk of making a poor or inappropriate purchase decision. Aspects involving product risk can be an inability to compare prices, being unable to return a product, not receiving a product paid for and product not performing as expected (Bhatnagar *et al.*, 2000; Jarvenpaa and Todd, 1997; Tan, 1999; Vijayasarathy and Jones, 2000).

Bhatnagar *et al.* (2000) suggest that the likelihood of purchasing on the Internet decreases with increases in product risk.

Other dimensions of perceived risk related to consumers' perceptions on the Internet as a trustworthy shopping medium. For example, a common perception among consumers is that communicating credit card information over the Internet is inherently risky, due to the possibility of credit card fraud (Bhatnagar *et al.*, 2000; George, 2002; Hoffman *et al.*, (1999); Jarvenpaa and Todd, 1997; Liebermann and Stashevsky, 2002).

Previous studies found that beliefs about trustworthiness of the Internet were associated with positive attitudes toward Internet purchasing (George, 2002; Hoffman *et al.*, (1999); Liebermann and Stashevsky, 2002).

Privacy risk includes the unauthorized acquisition of personal information during Internet use or the provision of personal information collected by companies to third parties.

Perceived privacy risk causes consumers to be reluctant in exchanging personal information with Web providers (Hoffman *et al.*, 1999). The same authors suggest that with increasing privacy concerns, the likelihood of purchasing online decreases. Similarly, George (2002) found that a belief in the privacy of personal information was associated with negative attitudes toward Internet purchasing.

4. EXOGENOUS FACTORS

Based on previous literature review four exogenous factors were reported to be key drivers in moving consumers to ultimately adopt the Internet as a shopping medium.

4.1. Consumer traits

Studies on online shopping behavior have focus mainly on demographic, psychographics and personality characteristics.

Bellman *et al.* (1999) cautioned that demographic variables alone explain a very low percentage of variance in the purchase decision.

According to Burke (2002) four relevant demographic factors – age, gender, education, and income have a significant moderating effect on consumers' attitude toward online shopping.

In studying these variables several studies arrived to some contradictory results.

Concerning age, it was found that younger are more interested in using new technologies, like Internet, to search for comparative information on products (Wood, 2002). Older consumers avoid shopping online as the potential benefits from shopping online are offset by the perceived cost in skill needed to do it (Ratchford *et al.*, 2001).

On the other hand as younger are associated with less income it was found that the higher a person's income and age, the higher the propensity to buy online (Bellman *et al.*, 1999; Liao and Cheung, 2001).

Gender differences also related to different attitudes towards online shopping. Although men are more positive about using Internet as a shopping medium, female shoppers that prefer to shop online, do it more frequently than male (Burke, 2002; Li *et al.*, 1999).

Furthermore Slyke *et al*. (2002) reported that as women view shopping as a social activity they were found to be less oriented to shop online than men.

Regarding education, higher educated consumers have a higher propensity to use no-store channels, like the Internet to shop (Burke, 2002). This fact can be justified as education has been positively associated with individual's level of Internet literacy (Li *et al*., 1999).

Higher household income are often positively correlated with possession of computers, Internet access and higher education levels of consumers and consequently with a higher intention to shop online (Lohse *et al*., 2000).

In terms of psychographics characteristics, Bellman *et al*. (1999) stated that consumers more likely to buy on the Internet have a "wired life" and are "starving of time". Such consumers use the Internet for a long time for a multiple of purposes such as communicating through e-mail, reading news and search for information.

A personality characteristic closely associated with Internet adoption for shopping is innovativeness defined as the relative willingness of a person to try a new product or service (Goldsmith and Hokafer, 1991).

Innovativeness seems to influence more than frequency of online purchasing. It relates to the variety of product classes bought online, both in regard to purchasing and to visiting Web sites seeking information. (Blake *et al*., 2003). In this sense innovativeness might be a fundamental factor determining the quantity and quality of online shopping.

4.2 Situational factors

Situational factors are found to be factors that affect significantly the choice between different retail store formats when consumers are faced with a shopping decision (Gehrt and Yan, 2004). According to this study, the time pressure and purpose of the shopping (for a gift or for themselves) can change the consumers' shopping habits Results showed that traditional stores were preferred for self-purchase situations rather than for gift occasions as in this case other store formats (catalog and Internet) performed better in terms of expedition. As for time pressure it was found that it was not a significantly predictor of online shopping as consumers when faced with scarcity of time responded to temporal issues related to whether there is a lag of time between the purchase transaction and receipt of goods rather than whether shopping can take place anytime.

Contradictory results were reported by Wolfinbarger and Gilly (2001). According to this study important attributes of online shopping are convenience and accessibility. When faced with time pressure situations, consumers engaged in online shopping but no conclusions should be taken on the effect of this factor on the attitude toward Internet shopping.

Lack of mobility and geographical distance has also been addressed has drivers of online shopping as Internet medium offers a viable solution to overcome these barriers (Monsuwé *et al*., 2004). According to the same authors the physical proximity of a traditional store that sells the same products available online, can lead consumers to shop in the "brick and mortar" alternative due to its perceived attractiveness despite consumers' positive attitude toward shopping on the Internet.

The need for special items difficult to find in traditional retail stores has been reported a situational factor that attenuates the relationship between attitude and consumers' intention to shop online (Wolfinbarger and Gilly, 2001).

4.3 Product Characteristics

Consumers' decisions whether or not to shop online are also influenced by the type of product or service under consideration.

The lack of physical contact and assistance as well as the need to "feel" somehow the product influences the suitability differentiates products according to their suitability for online shopping.

Relying on product categories conceptualized by information economists, Gehrt and Yan (2004), reported that it is more likely that search goods (i.e. books) can be adequately assessed within a Web than experience goods (i.e. clothing), which usually require closer scrutiny.

Grewal *et al*. (2002) and Reibstein (1999) referred to standardized and familiar products as those in which quality uncertainty is almost absent and do not need physical assistance or pre-trial. These products such as groceries, books, CDs, videotapes have a high potential to be considered when shopping online.

Furthermore in case of certain sensitive products there is high potential to shop online to ensure adequate levels of privacy and anonymity (Grewal *et al.*, 2002). Some of these products like medicine and pornographic movies are raising legal and ethical issues among international community.

On the other hand, personal-care products like perfume or products that required personal knowledge and experience like cars or computers, are less likely to be considered when shopping online (Elliot and Fowell, 2000).

4.4 Previous online shopping experiences

Past research suggests that prior online shopping experiences have a direct impact on Internet shopping intentions.

Satisfactory previous experiences decreases consumers' perceived risk levels associated with online shopping but only across low-involvement goods and services (Monsuwé *et al.*, 2004).

Consumers that evaluate positively the previous online experience are motivated to continue shopping on the Internet (Eastlick and Lotz, 1999; Shim *et al.*, 2001; Weber and Roehl, 1999).

5. CONCLUSION

Relying on an extensive literature review this paper aims to identify the main drivers of online shopping and thus to give further insights in explaining consumer behavior when adopting the Internet for buying as this issue is still in its infancy stage despite its major importance for academic and professionals.

This literature review shows that attitude toward online shopping and intention to shop online are not only affected by perceived benefits and perceived risks, but also by exogenous factors like consumer traits, situations factors, product characteristics, previous online shopping experiences.

Understanding consumers' motivations and limitations to shop online is of major importance in e-business for making adequate strategic options and guiding technological and marketing decisions in order to increase customer satisfaction. As reported before consumers´ attitude toward online shopping is influenced by both utilitarian and hedonic factors. Therefore, e-marketers should emphasize the enjoyable feature of their sites as they promote the convenience of shopping online. As personal characteristics also affect buyers´ attitudes and intentions to engage in Internet shopping e-tailers should customize customers´ treatment. Furthermore, e-vendor should assure a trust-building relationship with its customers to minimize perceived risk associated to online shopping. Adopting and communicating a clear privacy policy, using a third party seal and offering guarantees are mechanisms that can help in creating a reliable environment.

Some limitations of this study must be pointed out as future avenues for future research. The factors identified as main drives of shopping online are the result of a literature review and there can always be factors of influence on consumers´ intentions to shop on the Internet that are not included because they are addressed in other studies not included in this review. However there are methodological reasons to believe that the most relevant factors were identified in this context. A second limitation is that this paper is the result of a literature review and has never been tested in its entirety using empirical evidence. This implies that some caution should be taken in applying the findings that can be derived from this study. Further research is also needed to determine which of the factors have the most significant effect on behavioral intention to shop on the Internet.

REFERENCES

Ajzen, I. (1991). The theory of planned behavior: some unresolved issues. *Organizational Behavior and Human Decisions Processes*, 50 (2), 179-211.

Bellman, S., Lohse, G., and Johnson, E. (1999). Predictors of online buying behavior. *Communications of the Association for the Comptuting Machinery*, 42 (12), 32-38.

Bhatnagar, A., Misra, S., and Rao, H. R. (2000). On risk, convenience and internet shopping behaviour. *Communications of the Association for Computing Machinery*, 43 (11), 98-105.

Blake, B. F., Kimberly, A. N., and Colin, M. V. (2003). Innovativeness and variety of internet shopping. *Internet Research*, 13 (3), 156-169.

Burke, R. R. (2002). Technology and the customer interface: what consumers want in the physical and virtual store. *Journal of the Academy of Marketing Science*, 30 (4), 411-432.

Childers, T. L., Carr, C. L., Peck, J., and Carson, S. (2001). Hedonic and utilitarian motivations for online retail shopping behavior. *Journal of Retailing*, 77 (4), 511-535.

Corbitt, B. J., Thanasanki, T., and Yi, H. (2003). Trust and e-commerce: a study of consumer perceptions. *Electronic Commerce Research and Applications*, 2, 203-215.

Csikszentmihalyi, M. (1988). *Optimal experience: psychological studies of flow in cousciousness*. U.K: Cambridge University Press.

Dabholkar, P. A. and Bagozzi R. P. (2002). An attitudinal model of technology-based self-service: moderating effects of consumer traits and situational factors. *Journal of the Academy of Marketing Science*, 30 (3), 184-201.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use and user acceptance of information techonology. *MIS Quaterly*, 13 (4), 319-340.

Davis, F. D., Bagozzi, R. P., and Warshaw, P. R. (1989). User acceptance of computer technology: a comparation of two theoretical models. *Management Science*, 35 (8), 982-1002.

Doolin, B., Dillon, S., Thompson, F., and Corner, J. L. (2005). Perceived risk, the internet shopping experience and online purchasing behavior: a New Zeland perspective. *Journal of Global Information Management*, 13 (2), 66-88.

Eastlick, M. A. and Lotz, S. L. (1999). Profiling potential adopters of an interactive shopping medium. *International Journal of Retail and Distribution Management,* 27 (6/7), 209-223.

Elliot, S. and Fowell, S. (2000). Expectations versus reality: a snapshot of consumer experiences with internet retailing. *International Journal of Information Management,* 20 (5), 323-336.

Fishbein, M., and Ajzen, I. (1975). *Belief, attitude, intention and behavior: an introduction to theory and research*. Reading, MA: Addison-Wesley.

Gehrt, K. C. and Yan, R-N. (2004). Situational, consumer, and retail factors affecting internet, catalog, and store shopping. *International Journal of Retail and Distribution Management*, 32 (1), 5-18.

George, J. F. (2002). Influences on the intent to make internet purchases. *Internet Research*, 12 (2), 165-180.

Goldsmith, R. E. and Hofacker, C. F. (1991). Measuring consumer innovativeness. *Journal of the Academy of Marketing Science*, 19 (3), 209-221.

Grewal, D., Iyer, G. R., and Levy, M. (2002). Internet retailing: enablers, limiters and market consequences. *Journal of Business Research*.

Hoffman, D. L., Novak, T. P., and Peralta, M. (1999). Building consumer trust online. *Communication of the Association of Computing Machinery*, 42 (4), 80-85.

Jarvenpaa, S. and Todd, P. (1997). Consumer reactions to electronic shopping on the world wide web. *International Journal of Electronic Commerce*, 1 (2), 59-88.

Jarvenpaa, S., Tractinsky, N., and Vitale, M. (1999). Consumer trust in an internet store. *Information Technology and Managemet*, 1 (1/2), 45-72.

Lee, M. K.-O. and Turban, E. (2001). A trust model for consumer internet shopping. *International Journal of Electronic Commerce*, 6 (1), 75-91.

Li, H., Kuo, C., and Russel, M. G. (1999). The impact of perceived channel utilities, shopping orientations, and demographics on the consumer's online buying behavior. *Journal of Computer-Mediated Communications*, 5 (2).

Liao, Z. and Cheung, M. T. (2001). Internet based e-shopping and consumer attitudes: an empirical study. *Information and Management*, 38 (5), 299-306.

Liebermann, Y. and Stashevsky, S. (2002). Perceived risks as barriers to internet and e-commerce usage. *Qualitative Market Research*, 5 (4), 291-300.

Liu, X. and Wei, K. K. (2003). An empirical study of product differences in consumers' e-commerce adoption behavior. *Electronic Commerce Research and Applications*, 2, 229-239.

Lohse, G. L., Bellman, S., and Johnson, E. J. (2000). Consumer buying behavior on the internet: findings from panel data. *Journal of Interactive Marketing*, 14 (1), 15-29.

Mathwick, C., Malhotra, N. K. and Rigdon, E. (2001). Experiential value: conceptualisation, measurement and application in the catalog and internet shopping environment. *Journal of Retailing*, 77 (1), 39-56.

Menon, S. and Kahn, P. (2002). Cross-category effects of induced arousal and pleasure on the internet shopping experience. *Journal of Retailing*, 78 (1), 31-40.

Monsuwé, T. P., Dellaert, G. C.and de Ruyter, K. (2004). What drives consumers to shop online? A literature review. *International Journal of Service Industry Management*, 15 (1), 102-121.

O'Cass, A. and Fenech, T. (2002). Web retailing adotion: exploring the nature of Internet users web retailing behavior. *Journal of Retailing and Consumer Services*, 13 (2), 151-167.

Peterson, R. A., Balasubramaniam, S., and Bronnenberg, B. J. (1997). Exploring the implications of the internet for consumer marketing. *Journal of the Academy of Marketing Science*, 25 (4), 329-346.

Pires, G., Staton, J., and Eckford, A. (2004). Influences of the perceived risk of purchasing online. *Journal of Consumer Behaviour*, 4 (2), 118-131.

Ranganathan, C. and Ganapathy, S. (2002). Key dimensions of business-to-consumer web sites. *Information and Management*, 39 (6), 457-465.

Ratchford, B. T., Talukdar, D., and Lee, M.-S. (2001). A model of consumer choice of the internet as an information source. *International Journal of Electronic Commerce*, 5 (3), 7-21.

Reibstein, D. J. (1999). *Who is buying on the Internet, 1999?* Working Paper, The. Wharton School, University of Philadelphia.Philadelphia, PA.

Rogers, E. M. (1985). *Diffusion of innovations*. New York: Free Press.

Saeed, K. A., Hwang, Y., and Yi, M. Y. (2003). Toward an integrative framework for online consumer behavior research: a meta-analysis approach. *Journal of End User Computing*, 15 (4), 1-26.

Shim, S., Eastlick, M. A., Lotz, S. L., and Warrington, P. (2001). An online prepurchase intentions model: the role of intention to saerch. *Journal of Retailing*, 77 (3), 397-416.

Slyke, C. V., Comunale, C. L., and Belanger, F. (2002). Gender differences in perceptions of web-based shoping. *Communications of the Association for Computing Machinery*, 45 (7), 82-86.

Swaminathan, V., Lepkowska-White, E., and Rao, B. P. (1999). Browsers or buyers in cyberspace? An investigation of factors influencing electronic exchanges. *Journal of Computer-Mediated Communication*, 5 (2).

Tan, S. J. (1999). Strategies for reducing consumers' risk aversion in internet shopping. *Journal of Consumer Marketing*, 16 (2), 163-180.

van der Heidjen, H., Verhagen, T., and Creemers, M. (2003). Understanding online purchase intentions: Contributions from technology and trust perspectives. *European Journal of Information Systems*, 12, 41-48.

Vijayasarathy, L. R. and Jones, J. M. (2000). Print and internet catalog shopping: assessing attitudes and intentions. *Internet Research*, 10 (3), 191-202.

Weber, K. and Roehl, W. S. (1999). Profiling people searching for and purchasing travel products on the world wide web. *Journal of Travel Research*, 37, 291-298.

Wolfinbarger, M. and Gilly, M. C. (2001). Shopping online for freedom, control, and fun. *California Management Review*, 43 (2), 34-55.

Wood, S. L. (2002). Future fantasies: a social change perspective of retailing in the 21st century. *Journal of Retailing*, 78 (1), 77-83.

WLAN-BASED ASSET TRACKING FOR WAREHOUSE MANAGEMENT

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ABSTRACT

Asset tracking offers high potential to improve efficiency of warehouse management. Typically the tracking is done employing RFID technology. As yet however, most goods are not prepared with RFID and it would require investment in costly hardware, infrastructure, and process adaptations. WLAN-based asset tracking is getting ready as a cost-effective alternative since software-only approaches are becoming mature. They can reuse existing standard WLAN devices and infrastructure for position sensing. In this paper we present such a system – MagicMap – that we have developed for real-time positioning based on WLAN signal strength measurements, and describe how it seamlessly integrates into a warehouse management scenario. Unfortunately, metal construction of a warehouse and high dynamics of goods influence the WLAN signal dissemination and thus make the approach generally difficult for such scenarios. To assess its applicability, we have measured positioning accuracy and real-time capabilities of MagicMap in comparison with two similar systems (Ekahau and MobileLocator Light) in a typical warehouse setup. Result show applicability of all three WLAN-based systems at an average positioning deviation of 3-5 meters and a tracking delay below 150 seconds – provided some physical constrains are considered.

1. INTRODUCTION

The implications of new technologies and e-commerce on the supply chain in general, and on warehouse management in particular, became major research topics in the last years (see, e.g., Karmakar, N., 2002, Liu, M.-L. L. et al. 2000). The service-oriented paradigm also has a strong impact on future trends in that area (see Stantchev, V. and Scherz, M., 2004). According to a SCM study of the ARC Advisory Group "the worldwide market for supply chain management is expected to grow at a compounded annual growth rate (CAGR) of 7.4% over the next five years". The market is forecasted to be $ 7.4 billion in 2008. One of the processes where automation can lead to large scale savings and better time-to-market is asset tracking. A common approach here is usage of RFID solutions. While promising, such solutions require complex infrastructure which makes their implementation and usage non-trivial. This is a very real obstacle for market growth – a recent WMS study of the ARC Advisory Group (ARC 2005) found out that "other add-on modules actually are poised to grow much faster than RFID". An interesting option is to track assets using WLAN signals instead of RFID.

A bunch of systems for position sensing based on radio signals have been proposed, including WLAN approaches (see Section 2). Since WLAN has not been designed for position sensing, expectedly a number of difficulties occur. For example, the 2.4 GHz WLAN frequency is highly sensible for hydrous material or metal, and thus radio obstacles significantly disturb homogeneous signal dissemination. WLAN-based

systems, accordingly, are not as accurate as systems specifically designed for position sensing. However, they suit perfectly for many cost-sensitive scenarios that do not depend on optimum precision – especially, if a WLAN infrastructure already exists and can serve multiple purposes. Currently, many companies in the logistics domain consider WLAN for asset tracking, but still are uncertain about its suitability in their specific scenario.

To figure out whether WLAN positioning can accomplish asset tracking for warehouse management, we employ our WLAN-positioning system, MagicMap (Section 3), describe its integration into warehouse management (Section 4), investigate the signal disturbance resulting from obstacles (Section 6), and evaluate resulting accuracy and timing with respect to comparable systems (Section 7).

2. POSITION SENSING BASED ON RADIO SIGNALS

There are two basic approaches to locate objects based on radio signals: measuring angles between sender and receiver, or evaluating the distance between them. Angle-based approaches require special antennas with precise directivity of signal dissemination in order to accurately estimate the angles. Although promising, current costs, accuracy, and coverage of angle-based systems exclude mass-market deployment. Distance-based approaches instead, either use signal time to air or signal strength indications to calculate the physical distance between a node and the reference points. With three or more reference points available, two-dimensional positioning using trilateration is possible. Four or more reference points (multilateration) allow for higher accuracy and three-dimensional positioning.

Real-time location sensing (RTLS) approaches typically measure time of arrival (TOA) or time difference of arrival (TDOA) and then derive time to air and corresponding physical distance. There are different RTLS standards such as the air interface protocol according to INCITS 371.1 (INCITS 2003). Companies such as WhereNet offer corresponding products. The "Location Receivers" from AeroScout are also compatible with IEEE 802.11 and can sense the positions of any regular WLAN sender with a precision of approximately 3 meters using TDOA multilateration. Especially remarkable is the Witrack system (Pflaum, A. et al, 2004). It offers centimeter-precise position sensing of soccer ball and players in order to support referee decisions. Of course, that is only possible under obstacle-free line-of-sight conditions for signal dissemination. Moreover, since radio waves disperse at approximately 30 cm per nanosecond, all TOA/TDOA approaches require highly accurate clock synchronization and specialized and costly infrastructure.

Signal strength-based approaches aim for position sensing without the need for special hardware and precise clock synchronization. The simplest approach maps the position to the cell of origin (COO) indicating the highest signal strength. COO technique is commonly used in GSM telecommunication networks, because of its simplicity and the low infrastructure requirements. The positioning accuracy ranges from 100 m (in cities) to multiple km (in rural areas) according to cell size and coverage. More precise position sensing is possible, if a quadratic decrease of signal strength per distance of radio wave spread is presumable. Unfortunately, this theoretical relation is significantly disturbed in practice by attenuation, diffusion, and reflection (Nadeem, T. et al. 2003). Therefore, often a radio map is created which requires an offline calibration phase.

The WLAN standard according to IEEE 802.11 defines beacon-frames that are periodically transmitted by the access points and from which the receivers can estimate the signal strength calibrated in decibel milliwatt (dBm). With its rapidly increasing deployment, WLAN also became very popular for signal-strength-based position sensing and numerous WLAN positioning systems have been developed. One of the first such systems was RADAR from Microsoft Research (Bahl, P. and Padmanabhan, V. N., 2000). It uses a radio map in the form of a raster of measured reference points. The position of the reference point with the most similar signal characteristics is chosen as position estimation. This nearest neighbor approach reaches precisions of around 3 m. Higher precision can be obtained by the averaged k-nearest neighbor approach. Different approaches (Castro, P. et al, 2001; Roos, T. et al. 2002) improve the position estimation by interpolating the signal strength between the reference points and choose the intermediate location that corresponds best to the measured value. Such an approach is used, e.g., by the Horus system (Youssef, M. and Agrawala, A., 2005; Youssef, M. and Agrawala, A., 2004) of the University of Maryland. There, average positioning deviation is around 2 m under convenient conditions, i.e., a sufficiently high number of correctly positioned signal sources with non-disturbed signal dissemination. The commercial system of the company

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Ekahau (Ekahau, 2005), which currently is the commercial de facto standard, works similarly. More advanced probabilistic positioning approaches try to estimate position using a maximum likelihood estimation that at best explains the measurements. Bayesian approaches (Maligan, D. et al, 2005) add position probability distributions. Analytical techniques (Krishnakumar, A. S. and Krishnan, P., 2005) allow for quantitative comparison of the approaches and show that under ideal conditions, current approaches already get close to the theoretical optimum.

However, there is only little knowledge about the accuracy that these systems obtain under non-ideal conditions, e.g., caused by moving radio obstacles such as pallets, containers, or forklifts. Obviously, this highly depends on the specific application scenario.

3. LOCATING OBJECTS WITH MAGICMAP

MagicMap is a cooperative context aware computing application that was introduced in Ibach, P.K. et al, 2004 and Ibach, P.K. et al, 2005. Every node senses its environment and uses the observed data to calculate its location and situation. From that, location/situation specific actions can be triggered. The system works cooperatively, i.e., nodes exchange their measurements among each other, for example, to calculate the overall system state or to compare a node's measurements to those of neighboring nodes. Since some nodes may have only little processing capacity, calculations can be moved to any other, more capable device without restrictions. Calculations can be done redundantly on multiple nodes to improve fault tolerance, in particular, to prevent a minority of malicious nodes to affect system stability.

As yet, intended devices are typically equipped with RF capability for wireless communication, e.g., GSM, WLAN, Bluetooth, or RFID, and can send or receive data to or from its neighboring nodes. The current implementation uses WLAN equipped Laptops, PDAs, and Smartphones that exploit WLAN signal strength to sense the environment and calculate their positions (see Figure 1). In principal however, devices might observe their environment by any kind of sensors, including, optic, acoustic, or haptic sensors from which they derive contextual knowledge and appropriate behavior.
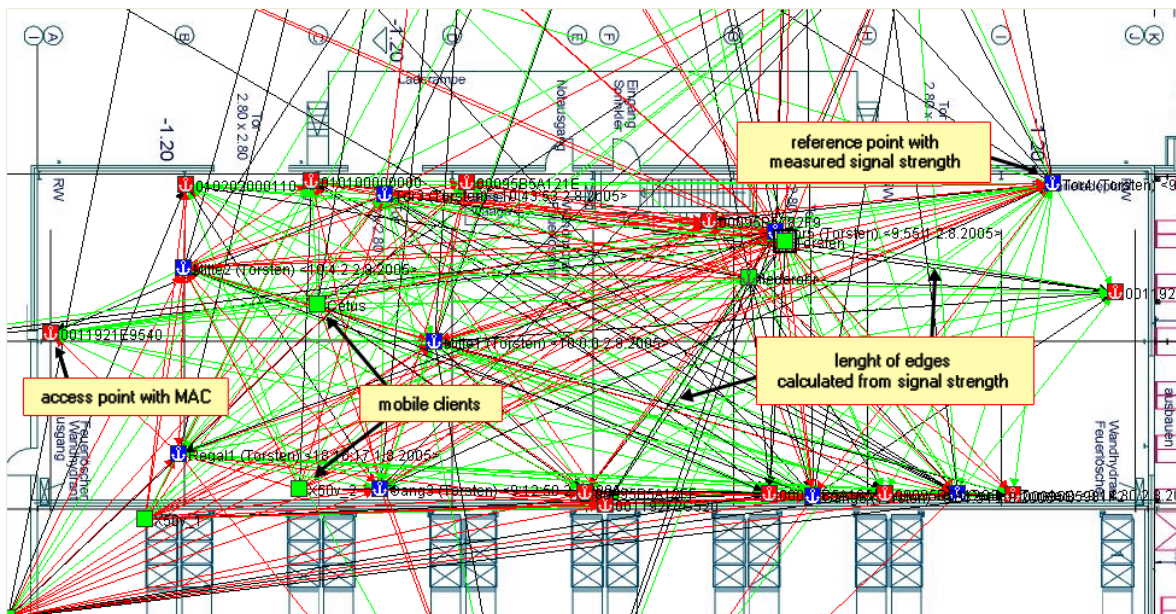

Figure 1. MagicMap screenshot: Nodes sense the WLAN received signal strength (RSSI) of neighboring nodes (access points, other clients, or previously measured reference points) and estimate the physical distance. A *spring layout* algorithm moves the nodes with unknown positions such that length of edges best match the calculated physical distance. Thus, the graph converges to a "magic map", where nodes are located approximately at their true physical position

4. WAREHOUSE MANAGEMENT SCENARIO

We consider a use case of a warehouse management system (WMS) in a high rack warehouse with external storage areas. When goods arrive at the warehouse, storage workers acquire them into the WMS by scanning a barcode attached to each product. Then the WMS assigns a place for each good to be stored. The goods are transported by a storage worker with a forklift to the target location. If the target is located in a high rack, the storage worker scans the location barcode assigned to each high rack store place after he delivered the cargo. Since the code relates to an accurately known position, a security camera can be selected and focused on the object to take a picture of it. Securing the processes by cameras has proven to significantly reduce transportation damages and improve process traceability. However, some of the goods are stored in the external storage area where no definite store places exist. Here, item location cannot be assigned precisely, so it is hardly possible to focus a camera on it and take a clear picture of the commodity. When an order arrives at the warehouse, the system prints out a list with the products, their barcodes, and their locations in the warehouse or the external storage area. A worker picks up all required goods and scans their barcodes into the WMS. Once he has finished collecting them, he puts everything in a box with a special number given by the WMS. Then the system tells another worker that the order is ready for packaging. He takes the box and scans everything again to make sure that nothing was forgotten or lost and makes the package ready for shipping. This process is commonly known as picking in logistics and may differ depending on the specific management process of the warehouse company.

5. INTEGRATING WLAN-BASED ASSET TRACKING

MagicMap integrates into the warehouse scenario by locating the WLAN-equipped mobile scanning devices. When the barcode of an item is scanned, its position is known to be close to the scanning device which can be located employing WLAN. After items are scanned into the system, MagicMap tracks them by sensing the position of the WLAN-equipped scanning device, and commits the position to the server (see Figure 2). This enables to track the goods exactly with the security cameras taking a motion video of the delivery process. This is possible, since the WLAN device remains in the items proximity when transported, a second scan (at a different position) tells the system when an item is released. Subsequent relocation assignments are handled in the same way. This ensures that the current position of an item stored on the server is always its real-time position within the warehouse and also allows complex relocation scenarios according to specific objectives, e.g., storing items by order of dispatch or optimal usage of storage space.
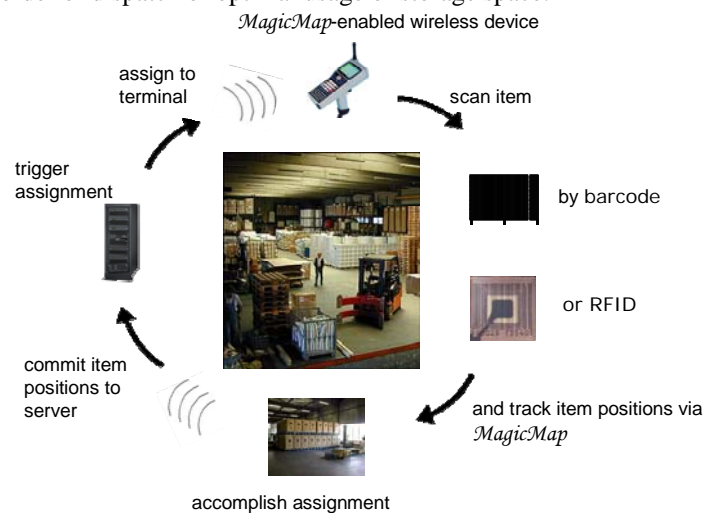

Figure 2. Asset Tracking with MagicMap

6.   WLAN SIGNAL DISSEMINATION

The above scenario relies on accurate WLAN positioning. Signal-strength-based trilateration is only possible if the signal strength/distance relation approximately obeys a quadratic decrease. Unfortunately, this theoretical relation is significantly disturbed in practice. Therefore, we have to ensure that on all places where WLAN positioning shall be employed, signal strength is sufficiently coherent with the distance between sender and receiver. Therefore we conducted measurements in a warehouse near Cologne, Germany from the company Lufapak during two days of normal warehouse operations. The warehouse is used to store different kind of construction machinery parts of various sizes. The floor space is about 3000m² consisting of 2500m² high rack area and 500m² (12x42 meters) delivery area where the tests were done.
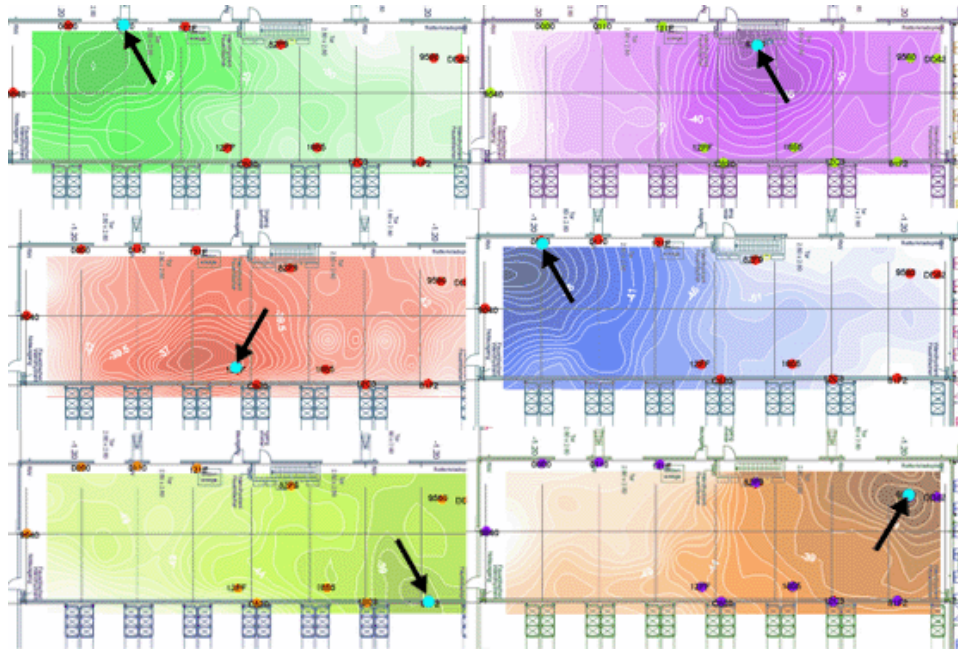
Figure 3. Signal strength map for each of the access points
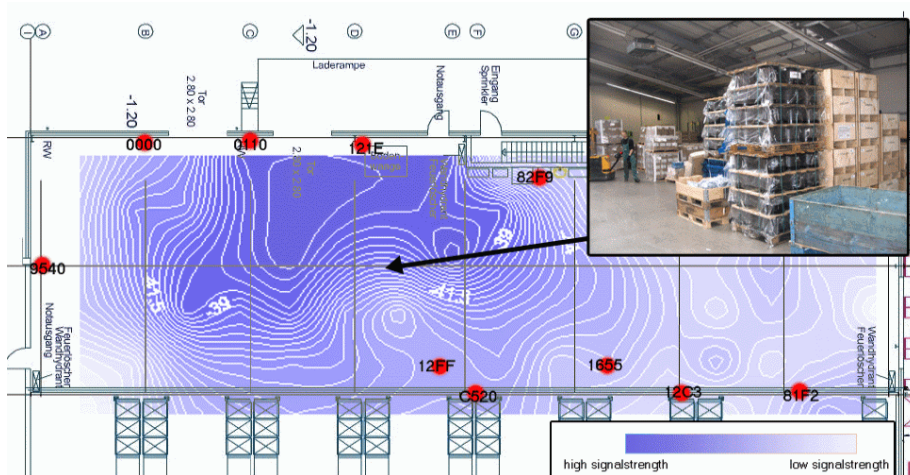
Figure 4. Palettes with cast iron parts strongly influence signal dissemination

As can be seen in Figure 3, signal dissemination is not homogeneous but significantly influenced by various materials. Particularly large accumulation of assets made from strongly attenuating materials, such as iron, between AP and receiver result in signal damping (Figure 4). Beside warehouse inventory, also other factors affect signal dissemination, e.g., building construction and infrastructural setup. Construction elements such as steel girders may channel electromagnetic waves and thus deform the field in an unexpected way. Therefore, the highest signal strength location can differ from the actual position of the AP (Figure 5). For exact position estimations the system would have to know all factors that influence signal dissemination given by some environment model. Obviously, in dynamic environments as a warehouse definitely is, it is hardly possible to incorporate all these influencing factors. MagicMap therefore pursues the approach to only compute an average attenuation factor and subsumes all individual signal disturbance factors in a stochastic noise parameter – admitting sacrificed accuracy. However, none of the currently available systems can handle the dynamic environment problem where an overwhelming number of factors influence signal dissemination and deteriorate accuracy of WLAN-based positioning. The following comparative evaluation gives insights whether current systems can provide results that are precise and stable enough to be used in this specific asset tracking scenario.
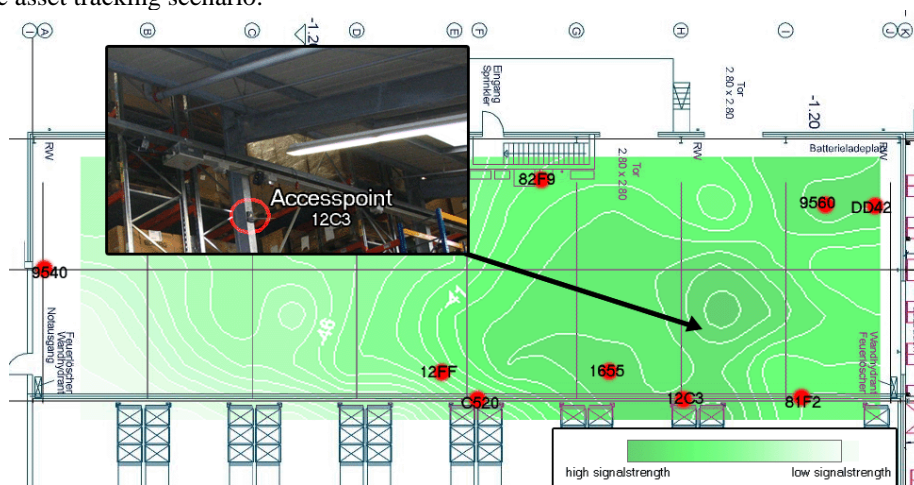

Figure 5. Steel girders can lead to deviation between AP location and highest signal strength

7. COMPARATIVE EVALUATION OF WLAN POSITIONING SYSTEMS

We compared MagicMap with two reference WLAN positioning systems – Ekahau (Ekahau, 2005) and MobileLocator Light (Fraunhofer IIS, 2004). Ekahau is a widely-used commercial system for signal strength-based position sensing. It uses a radio map with reference points and claims to offer the "most precise real-time location tracking available on the market". MobileLocator Light is a system developed at Fraunhofer Institut für Integrierte Schaltungen. It uses an approach similar to Ekahau but does not have its high processing requirements. Therefore, MobileLocator Light can also run on mobile devices, such as PDAs. A flexible component-based architecture allows to employ more powerful computers for calculation and environment modeling or to store and update the signal map. Ekahau, instead, offers a network stumbler for PDA Clients with Windows Mobile, which send signal strength data to a central server that calculates and visualizes their positions.

All systems were tested with the same environment and setup (Table 1). Test results show that MagicMap deviation in this specific scenario varies between 1.5 and 6 m (Table 2). Data from the client PDA 1 shows greater variation and subsequently we have identified possible hardware problems in that device. Therefore, we assess performance based on the results for PDA 2 which is an identical device (Dell Axim X50v). Also the notebooks varied in their WLAN characteristics and we choose the ASUS notebook for system comparison since it showed most stable results. Average deviation of MagicMap on the notebook was 3.94 m (Table 2) which is slightly higher than the measured deviation of Ekahau (Table 3) and slightly lower than

the deviation of MobileLocator Light (Table 4). While all tested systems where showing pretty similar average deviation of 3-5 m, deviation of MagicMap CE (the PDA client) was the best in the test with an average positioning error of 3.25 m. MagicMap needed only 9 reference points (Table 1) to achieve such precision, while both other systems required three to five times more. That's because MagicMap employs a hybrid algorithm: (1) multilateration to the access points plus (2) weighted averaged k-nearest neighbor regarding the reference points. The sparse number of reference points simplifies automatic recalibration of the radio map, which can be done using the WLAN signal strength measurements of the scanner devices whenever they scan a barcode not relating to an item but indicating a marker of a stationary and known position.

All systems improve positioning stability by smoothing temporal signal variations – which results in some tracking delay (up to 150 seconds calibration time). Due to the hybrid algorithm, overall positioning of MagicMap was more stable being fewer influenced by dynamics in the environment (e.g., movement of forklifts, goods, or personnel). In MagicMap, nodes send out their signal measurements periodically every 10 seconds. Lowering the update periods for timeliness reasons has significant impact on system load. Adaptive update periods that depend on the speed – longer periods for stationary or slow objects and shorter periods if objects accelerate and move faster – can tackle the timeliness issue. To arrive at real-time capability, as intended in the video tracking scenario, additional performance optimizations are required.

Table 1. The infrastructure included one server, several mobile clients and access points

Roles	Equipment
Server	1 ACER Travelmate 4600
Clients	1 ACER Travelmate 4600 1 Acer Extensa 2902LMi 1 ASUS 2 Dell Axim X50v
Access Points	8 Netgear ME102 AP 1 Asus WL-500g 3 unknown preinstalled
Reference Points for Radio Maps	70
Reference Points for MagicMap	9
Reference Points for Ekahau	48
Reference Points for MobileLocator Light	30

Table 2. Test Results: MagicMap at 8 different positions

Notebook		PDA	
Calibration time	Deviation	Calibration time	Deviation
90 s	1,5 m	90 s	1,5 m
60 s	3 m	45 s	1 m
45 s	5 m	30 s	3 m
120 s	6 - 8 m	120 s	6 - 8 m
60 s	5 m	60 s	5 m
120 s	2 m	120 s	1,5 m
90 s	6 m	120 s	3 m
150 s	4 m	150 s	4 m
Average	**3.94 m**	**Average**	**3.25 m**

Table 3. Test Results Ekahau (ASUS Notebook)

Calibration time	Deviation
60 s	3 m
60 s	8 - 9 m
120 s	6 m
60 s	3 m
10 s	1 - 3 m
90 s	2 m
120 s	2 - 3 m
60 s	1 - 3 m
Average	**3.62 m**

Table 4. Test results MobileLocator Light (PDA)

Calibration time	Deviation
15 s	1- 8 m
10 s	1- 4 m
10 s	3- 4 m
30 s	0-1 m
10 s	10 m
10 s	0-1
10 s	1 – 3 m
10 s	10 m
Average	**4.18 m**

8. CONCLUSION AND OUTLOOK

We have shown how WLAN-based position sensing is applicable for asset tracking in warehouse management. The dynamic environment which is typical for warehouses, requires measuring and updating reference points whenever assets are relocated significantly. This recalibration process can be automated in the item scanning and tracking scenario. The investigated systems provided similar precision at around 3-5m average deviation. Our MagicMap solution provided slightly better average precision with the least amount

of reference points required. With growing prevalence of PDAs and Windows CE-based embedded devices in supply chain management and warehouse management scenarios, the result shows the possible gain in efficiency that WLAN-based asset tracking can provide. A definite advantage of WLAN over RFID solutions is the easy and by far less costly integration in existing IT infrastructures.

Finally, there is a large field of research left to improve positioning accuracy under dynamic environment changes. Currently, we are investigating three options: (1) adding sniffers (nodes that sense the signal strength in real-time and thus eliminate the recalibration problem) to the system, (2) using symmetric peer-to-peer measurements of signal strength that can collect more information and thus will provide better accuracy, and (3) various ways to improve the positioning algorithm itself, e.g., by incorporating a priori knowledge about walls, ways, and movements.

REFERENCES

ARC (ARC Advisory Group), 2005, Market Analysis and Forecast Through 2009. *http://www.arcweb.com/research/ent/wms.asp*

Bahl, P. and Padmanabhan, V. N., 2000, RADAR: An In-Building RF-Based User Location and Tracking System. *IEEE INFOCOM 2000 Proceedings*. pp. 775-784, http://www.ieee-infocom.org/2000/papers/589.pdf

Castro, P. et al, 2001, A Probabilistic Room Location Service for Wireless Networked Environments. *Proceedings of Ubicomp 2001: Ubiquitous Computing, Third International Conference*. Atlanta, Georgia, USA, Sept. 30 – Oct. 2, 2001. pp. 18-34

Ekahau, Inc., 2005, Ekahau Positioning Engine 3.1. *http://www.ekahau.com/file.php?id=129*

Fraunhofer Institut für Integrierte Schaltungen (Fraunhofer IIS), 2004, Messe-Navigator. *http://www.iis.fraunhofer.de/ec/navigation/indoor/projekte/messe/index.html*

Ibach, P.K. et al, 2004. MagicMap – Kooperative Positionsbestimmung über WLAN. *Chaos Communication Congress Online Proceedings.* Berlin, Germany

Ibach, P.K. et al, 2005. Ortung drahtlos kommunizierender Endgeräte mit GRIPS/MagicMap. *Workshop "Mobiles Informationsmanagement und seine Anwendungen", 35. Jahrestagung der Gesellschaft für Informatik.* Bonn, Germany

INCITS - International Committee for Information Technology Standards, 2003. Real Time Locating Systems (RTLS) - Part 1: 2.4-GHz Air Interface Protocol. *http://www.incits.org*

Karmakar, N., 2002. Streamlining the Supply Chain With Electronic Commerce: A Key to Success in the Digital Economy. *Proceedings of the IADIS International Conference WWW/Internet*. Lisbon, Portugal, pp. 418-426

Krishnakumar, A. S. and Krishnan, P., 2005. On the accuracy of signal strength-based location estimation techniques. *IEEE INFOCOM 2005 Proceedings*

Liu, M.-L. L. et al. 2000. Deploying the Mobile-Agent Technology in Warehouse Management. *Intelligent Problem Solving, Methodologies and Approaches, 13th International Conference on Industrial and Engineering Applications of Artificial Intelligence and Expert Systems, IEA/AIE 2000, Proceedings*. New Orleans, Louisiana, USA, June 19-22, 2000, pp. 651-659

Maligan, D. et al, 2005. Bayesian Indoor Positioning Systems. *IEEE INFOCOM 2005 Proceedings*

Nadeem, T. et al. 2003. Implementation of a Scalable Context-Aware Computing System. *Personal Wireless Communications, IFIP-TC6 8th International Conference, PWC 2003 Proceedings*. Venice, Italy, September 23-25, 2003, pp. 364

Pflaum, A. et al, 2004. Verschmelzung von Lokalisierungs- und Identifikationstechnologien. Beitrag zum Aufbau einer technologischen Roadmap für die Weiterentwicklung der RFID-Technologie. *RFID-Workshop St. Gallen*, St. Gallen, Switzerland

Roos, T. et al. 2002. A Statistical Modeling Approach to Location Estimation. *IEEE Transactions on Mobile Computing*, vol. 1, No. 1, pp. 59-69

Stantchev, V. and Scherz, M., 2004. Challenges of Service-oriented Architectures, *Proceedings of IPSI 2004.* Venice, Italy, pp. 18-19

Youssef, M. and Agrawala, A., 2004. Handling Samples Correlation in the Horus System. *IEEE INFOCOM 2004 Proceedings*. http://www.ieee-infocom.org/2004/Papers/21_3.PDF

Youssef, M. and Agrawala, A., 2005 The Horus WLAN location determination system. *Proceedings of the 3rd International Conference on Mobile Systems, Applications, and Services (MobiSys 2005)*. June 6-8, 2005, Seattle, Washington, USA, pp. 205-218

DOES SIZE MATTER? A STUDY COMPARING E-BUSINESS IMPLEMENTATION IN LARGE AND SMALL COMPANIES IN AUSTRALIA

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ABSTRACT

In recent years companies of all sizes have invested in e-business technologies in an attempt to gain a competitive advantage. This paper attempts a comparative analysis of the benefits from and barriers to e-business in small and large companies in Australia. We establish that a strong correlation exists between the ranking orders of large and small companies for both the benefits from and impediments to e-business indicating that for both the benefits and impediments the ranking orders are not independent. In other words there is a strong association between the ranking orders of large and small companies in both benefits and impediments to e-business. Further, investigation of the responses from small and large companies indicated that there generally appeared to be a higher level of response from large companies. T-tests were carried out to assess the statistical significance of these apparent differences.

KEYWORDS

E-business benefits, e-business barriers, correlation, t-test.

1. INTRODUCTION

In recent times Australian organisations have invested heavily to leverage the Internet and transform their traditional businesses into e-businesses. In the last four years there has been almost no increase in the proportion of businesses using computers. However there has been a steady rise in the proportion of businesses using the Internet and various information and communication technologies (ICTs). The growth in business Internet income in Australia over this period has been at a compound rate of 54% per annum.

Business organisations doing business on the Internet with digitised business processes are expected to achieve business improvements from reduced operation costs, labour, time and paper. E-business investments are claiming a substantial share of overall IT budgets in most organisations based on anecdotal evidence that organisations achieve unprecedented benefits by leveraging the Internet as a medium of business. According to Kearney (2002) e-business budgets in Australia are about 27% of overall IT budgets.

E-business research data in Australia to date is mostly on the number of business organizations trading electronically, type of e-business applications, potential benefits of e-business and the application of the Internet to certain business processes (NOIE, 2001, 2002 and 2003, Kearney, 2002). These reports also indicate a substantial increase in the uptake of e-business and Internet applications by Australian organisations. Further there has been work carried out into the inhibitors to e-business in Australia (Grigor et al 2004) and data published on the benefits and barriers of receiving orders over the Internet in Australia (ABS, 2005). Internationally research has been carried out into the barriers of entry into e-business for small firms (Taylor and Murphy, 2004) and why some small firms use e-business and others do not (Fillis et al, 2003).

By 2004, 85% of Australian businesses used computers, 74% used the Internet, 25% had a web site, 31% placed orders via the Internet, 12% received orders via the Internet and total business Internet income was $33 billion (ABS, 2005). Significantly, businesses with over 100 workers made much greater use of ICT.

They had almost 100% computer and Internet use by 2004, 83% had a web presence, 69% placed orders via the web and 21% received orders via the web (ABS, 2005). It is therefore clear that the penetration made by ICTs in small businesses is far less than in large businesses. This leads to the obvious question about whether the benefits gained from and the barriers posed by e-business are greater in large companies than in small companies.

The Australian Bureau of Statistics (ABS) bases its classification of company size on the number of employees. It uses the employment size categories of 0-4 employees, 5-19 employees, 20-100 employees and over 100 employees. We aggregated the first three categories into one grouping of 100 employees or fewer and refer to this group as small companies. We defined companies with over 100 employees as large companies. The majority of businesses in Australia are small businesses employing 100 or fewer workers.

This research was initiated to compare the barriers to and improvements from e-business adoption in small and large firms in Australia. It was accomplished via an online and hard copy survey and data was statistically analysed. This paper includes a brief review of the literature on e-business benefits and barriers, an outline of the research methodology, a summary of the analysis techniques, presents some results from the survey, outlines the implications of the research and finally lists some of the conclusions.

2. LITERATURE REVIEW

The Internet has had a profound impact on all businesses in Australia and around the world. E-business enables organisations to reduce costs, increase demand and create new business models. It has the potential to benefit all consumers through reduced prices and improved products and information flows (Dunt and Harper, 2002). Small and large firms alike can access the Internet and exploit near-zero marginal costs of distribution for their products (Dunt and Harper, 2002). Although e-business has been proved to be popular with large businesses, small companies also create value by marketing and selling goods and services electronically (Dublish, 2000).

Australian organisations like their international counterparts have increasingly resorted to e-business to capitalise on the opportunities of business efficiencies. Benefits of e-business as outlined by Chaffey (2004), Grigor et al (2004), Singh (2002) and Turban et al (2004) are increased revenue from enhanced sales; reduced marketing costs with online advertising, reduced time in customer service and online sales; supply chain cost reductions from reduced inventory levels, increased competition from suppliers and shorter cycle time in ordering; and reduced administrative costs from automated routine business processes, order confirmation, accuracy of data and an improved competitive position. Other non quantifiable improvements achieved from e-business include a better corporate image, improved communication with customers and business partners and customers via electronic templates, a faster product development lifecycle enabling faster response to market needs, improved customer service, better information and knowledge management, ability to incorporate positive feedback from customers to enhance sales and ability to incorporate intelligent applications of software for data mining and for forecasting trends and demands.

Suggested problems experienced in implementing e-business include poor budgeting, inadequate resource allocation, overestimation of the efficiency gains, lack of technical resources, resistance from staff, lack of training for staff, incompatibility of the new technology with existing back-end systems, lack of expert advice available since e-business is a new way of doing business, information overload, lack of skilled staff, lack of technical resources and lack of senior management or board support (Singh, 2000, Chaffey, 2004 and Turban et al, 2002 and Turban et al, 2004).

3. METHODOLOGY

The research was carried out by a mixed mode survey of Australian businesses using online and postal questionnaires. The questionnaire was sent to a random sample of 725 companies obtained from a database Business Who's Who http://www.dnb.com.au/default.asp. However since the response to this was disappointing the survey was mailed to the businesses that had not responded. Originally, the questionnaire was disseminated via emails addressed to the e-business manager. A short explanation of the objectives of the research and the URL for the survey was included in the package.

The questionnaire was divided into sections with thirteen questions in the section on improvements achieved by e-business and twelve questions in the section on barriers to e-business. Each of the questions required a response on an eight point scale. In the case of the improvement section a response of 0 indicated no improvement, with 1 meaning minimal improvement and 7 maximum improvement. In the case of the barrier section a response of 0 indicated no barrier, with 1 meaning a minimal impediment and 7 a maximum impediment. There were a total of 91 online responses received and 78 hard copy responses. This represented 23.3% of the sample.

3.1 Hypotheses Tested

In each question or dimension in each section it was possible to obtain the average score for small companies and large companies. It was then possible to rank the average scores for the thirteen improvement dimensions and the average scores for the twelve barrier dimensions. Two hypotheses were tested for each section. Firstly we tested to see if there was a difference in the ranking order for small and large companies of the suggested improvements obtained from e-business and of the suggested impediments to e-business. The data indicated generally that large businesses generated a higher average score in each improvement and barrier dimension than small businesses. So secondly we tested to see if there was a significant difference in the average score for smaller companies and larger companies for each dimension in the improvements section and the barriers section.

3.1.1 Ranking Order Hypotheses

There were two hypotheses tested in the case of ranking order. The null and alternative hypotheses in each case are listed below.

In the case of improvements
H_0: The ranking orders for improvements were independent of the size of the company.
H_1: The ranking orders for improvements were not independent of the size of the company.

In the case of barriers
H_0: The ranking orders for barriers were independent of the size of the company.
H_1: The ranking orders for barriers were not independent of the size of the company.

In order to test these two hypotheses we obtained the ranking order based on the average value of the response to each question for both small companies and large companies. We then calculated the Spearman Rank Correlation Coefficient, r, for each of the data sets,

$$r = 1 - \frac{6\sum_{i=1}^{n} d_i^n}{n(n^2 - 1)}$$

where d is the ranking difference and n is the number of dimensions, in this case 13 in the improvement section and 12 in the barriers section. To test the null hypothesis we used the standard large sample approximation formula

$$Z = r \sqrt{n - 1}$$

where Z is the standard normal variate. For both hypotheses we used a two-tailed test.

3.1.2 Average Score Hypotheses

There were two hypotheses tested in the case of average score in each dimension. The null and alternative hypotheses in each case are listed below.

In the case of improvements

H_0: The average score for large companies on each improvement dimension was not greater than the average score for small companies on each improvement dimension.

H_1: The average score for large companies on each improvement dimension was greater than the average score for small companies on each improvement dimension.

In the case of barriers

H_0: The average score for large companies on each barrier dimension was not greater than the average score for small companies on each barrier dimension.

H_1: The average score for large companies on each barrier dimension was greater than the average score for small companies on each barrier dimension.

In order to test these two hypotheses we calculated the mean and standard deviation for both large and small companies on each dimension and used a t-test with independent variances. The independent variances t-test statistic is given by

$$t = \frac{\overline{X}_s - \overline{X}_l}{\sqrt{\dfrac{S_s^{\,2}}{n_s} + \dfrac{S_l^{\,2}}{n_l}}}$$

where

$\overline{X}_s$ is the mean score for the small companies

$\overline{X}_l$ is the mean score for large companies

S_s is the standard deviation for the small companies

S_l is the standard deviation for the large companies

n_s is the number of small companies

n_l is the number of large companies

To test the null hypotheses in both cases we used a one-tailed test with a 5% level of significance.

4. RESULTS

In this section we outline our results, dealing with the ranking order hypotheses in the first part of the section and the average score hypotheses in the second part of the section.

4.1 Ranking Order Hypotheses

4.1.1 Improvements Achieved by e-Business

Table 1 contains the average scores and rankings for small and large companies assuming that the highest score, which equates with the highest level of improvement, is given the highest ranking. In the case of small companies, the highest average score was given to increased information available to the company, whereas in the case of large companies the highest average score was achieved by increased information available to the customer.

Table 1. Rankings of perceived improvements achieved by e-business

	Small Companies		Large Companies	
	Average Score	Ranking	Average Score	Ranking
Reduction in labour	2.73	6	3.81	6
Reduction in inventory	2.13	11	3.15	11
Reduction in total costs	2.90	5	4.08	5
Increase in revenue	2.43	8	3.42	7
Increase in the number of new customers	2.27	10	3.42	7
Increase in the number of customers overseas	1.90	13	2.54	13
New markets	2.03	12	2.73	12
Retention of online customers	2.60	7	3.38	9
Improved customer service	3.03	4	4.88	2
Increased information available to suppliers	2.37	9	3.19	10
Increased information available to customers	4.07	2	5.08	1
Increased information available to employees	3.83	3	4.38	4
Increased information available to the company	4.23	1	4.65	3

The Spearman Rank Correlation Coefficient was 0.93. This equates to a Z score of 3.22. Therefore we can reject the null hypothesis that the rankings of small and large companies are independent and conclude that there is a strong association in the rankings.

4.1.2 Barriers to e-Business

Table 2 contains the average scores and rankings for small and large companies assuming that the highest score, which equates with the highest level of impediment, is given the highest ranking. In the case of small companies, the highest average score was given to incompatibility of the new technology with existing back-end systems, whereas in the case of large companies the highest average score was achieved by inadequate resource allocation.

Table 2. Rankings of perceived barriers to e-business

	Small Companies		Large Companies	
	Average Score	Ranking	Average Score	Ranking
Poor budgeting	2.27	8	3.12	7
Inadequate resource allocation	3.17	2	3.77	1
Overestimation of the efficiency gains	2.40	7	2.85	10
Lack of technical resources	3.13	3	3.62	2
Resistance from staff	2.97	4	3.12	7
Lack of training for staff	2.57	6	3.38	4
Incompatibility of the new technology with existing back-end systems	3.40	1	3.19	5
Lack of expert advise as e-business is a new way of doing business	2.23	10	2.65	12
Overload of information	2.07	11	3.04	9
Lack of qualified (skilled) staff	2.27	8	3.19	5
Lack of technical resources	2.77	5	3.50	3
Lack of senior management/board support	2.03	12	2.69	11

The Spearman Rank Correlation Coefficient was 0.78. This equates to a Z score of 2.59. Therefore we can reject the null hypothesis that the rankings of small and large companies are independent and conclude that there is a strong association in the rankings.

4.2 Average Score Hypotheses

A close inspection of Tables 1 and 2 will lead to the conclusion that the average score in almost every dimension is higher for large companies than for small companies. However we wish to establish whether these differences are statistically significant.

4.2.1 Improvements Achieved by e-Business

Table 3 contains the p score on each dimension and the decision about whether the null hypothesis should be accepted or rejected. The greatest perceived difference was on the dimension of improved customer service which ranked second with an average score of 4.88 for large companies and fourth with an average score of 3.03 for small companies. The least perceived difference was in the dimension of increase in the number of customers overseas which ranked thirteenth for both types of companies scoring 2.54 for large companies and 1.90 for small companies.

Table 3. Perceived improvements achieved by e-business

	P score	Accept/Reject
Reduction in labour	5.08%	Accept
Reduction in inventory	6.25%	Accept
Reduction in total costs	3.42%	Reject
Increase in revenue	4.98%	Reject
Increase in the number of new customers	3.38%	Reject
Increase in the number of customers overseas	16.36%	Accept
New markets	13.32%	Accept
Retention of online customers	12.59%	Accept
Improved customer service	0.18%	Reject
Increased information available to suppliers	10.23%	Accept
Increased information available to customers	6.70%	Accept
Increased information available to employees	21.60%	Accept
Increased information available to the company	25.46%	Accept

The average score for large businesses was significantly higher than the average score for small businesses for the dimensions of reduction in total costs, increased revenue, increase in the number of customers and improved customer service. In all other dimensions there was no difference in perceived benefits based on the size of the company.

4.2.2 Barriers to e-business

Table 4 contains the p score on each dimension and the decision about whether the null hypothesis should be accepted or rejected. The greatest perceived difference was on the dimension of information overload which ranked ninth with an average score of 3.04 for large companies and eleventh with an average score of 2.07 for small companies. The least perceived difference was in the dimension of incompatibility of the new technology with existing back-end systems which ranked fifth with a score of 3.19 for large companies and first with a score of 3.40 for small companies.

Table 4. Perceived barriers to e-business

	P score	Accept/Reject
Poor budgeting	4.91%	Reject
Inadequate resource allocation	10.75%	Accept
Overestimation of the efficiency gains	14.66%	Accept
Lack of technical resources	14.75%	Accept
Resistance from staff	31.14%	Accept
Lack of training for staff	5.08%	Accept
Incompatibility of the new technology with existing back-end systems	45.42%	Accept
Lack of expert advise as e-business is a new way of doing business	18.01%	Accept

Overload of information	1.56%	Reject
Lack of qualified (skilled) staff	3.75%	Reject
Lack of technical resources	7.92%	Accept
Lack of senior management/board support	10.91%	Accept

The average score for large businesses was significantly higher than the average score for small businesses for the dimensions of poor budgeting, information overload and lack of qualified staff. In all other dimensions there was no difference in perceived benefits based on the size of the company.

5. IMPLICATIONS

The implications of the study are of significance in the Australian context since the study indicates a number of outcomes.

- It would appear that there is a strong association between the ranking orders of benefits from e-business between small and large businesses in Australia (this result was significant at the 1% level).
- It would appear that there is a strong association between the ranking orders of barriers to e-business between small and large businesses in Australia (this result was significant at the 5% level).
- Among the perceived improvements achieved by e-business, large companies viewed the improvement significantly higher in the areas of reduction in total costs, increase in revenue, increase in the number of customers and improved customer service.
- Among the perceived barriers to e-business, large companies viewed the impediment significantly higher in the areas of poor budgeting, information overload and lack of qualified or skilled staff.

Finally, in no case, either improvements achieved by e-business or barriers to e-business, did small companies perceive significantly higher improvements or significantly higher impediments than large companies.

6. CONCLUSION

In presenting this study, we are mindful of the nature of the data collected for this study. Although the final analysis was based on data collected from a reasonable proportion of the sample, there remains the problem about non-response. The question remains as to whether the sample of small companies is representative of the population of small companies in Australia, and similarly whether the sample of large companies used in the analysis is representative of all large companies in Australia.

We based our classification of small and large companies in Australia on the ABS classifications. It is clearly possible to analyse the data based on some other cut-off point than 100 employees or to carry out the analysis using a four category approach based on the four size categories used by the ABS. These options are available to other researchers.

Finally, prior to this study there was no data available on the different attitudes and perceptions of small and large Australian companies to the benefits gained from and the barriers to e-business. We assume that this is also the case in most other countries. Therefore we hope that this study will give researchers in other countries a direction to follow in their research into this issue.

REFERENCES

ABS, 2005. Business use of information technology. *Australian Bureau of Statistics, Canberra, Australia*, 8129.0 2003-2004.

ABS, 2000. Business use of information technology. *Australian Bureau of Statistics, Canberra, Australia*, 8129.0 1999-2000.

Chaffey, D., 2004, E-Business and E-Commerce Management, Second Edition, London, Prentice Hall. .

Dublish, S., 2000, Retailing and the Internet, proceedings of the First World Congress on the Management of Electronic Commerce, McMaster University, Hamilton, Canada (CD ROM).

Dunt, E. S. and Harper, I. R., 2002, "E-Commerce and the Australian Economy", *The Economic Record*, Vol. 78 No. 242, pp. 327-342.

Fillis, I., Johansson, U. and Wagner, B., 2003, A conceptualization of the opportunities and barriers to e-business development in the smaller firm. *Journal of small business and enterprise development,* 10, 3, 336-344.

Gregor, S., Fernandez, W., Holthom, D., Martin, M., Stern, S., Vitale, M. and Pratt, G., 2004, Achieving value from ICT: Key management strategies. *Department of Communications, Information Technology and the Arts, Canberra, Australia*.

Kearney, A T, 2002, 'E-Business Outlook: 2003 ATKearney an EDS Company, August.

NOIE, 2001, NOIE Report (2001, 'B2B E-Commerce: Capturing Value Online', Commonwealth of Australia http://www.noie.gov.au/publications/NOIE/B2B/start.htm March 2003

NOIE, 2002, 'The Current State of Play, Australia's Scorecard', www.noie.gov.au

NOIE Report, 2003, The Benefits of Doing Business Electronically - eBusiness.

Singh, M., 2000, 'Electronic Commerce in Australia: Opportunities and Factors Critical for Success', proceedings of the 1st World Congress on the Management of Electronic Commerce (CD ROM), January 19 – 21, Hamilton, Ontario, Canada.

Taylor, M. and Murphy, A., 2004SMEs and e-business. *Journal of small business and enterprise development,* 11, 3, 280-289.

Singh, M., 2002, 'Electronic Commerce Opportunities, Challenges and Organisational Issues for Australian SME's', Managing Information Technology in Small Businesses: Challenges and Solutions edited by Burgess, S., IDEA GROUP PUBLISHING, Hershey, USA, pp 322 – 339.

Turban, E., Lee, J., King, D. and Chung, H. M., 2002, Electronic Commerce A Managerial Perspective, Prentice Hall International Inc., New Jersey.

Turban, E., King, D., Lee, J. and Viehland, D., 2004, Electronic Commerce A managerial Perspective, Prentice Hall, New Jersey.

THE EFFECTIVENESS OF SME WEBSITES IN A BUSINESS TO BUSINESS CONTEXT

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ABSTRACT

This research analyses the effectiveness of SME business to business websites from a user perspective. An established evaluation instrument (eQual) is used to assess 80 websites in terms of usability, information quality, and interaction and service. The analysis shows that although a significant number of sites reflect little understanding of the attributes of good design or potential benefits to be gained from websites, there are examples of competent and effective website use.

KEYWORDS

SMEs, websites, eQual, evaluation

1. INTRODUCTION

Smaller and medium sized businesses (SMEs) play a crucial role in national economies and are estimated to account for 80% of global economic growth (Jutla, Bodorik, & Dhaliqal, 2002). The health of such companies and their ability to compete in an increasingly connected global market are therefore of concern to governments and industry bodies. One aspect of SME e-commerce activity that is acknowledged but rarely examined is their use of websites. Websites are 'a critical component of the rapidly growing phenomenon of e-commerce' (Loiacono, Watson, & Goodhue, 2002) and their successful design and use can alter the effectiveness of an SME's venture into e-commerce. Understanding the factors used by customers to determine website quality can serve as a basis for creating and improving websites (Webb & Webb, 2004).

This paper supports calls for more extensive work into the analysis and evaluation of B2B websites (Chakraborty, Lala, & Warren, 2002; Ellinger, Lynch, Andzulis, & Smith, 2003; Loiacono et al., 2002). The research analyses the effectiveness of current SME websites from a user perspective. It uses an established evaluation instrument (eQual) to gain an understanding of how SME websites are meeting the needs of potential customers. The paper contributes to a better understanding of how SMEs are addressing the constructs of website development identified in the literature. These constructs have been incorporated into eQual and tested in other environments (Barnes & Vigden 2001, 2002, 2003). A deeper understanding of SME websites and where areas for improvement lie will enable development of support frameworks to improve SMEs' recognition and realisation of benefits from their websites; a prerequisite for encouraging e-commerce adoption (Poon & Swatman, 1999).

2. WEBSITES FOR SMES

Several initiatives have been launched to improve electronic adoption rates and e-competencies (Jones Donald Strategic Partners, 2000; NOIE, 2002), but many SMEs are failing to achieve the levels of e-commerce abilities required to benefit from Internet based business (Walker, Bode, Burn, & Webster, 2003). Smaller businesses are often caught between the need to understand the dynamic and frequently intimidating electronic environment and the need to respond to the many calls to conduct more business online (Goode, 2002; Walker et al., 2003). Their subsequent attempts to trade online results in e-commerce activity that is unproductive such as launching ineffective websites, ignoring customer e-mails and failing to efficiently fulfil online orders. Where smaller businesses turn to consultants to overcome their own lack of expertise, results often fall short of expectations as SMEs do not have sufficient knowledge to judge the effectiveness of a consultant's work prior to implementation (Bode & Burn, 2001).

One highly visible aspect of e-commerce activity that is often seen as the first step towards online trading is the launch of a website. Statistics show that 36% of small and 82% of medium-sized businesses in Australia have established a website (ABS, 2003). Two thirds of SMEs believe that their website enhances their business effectiveness, by increasing visibility and accessibility, improving communications and increasing sales (ABS, 2003). This accords with Loiacono et al's (2002) view that websites 'play a significant role in the overall marketing communication mix'. The implementation of B2B websites is seen as an important stage in e-commerce development (Ellinger et al., 2003) and a crucial part of a firm's use of the Internet for communicating, entertaining and interaction with stakeholders (Chakraborty et al., 2002).

Despite the statistics and the frequent mention of the use of websites in the many papers on SME e-commerce adoption (Bode & Burn, 2001; Daniel, Wilson, & Myers, 2002; Korchak & Rodman, 2001), the quality of such websites and the need to determine their function is rarely addressed (Manuel, 2004). Auger 2005)discusses the impact of design sophistication and level of interactivity in increasing the number of visitors and the impact on overall performance. While design sophistication was not found to necessarily positively affect performance, interactivity is an important asset. Fry et al., (2004) examine the elements of accessibility and visibility amongst the increasing number of sites on the Web. They note however, that government targeting of small businesses in this field tends to overly emphasize the technical rather than business aspects of website use. There are numerous online sources offering, often conflicting, advice and help on setting up a website while business organisations and government sources continue to encourage smaller businesses to launch websites. The proliferation of sites has increased the imperative for businesses to have some knowledge of what they intend their site to achieve.

That many of these sites are subsequently deemed ineffective by their owners is often due to an uncertainty over the role of the site and a lack of understanding of how to integrate Internet strategies into an existing business. Indecision and lack of knowledge leads to ineffective sites and consequent disappointment in recognisable benefits (Ellinger et al., 2003; Stockdale & Standing, 2004). Therefore, it is critical for these SMEs to understand customer requirements and to enhance their web accordingly. A SME with a web site that is difficult to use and understand can weaken the firm's presence on the Internet (Barnes and Vidgen, 2002). According to Turban and Gehrke (2000), there are significant discrepancies between factors identified in various academic publications and those rated in consumer surveys. Therefore, there is a need to identify critical success factors for effective website usage by SMEs both from the customers' viewpoint and from the designer and owner perspective. Such factors can contribute to the ability of SMEs to improve their websites over time, then benchmark against competitors and best practice in any industry (Barnes and Vidgen, 2002).

3. RESEARCH DESIGN

To assess the quality of websites within the small business sector of one regional area within Australia, an established quality evaluation instrument, eQual (version 4), is used (Barnes & Vigden, 2002). The instrument was designed and tested over several years (Barnes & Vigden, 2001, 2002, 2003) as a method for assessing the quality of a firm's e-commerce offerings through its website. It enables website quality to be judged through three dimensions: usability, information quality and service interaction quality. In developing the instrument, Barnes and Vigden (2002) identified five factors of importance that are encompassed within the three dimensions: usability, design, information, trust and empathy.

This research examines the websites of 80 SMEs based in Western Australia (WA). The region appears particularly suited to the development of e-commerce. WA has a high percentage of SMEs in the private sector that employ over 47% of non-agricultural workers (ABS,2003). It is a technologically well developed region with a strong exporting economy. The use of e-commerce applications is well suited to its geographical isolation both within the State and from its export destinations. B2B e-commerce is the most profitable sector of online trading (Ellinger et al., 2003), although it has been insufficiently addressed in website evaluation research (Loiacono et al., 2002). This research targets B2B SMEs, but includes firms that also trade B2C. Purely B2C firms are not addressed in this research.

3.1 Data Collection and Analysis

Eighty SMEs trading in Western Australia have been identified through web searches, use of online directories, Yellow Pages and local knowledge. SMEs are defined according to the Australian Bureau of Statistics as firms employing less than 200 full time equivalent workers and that are not subsidiaries, public companies or incorporated bodies (ABS, 2003).

An initial analysis of ten websites was made by the authors to familiarise themselves with the use of eQual 4.0, the research instrument. This enabled them to become familiar with the research instrument and to make a preliminary assessment of the range of SME websites in WA. The evaluation of the remaining seventy websites was then carried out by a research assistant and six members of a postgraduate (Masters) class studying web usability. The research instrument consists of 23 questions with a Likert scale of 1 to 7. After the initial analysis, the authors added a comment area for each question to collect further data on the evaluators' responses to each website. The qualitative nature of the additional responses enables the context of each website to be considered and supports greater understanding of the 'why' behind identified patterns in the survey data (Barnes & Vigden, 2003).

Analysis of the data involved the assessment of each website within the three instrument dimensions of usability, information quality, and interaction and service quality. The researchers evaluated each of the websites using a Likert scale where the anchors are 1="strongly disagree" and 7="strong agree" in each of the three instrument dimensions. The results were analysed using a statistical software package, SPSS. The evaluators' comments were analysed by coding the texts using the research instrument to construct the units of analysis. These were based around the three dimensions of the instrument and with particular reference to the five factors of usability, design, information, trust and empathy as identified by Barnes & Vigden (2002).

4. FINDINGS

Of the 80 SME websites evaluated, 46.9% were assessed as above average for overall quality, while a third (37.0%) were rated as below average for quality. The mean scores for the 23 eQual 4.0 questions are listed in Table 1. The findings are presented within the three dimensions of the research instrument.

4.1 Usability

In terms of website usability, most SME websites were easy to learn to operate (56.8%) and to use (65.5%). These websites had also conveyed a sense of competency (59.2%). However, only 49.4% of the websites examined reportedly created a positive experience for the users. Moreover, it appears that a positive experience was the most important usability factor for determining the overall view of the websites (correlation=0.858). Of those websites that had scored an overall positive rating, 76.3% of them had also scored positive ratings for conveying a sense of competency. Overall, the average score for the usability dimension was 4.39 out of a possible 7 points.

Usability in the context of this evaluation addresses how a user interfaces and reacts to a website: the emphasis is on the user and not on the designer or the software of the site (Barnes & Vigden, 2002). Ease of use of a website is seen as a prerequisite for visitor use (Barnes and Vigden, 2002) and has a positive influence on customer responsiveness (Dadzie, Cherlariu & Winston, 2005). A website that is easy to use also enhances the ability of visitors to learn to navigate around the site and to find the facilities that they seek.

Table 1. Mean score for eQual 4.0 questions

	eQual 4.0 questions	Mean	Sum	Standard Deviation
Usability	I find the site easy to learn to operate	4.52	366	0.823
	My interaction with the site is clear and understandable	4.41	357	0.997
	I find the site easy to navigate	4.51	365	0.976
	I find the site easy to use	4.54	368	0.923
	The site has an attractive appearance	4.48	363	1.256
	The design is appropriate to the type of site	4.26	345	1.302
	The site conveys a sense of competency	4.54	368	1.582
	The site creates a positive experience for me	3.93	318	1.439
Information	The site provides accurate information	4.20	340	1.487
	The site provides believable information	4.49	364	1.518
	The site provides timely information	4.14	335	1.498
	The site provides relevant information	4.26	345	1.481
	The site provides easy to understand information	4.20	340	1.249
	The site provides information at the right level of detail	3.85	312	1.606
	The site presents the information in an appropriate format	3.91	317	1.535
Service Interaction	The site has a good reputation	4.22	342	1.533
	It feels safe to complete transactions	3.93	318	1.464
	My personal information feels secure	3.79	307	1.498
	The site creates a sense of personalization	4.04	327	1.495
	The site conveys a sense of community	4.12	334	1.426
	The site makes it easy to communicate with the organization	4.93	399	1.170
	I feel confident that goods/services will be delivered as promised	4.32	350	1.540
	My overall view of this web-site	4.17	338	1.539

In a B2B situation it is to be expected that visitors will have at least some level of competency in electronic business, although this assumption should not be taken for granted. Therefore websites should have high usability in order to attract visitors of all types. Design is an integral part of usability and influences both the evaluators' perceptions of ease of use, and of the sense of competence. Appropriate design was one of the lowest rated factors in the usability section.

Evaluation of a website must be necessarily subjective, but there was some consensus displayed by the evaluators on the ease with which visitors could learn how to use the sites and how easy they were to use. However, it is worth noting that nearly a third of the websites did not rate as easy to use; a significant number in terms of potential visitors visiting and remaining to use the site. Website users have low levels of tolerance and will move websites if they cannot find the information they need quickly (Shuster, 2000).

4.2 Information Quality

In terms of information quality, most B2B websites provided believable information (54.3%) but failed to provide information at the right level of detail (only 39.5%) as well as in an appropriate format (only 42.0%). Providing believable information to users was the most important information quality factor for determining the overall view of the websites (correlation=0.841). Of those websites that had scored an overall positive rating, almost all (97.4%) had scored highly for providing believable information. The average score for the information quality dimension was also 4.16 out of 7 points.

An acceptable level of detail was visible in less than half the sites evaluated and some vital elements of information were missing from these sites. For example information on products and services was found to be scant in many areas with the apparent assumption that the site visitor had sufficient knowledge to understand the variations of the product range. In contrast one of the highly recommended sites had detailed

information on the practical applications of each item in its product range linked to the catalogue entry, thereby providing levels of information to suit all customers.

A second important area where information was found to be lacking was in the provision of company details. This is considered a crucial element of a business website (Shuster, 2000) and is a necessary source of information for visitors searching for new suppliers. Again the highly rated sites had detailed company information that gave the history, business aims, location and sometimes testimonials from satisfied suppliers. In one case the names, photograph, contact details and area of expertise of each of the company's sales force were presented. This level of contact detail was rare and sites provided only an email address or a telephone number. In one case the only content information was a map from which the customer could infer the address and in another the website consisted only of contact details rather like a telephone book entry.

The refreshment of content is seen to be an important element of websites to keep up interest levels and show that the company is maintaining the site (Shuster, 2000), but few of the websites showed evidence of current input. In at least half of the sites the last update or date of creation was unknown. In 12% of cases, the website had not been altered since before 2004 and only three sites actually gave a date of less than a month since the last upgrade. In the more highly rated sites, information was seen to be well organised, timely and relevant. This led to the perception of accurate and believable information being presented. Some sites provided extensive information that was not found to be useful. For example, one company using natural products displayed encyclopaedia extracts explaining the nature of the product, but had no prices or catalogue showing the product range on offer. The site had the appearance of an educational site rather than a commercial venture. The lack of prices on some transactional sites was somewhat of a puzzle and was recorded as insufficient information in the evaluation. In at least one case, prices may be visible through a passworded extranet although it was not possible to verify this.

4.3 Interaction and Service Quality

In terms of interaction and service quality, most SMEs' websites made it easy for users to communicate with them (72.9%). However, only 39.5% of the websites evaluated made users' personal information feel secure and 42.0% made users feel it was safe to complete transactions. In fact, only three of the SME websites evaluated actually transacted online through secure sites. Moreover, the users' confidence in the delivery of goods/services as promised was the important interaction quality factor for determining the quality of the websites (correlation=0.889). Of those websites that had scored an overall positive rating, all had scored positively for making users feel confident that goods/services will be delivered as promised. In addition, the average score for interaction and service quality dimension was also 4.21 out of 7 points.

Channels for communication were offered by all sites in at least one form although the use of email did not predominate. There was also little evidence of multi-channel communication on offer, with many sites offering either telephone or email, or in some cases only a postal address. The three websites with fully functional secure transactional sites rated highly in all areas. In two other firms offering online purchase, the websites offered a form into which visitors were invited to enter their credit card details, although no security precautions were evident. Other companies used intermediaries such as PayPal to host their transactions. Only one site offered a range of payment options within a secure site. Surprisingly, none of the sites discussed electronic invoicing or payment terms more in keeping with B2B transactions. The majority ran brochure sites only and invited potential customers to contact the firm to discuss things further. While this is an acceptable measure, the sites did not make it easy for potential customers to properly ascertain if they wished to progress with their enquiries; for example by offering complete product lists, prices, delivery details, invoicing details etc. Confidence in the delivery of goods received a 100% rating from firms considered to have very good sites, but was not relevant in the majority of cases where only brochure or catalogue sites were used.

5. DISCUSSION

The majority of websites examined were brochure and catalogue sites, with only 15 of the 80 sites selling online. This accords with Albert et al's findings that while many visitors are comfortable conducting transactional activities online, the primary activity remains information and communication based (2004).

The purpose of the majority of sites was held to be informational, either for existing customers or to attract visitors seeking to broaden their supplier base. In the transactional sites, online selling was primarily an addition to an informational site and only three sites had developed the secure transaction mechanisms necessary for online trading. These three sites displayed the attributes of full transactional sites including delivery options, online tracking and secure payment methods.

Users should have a positive experience when visiting a website (Barnes & Vigden, 2002; Turban & Gehrke, 2000). In a highly competitive commercial environment, a negative view of the overall experience might easily lead to a user searching for new suppliers. Where an established partner is concerned, it may be that they prefer not to use the site thereby losing opportunities for realising the benefits of e-commerce. A positive experience for the user was found in only half of the websites evaluated. Despite higher ratings in the usability section of the analysis, half of the SMEs were rated as below standard overall. This reflects the evaluators' comments that although the websites were easy to use and good to look at, they did not enable the visitor to find what they wanted. This aspect of usability is strongly influenced by the website design. Good website design must fulfil customers' needs for information or transaction capabilities (Heldal, Sjovold, & Heldal, 2004). The evaluators rated the more complex websites, incorporating graphics, animation and sound, as low on usability. The same sites also had lower ratings on information and interaction. The websites appeared designed to please the owner (or designer) rather than provide appropriate information to the visitor; a finding that supports the view that a designer's desire for artistry often supersedes the users' needs (Heldal et al., 2004). Since the designer viewpoint is rarely the same as the users' the dimension of service interaction quality can be affected by failure to address the customers and their needs.

The research instrument devotes a number of questions to ascertaining the quality of information, which is regarded as a major contributor to the success of a website. Consideration of the quality of the content presented is considered of primary importance when using a website (Turban & Gehrke, 2000). Specifically, comprehensive product information is vital if prospective customers are to develop an interest in the site and returning customers are to maintain loyalty (Dadzie et al., 2005). Product information was found to be incomplete or not included in a quarter of the websites evaluated. This has significant implications for attracting and retaining customers who may find it preferable to search for information elsewhere rather than consider contacting the company for more details. Where product information was given, there were some innovative ideas with well structured pages to enable the visitor to choose the depth of information required.

A further concern in this area is the lack of company information, including contact details. Nielsen argues that the home page of a site is the online equivalent of the reception area. The impression created will often influence whether a visitor remains on the site or leaves immediately (in Shuster, 2000). The homepage should contain basic information about the company, together with address, an email and telephone number to support multiple communication options. The lack of such fundamental information creates an unprofessional appearance to visitors and does not provide the necessary introduction to those searching for new suppliers.

Clear concise text in an appropriate format gives a positive feel to a website (Turban & Gehrke, 2000) and this was one area in which performance was high with rare examples of inappropriate text or layout. However, the overall assessment of the websites were lower than indicated by this section as although the text was clear and well laid out, it did not provide the information that visitors were seeking. Also, the appearance of more timely text would benefit the majority of the websites, particularly where dates of homepage creation or last update were over a year old. While it was known that these firms are still operating, visitors from further afield may doubt their continuing existence and search elsewhere. It was possible to see some examples where the site had been created by web consultants and subsequently left untended, probably through lack of in-house skills; a scenario well recorded in the literature (Bode & Burn, 2001; van Akkeren & Cavaye, 1999) and a problem for many smaller businesses dependent on the advice and expertise of consultants.

Concerns of empathy and trust are key factors of the service interaction quality (Barnes & Vigden 2002). The evaluators' comments confirmed the correlation between users' confidence in the delivery of goods and an overall positive assessment of the site. This supports the concepts of trust and empathy as a key feature of website interaction. While high user confidence implies empathy and trust, the notion of trust did not appear to be associated with security. This may arise from the low number of the firms actually trading online. The issue of security is seen as a significant concern in the business press, although it is interesting to note that in Turban & Gehrke's (2000) determinants of e-commerce sites, experts did not rank security highly and concentrated on network security, copyright and confirmation of purchase. In contrast, consumers ranked

security as of first importance in an e-commerce situation. Only three sites rated highly for confidence in security from a transactional perspective. These sites also rated highly in regard to protection of customer information. Those firms that are transacting through the use of downloadable forms for credit card details did not rate highly from either perspective. It also appeared to the evaluators that these firms were not supporting significant levels of online trading.

What emerged from the examination of these sites is that few of the firms are prepared to trade online. This finding is well supported by the literature (Saban & Rau, 2005). Although some SMEs have the ability to develop websites that function at a high level of e-commerce, the majority retain an informational perspective. Several of the evaluated sites have been in existence for a number of years but have not progressed beyond the brochure or catalogue format. This would imply either that the site owners are gaining no benefits from the site and have no motivation to improve or update them, or that they are satisfied with the level of custom being generated. Alternatively, the website may have been created as a result of peer group convention or perceived business wisdom to give the appearance of legitimacy (Grewal, Comer, & Mehta, 2001). In such cases owner expectations are usually low and lack of strategy means that the realisation of benefits remains very low and interest in the website is abandoned (Stockdale & Standing, 2004). Resource constraints are another factor that influences more complex adoption, not least the industry sector and the IT skills within the firm (Poon & Swatman, 1999; van Akkeren & Cavaye, 1999). Higher than anticipated costs for developing and maintaining a highly functional website can also stall progressive development of an informational site (Saban & Rau, 2005).

The customer-centric sites discussed by Albert et al., (2004) are clearly beyond the scope of the SMEs discussed in this evaluation. Differentiating the design of non-transactional and transactional websites to reflect the goals and experiential requirements (Albert et al., 2004) implies a level of strategy development that is rare in smaller businesses. Nevertheless, the evaluated firms have dedicated resources to building websites, many have taken steps towards online trading and there were excellent examples of how even the smallest businesses could effectively use the Internet for business purposes.

6. CONCLUSIONS

User perceptions of the websites evaluated varied across the three dimensions used to assess them. The effectiveness of the websites was evident in specific areas; ease of use, attractiveness and navigation were highly rated, as was providing believable information and conveying a sense of competence. The results in these areas are encouraging. Significant numbers of smaller businesses are managing to project themselves online and present websites that attract and encourage visitors.

Where problems then occur is in meeting visitors' subsequent needs. Users perceived that their needs were not met in regard to levels of information detail, and trust in the secure handling of both personal and transactional information. The inability to provide the right level of information and security seriously hinders the progression of e-commerce for these sites and affects the positive experience of the visitor. SMEs too often have little recognition of the benefits of a website and the adverse effect that an incomplete or untended site can have as an advertisement for ineffectiveness.

It is perhaps natural to emphasise the failings found in the evaluation and to overlook the number of smaller firms that are presenting competent and well designed websites to potential customers. Although in global terms the sites are not highly visible, within the regional market there is encouraging evidence of firms gaining benefits from their e-commerce activities and presenting effective websites to potential and existing customers. To extend the number of SMEs in this category, firms must be encouraged to develop the information and service quality dimensions of their websites and to gain an understanding of visitors' needs.

REFERENCES

ABS. (2003). *Business Use of Information Technology*. Canberra: Australian Bureau of Statistics.

Albert, T., Goes, P., & Gupta, A. (2004). GIST: A model for design and management of content and interactivity of customer-centric web sites. *MIS Quarterly, 28*(2), 161-182.

Auger, P. (2005). The impact of interactivity and design sophistication on the performance of commercial websites for small business. *Journal of Small Business Management, 43*(2), 119-137.

Barnes, S., & Vigden, R. (2001). An evaluation of cyber-bookshops: the WebQual method. *International Journal of Electronic Commerce, 6*(1), 11-30.

Barnes, S., & Vigden, R. (2002). An integrative approach to the assessment of e-commerce quality. *Journal of Electronic Commerce Research, 3*(3), 114-127.

Barnes, S., & Vigden, R. (2003). Measuring website quality improvements: a case study of the forum on strategic management knowledge exchange. *Industrial Management & Data Systems, 103*(5), 297-309.

Bode, S., & Burn, J. M. (2001). Website design consultants, Australian SMEs and electronic commerce success factors. *International Journal of Business Studies, vol 9*(1), pp 73-85.

Chakraborty, G., Lala, V., & Warren, D. (2002). An empirical investigation of antecedents of B2B Websites' effectiveness. *Journal of Interactive Marketing, 16*(4), pp. 51-72.

Dadzie, K., Chelariu, C., & Winston, E. (2005). Customer service in the internet-enabled logistics supply chain: Website design antecedents and loyalty effects. *Journal of Business Logistics, 26*(1), 53-78.

Daniel, E., Wilson, H., & Myers, A. (2002). Adoption of e-commerce by SMEs in the UK. *International Small Business Journal, 20*(3), pp. 253-269.

Ellinger, A., Lynch, D., Andzulis, J., & Smith, R. (2003). B-to-B e-commerce: A content analytical assessment of mot carrier websites. *Journal of Business Logistics, 24*(1), pp. 199-221.

Fry, J., Tyrrall, D., Pugh, G., & Wyld, J. (2004). The provision and accessibility of small business Websites: a survey of independent UK breweries. *Journal of Small Business and Enterprise Development, 11*(3), 302-314.

Goode, S. (2002). Management attitudes toward the World Wide Web in Australian small business. *Information Systems Management, Winter*, pp 45-48.

Grewal, R., Comer, J. M., & Mehta, R. (2001). An investigation into the antecedents of organizational participation in business-to-business electronic markets. *Journal of Marketing, 65*(3), pp. 17-33.

Heldal, F., Sjovold, E., & Heldal, A. F. (2004). Success on the Internet - optimizing relationships through the corporate site. *International Journal of Information Management, 24*, 115-129.

Jones Donald Strategic Partners. (2000). *Taking the plunge 2000, sink or swim? Small business attitudes to electronic commerce*. Commonwealth of Australia: National Office for the Information Economy.

Jutla, D., Bodorik, P., & Dhaliqal, J. (2002). Supporting the e-business readiness of small and medium-sized enterprises: approaches and metrics. *Internet Research: Electronic Networking Applications and Policy, 12*(2), 139-164.

Korchak, R., & Rodman, R. (2001). eBusiness adoption among US small manufacturers and the role of manufacturing extension. *Economic Development Review, 17*(3), 20-25.

Loiacono, E., Watson, R., & Goodhue, D. (2002). *WebQual™: A Measure of Web Site Quality.* Viewed online at http://www.terry.uga.edu/cisl/includes/pdf/webqual.pdf Accessed 25 March 2004

Manuel, N. (2004). Wizzy websites can make SMEs look like world-beaters*. Financial Times,* p. 18.

NOIE. (2002). *e-Business strategy for small business*, Viewed online at www.noie.gov.au/projects/ebusiness   Accessed 7 March 2003

Poon, S., & Swatman, P. (1999). An exploratory study of small business Internet commerce issues. *Information and Management, 35*, 9-18.

Saban, K., & Rau, S. (2005). The functionality of websites as export marketing channesl for small and medium enterprises. *Electronic Markets, 15*(2).

Shuster, L. (2000). Designing a website. *Civil Engineering, 70*(2), 64-65.

Stockdale, R., & Standing, C. (2004). Benefits and barriers of electronic marketplace participation: An SME perspective. *Journal of Enterprise Information Management, 17*(4), 301-311.

Turban, E., & Gehrke, D. (2000). Determinants of e-commerce websites. *Human Systems Management, 19*, 111-120.

van Akkeren, J., & Cavaye, A. L. M. (1999). Factors affecting entry-level Internet technology adoption by small business in Australia - evidence from three cases. *Journal of Systems and Information Technology, 3*(2), pp 33-48.

Walker, E. A., Bode, S., Burn, J. M., & Webster, B. J. (2003, 29-30th September). *Small business and the use of technology: why the low uptake?* Proceedings of SEAANZ Conference, Ballarat.

Webb, H. W. and Webb, L. A. (2004) SiteQual: An Integrated Measure of Web Site Quality, *The Journal of Enterprise Information Management*, 17(6), pp430-440

BUZZMONITOR: A TOOL FOR MEASURING WORD OF MOUTH LEVEL IN ON-LINE COMMUNITIES

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ABSTRACT

This paper describes an application to monitor on-line Word of Mouth across different Internet services and how the collected data can be used to feed a company's on-line marketing strategy. Our motivation lies on the theory of social maps and scale-free network laws. We describe briefly buzzMonitor, which is our first prototype for the task of measuring and monitoring conversations among consumers in on-line communities.

KEYWORDS

Social Networks, Viral Communication, Internet, Word of Mouth Communication, Hubs, Buzz Marketing.

1 INTRODUCTION

Since the last decade, the number of Internet users has been growing steadily as well as the use of on-line services that allows interaction among them. Consumers are now much more empowered to freely express their opinions about products and services through the so-called on-line communities, such as blogs, e-commerce sites, forums, discussion lists and others.

Before the advent of the Internet, Word of Mouth (WOM) among consumers were impossible or far too expensive a task to perform accurately. Hence the majority of companies could seldom use WOM data on their marketing strategy. The emerging of Internet applications such as blogs, chats, bulletim boards systems and other on-line communities allowed for the first time to observe the mapping of social networks and in doing so provided new perspectives to study interpersonal online communication for marketing purposes.

WOM phenomena once restricted to the real world, has now taken over the web as a result of the interaction among specific individuals, which feel compelled to talk about their experiences with products, services and brands. Such individuals act as opinion leaders in these communities and can influence literally hundreds of people through their postings on web sites.

As conversations about products and services of a brand spread through the web, companies must be aware of the power of influentials both as a source of information that help to improve their products and services and as a way to prevent emerging crisis by anticipating possible negative WOM detected earlier by hearing these very influentials.

This paper describes a proposal of an application to monitor on-line WOM across different Internet services and how the collected data can be used to feed a company's marketing strategy. Section 2 describes the so called social maps and Barabási scale-free network laws, section 3 explains our approach for word of mouth monitoring on the web, section 4 describes our proposed application BuzzMonitor, section 5 gives a brief for future work and section 6 concludes the paper.

2 SOCIAL MAPS ON THE INTERNET

Milgram demonstrated that our social networks are not random but has a scale-free topology. In 1967 he conducted an experiment that consisted in sending a package to each of 160 people that lived in Boston and Omaha (Nebraska), in the United States. These people were instructed to send each package to a person, living in another city. The participants were said not to send the package directly, but through someone who

they trusted and could help using his or her network to reach the target. To monitor the pathway taken by the package Milgram instructed the participants to write down the full name on it, helping to monitor the number of people handling it before it gets to its final destination. Surprisingly, six was the average number of people that the package passed through before getting to the target. The results of this experience created the hypothesis that everyone in the world is only 6 degrees apart from anybody else. This is sometimes referred also as the six-degree of separation hypothesis [Milgram67].

To Rosen [Rosen2000], what consumers talk, regarding the past acquisitions or future purchases are protected, because *our social ties are not easily visible to the world. It also means that marketers are in the dark. If members of social networks can't see their own links to each other, these links are even more hidden to outsiders.*

In 2004 though the first applications that enabled the creation of social maps, as Orkut and LinkedIn appeared on the web. These sites use the scale-free network model to make social ties visible to a community. Barabási [Barabási2003] proposed the scale-free network model for the Internet in 1999. According to this model, the scale-free networks obey two laws:

a) **Growth**: For each given period of time a new node is added to the network.
b) **Preferential Attachment:** If each node has a choice between two existing nodes, the probability that it will choose a given node is proportional to the number of links the target node has. That is, given the choice between two nodes, one with twice as many links as the other, it is twice as likely that the new node will connect to the more connected node.

Barabási found that most networks of practical interest, from the language to the sex web, are shaped by the same universal laws and therefore share the same hub-dominated architecture. According to the author, hubs are the integral components of scale-free networks; they are the statistically rare, highly connected individuals who keep social networks together. Gladwell affirms that six degrees of separation does not simply mean that everyone is linked to everyone else in just six steps. It means that a very small number of people are linked to everyone else in a few steps, and the rest of us are linked to the world through those few [Gladwell2000], these people are hubs.

Orkut demonstrates a social scale-free network. It is possible to find people with hundreds of contacts and people with just a few dozen. However Orkut works a bit different: the nodes with more links do not necessarily attract more nodes, as a *preferential attachment*.

To deal with this issue, Barabási introduced a third law to scale-free networks. This law is called Fitness. "Fitness is your ability to make friends relative to everybody else in your neighborhood; a company's competence in luring and keeping consumers compared to other companies; an actor's aptitude for being liked and remembered relative to other aspiring actors; a Webpage's ability to bring us back on a daily basis relative to the billions of other pages competing for our attention. It's a quantitative measure of a node's ability to stay in front of the competition. Fitness may have genetics roots in people; it may be related to product and management quality for companies, to talent for actors, or to content for Websites" [Rosen2000].

If our social ties are visible so are our nodes and what we talk. Blogs and communities such as Orkut make visible not only our social networks but also what individuals talk about with each other. What was before considered invisible and impossible to measure now is available, although scattered through thousands of nodes on the web. A company can measure these conversations among consumers, monitoring positive and negative comments that a certain product or service are generating.

Godes and Mayzlin [Godes2003] demonstrates that *WOM can and should be measured just as all of the other key metrics of a company's success are typically measured. Just because it is a difficult phenomenon to get one's hands around doesn't mean that it should be thought of as purely "qualitative."*

In the following sections we will describe how one get hands around the problem of gathering WOM data from the web by describing a search-based application that will help companies to monitor, categorize and analyze WOM among their on-line consumers.

3   THE MONITORING OF ON-LINE WORD-OF-MOUTH

According to Kotler [urlAnet2005], "Buzz marketing, the effort to generate business by WOM, will increase substantially. Marketers have improved their ability to identify opinion leaders and reach them early so that they can do the work of spreading the word about a distinct product or service". Although it is possible to use

several search engines to manually seek and analyze data from conversations on the web, it is not a practical approach for delivering accurate WOM reports on a systematic basis. As it turns out, a software application built specifically for this purpose may have a significant impact on the monitoring activities, freeing the marketers from the time-consuming raw search of terms and allowing them to focus on the analysis of relevant postings filtered automatically by incoming links, terms, URLs and other specific criteria.

The first issue to be considered is where the WOM happens; we should thus define what WOM stands for. WOM happens as a result of Internet users interpersonal communication, it is not an isolate comment, but the sum of all comments about a certain product that are exchanged among people at any given time [Rosen2000]. This communication is scattered on different on-line communities. According to Godes and Mayzlin the more dispersed information is today, the more likely it will be to inform new people tomorrow [Godes2003]. So, it is important not to focus on a particular community or web site but try to measure WOM across communities. Thus our proposal is to monitor WOM across different on-line communities where spontaneous communications occur.

Another key issue is to qualify the individuals responsible for the buzz, this can be accomplished based on Barabási hubs theory. Barabási call hubs nodes with an extraordinary large number of links. In a social network we can observe people that act like hubs. They accumulate a great number of linked contacts, they are people whose blogs have the larger number of incoming links from other blogs, they got a higher number of contacts in their Instant Messaging applications and got the maximum number of friends in Orkut (1,000).

Studying a scale-free network of people connected to each other through their e-mail, Ebel [Ebel2003] found that e-mail hubs on a network are more likely to spread computers worms once infected. Their experiment also showed that *making use of the high clustering, commercial e-mail providers can identify communities of users more easily and focus marketing more efficiently* [Ebel2003].

Pastor-Satorras and Vespignani [Watts2003] found out that even if a vaccine is available to a specific kind of virus, the virus continues to infect other users keeping a stable infection rate during a long period. This study blames the existence of *hubs* (Outlook users who have more contacts on their Contact List than the usual for example) to the keeping infection rate of computer virus.

Hub-users are more visible, because the preferential attachment law states that the probability a node will choose another specific node is proportional to the number of links the chosen node has, therefore these hub-users play a fundamental role in the word of mouth dynamics. It is also important to know who is responsible for the conversations and also the influence these people – also called by different names as Mavens, Hubs, and Opinion Leaders – have to the spreading of buzz.

3.1 Finding Hubs through Incoming Links

The blog phenomenon is one of the new on-line categories applications helping to create social maps. People usually link to each other from their blogs, creating a web of connected blogs that belong to the same cluster. Clusters are (…) *sets of people who share similarities in some dimension of their lives and, as a result, who frequently communicate with one another. Millions of clusters are formed according to dimensions such as age, sex, education, occupation, social class, area of interest, geography, and ethnic background.* [Rosen2000].

In word of mouth monitoring, it is essential to have systems that help the marketer to measure the hubs of a certain network and also the existence of a cluster surrounding a specific hub because this information will help the marketer not only to find out who are the opinion leaders about certain product or service, but to whom these people can directly lead.

A way of doing this is to measure the incoming links that a blog gets because people usually link to the blogs or sites they like. A recent research revealed that from 60 political web sites randomly chosen, only 15% linked to opposite ideology web sites, while 60% linked to same political ideas web sites [Barabási2003]. For marketers, knowing if a blog or a web site belongs to a certain cluster could be useful to imply social-demographic information once omitted. For example: if unidentified person belongs to a cluster of web sites which users are all from Rio de Janeiro, it will be more likely that this person is from Rio as well.

Determining the incoming links will also help us to create social maps, these maps in turn will help to understand how the word of mouth spreads across clusters and who the opinion leaders are. Although a direct relation among hubs and opinion leaders are not yet established we could use the social network

topology as an indicator of ways a message could flow through a network. Localizing clusters will also help to find out if a buzz is still restricted to a community (cluster) or if it spread across the Internet. This will be very useful to marketers to detect if a negative word of mouth is about to become an emerging crisis.

4 BUZZMONITOR: A TOOL FOR MEASURING THE O-LINE WOM LEVEL

BuzzMonitor is a web application designed to search, store and classify information on any number of web sites. It is targeted to on-line market researchers, on-line marketers and other professionals interested in analyzing on-line word of mouth.

BuzzMonitor lets users to define WOM monitoring projects for a specific URL and then generate search results reports. A BuzzMonitor project definition must include a set of parameters that ranges from search terms to auxiliary data that will help to classify them. A typical set of parameters are (numbers correspond to the fields in figure 1):

1 – Client: every project has a client (a firm or a person).
2 – Terms: the terms of the search.
3 – Tags: a project may include any number of tags (used to label each search result).
4 – Number of search results brought.
5 – The size of the text snippet that the user wants to retrieve from matched pages.
6 – Specific URL to be searched.

Figure 1. Project definition screen

Tags are a key feature of BuzzMonitor as they are the primary elements used to categorize search results. When visualizing the results, the user can apply any number of tags to one or more URLs brought by the search. Market researchers to categorize their results, as they like, may use tagging. For example a result could be either positive or negative or relevant or irrelevant. BuzzMonitor allows that these same results may be further classified as say male or female (meaning that they came from a posting written by a man or a woman) and so on. By providing tags to each relevant result the user will refine their search and may generate different reports from the tagged data, such as only positive results or only results posted by women. These reports are the very deliverables of the researcher, which can use the tool not only to gain productivity on their on going projects but also to keep track of every single search that she has ever made using BuzzMonitor as all results include the search date. Figure 2 shows the tagging process in action.

Figure 2. Tagging the results

Once a search is finished it is possible to visualize all the results brought by the engine. These results can be furthered filtered by term, by tag, search date or a refined word search within the snippets of each result. There are two kinds of snippets, the manual snippet, which lets the user to copy and paste any relevant piece that she finds on the matched page; and the automatic snippet, which gathers a piece of the text around the term and stores in the application database, the size of this snippet, is determined in the project creation. In the visualization mode the user can also archive the irrelevant results, this do not erase the results but hides them from the main view, meaning that the user can still retrieve the archived results and even to reactivate them. Figure 3 shows the refined search screen. The refined search lets the user chooses a time period, a keyword (to be searched within the snippets), a term and to indicate if she wants archived pages or pages that no longer are available on the web (using google cached pages feature). The refined search results encompasses all the relevant data the researcher needs, now all she has to do is to generate a report based on this data.
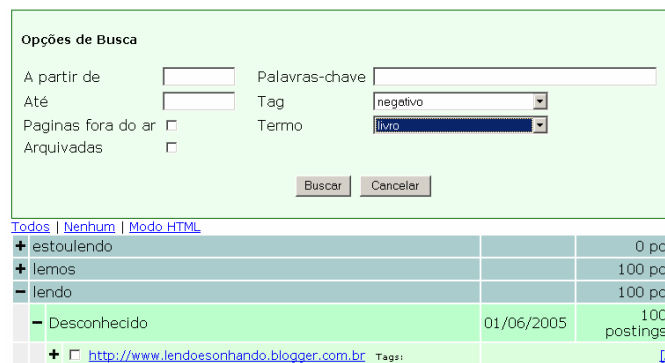
Figure 3. Searching for categorized results

Finally after tagging properly all the results and archiving the irrelevant ones, the user goes to the last phase of the process, which is to generate the reports. There are two kinds of reports: the default report gather all the refined search results and display the manual snippet for each result on the report, together with the name of the service (e.g. www.blogger.com or www.blig.com.br), the name of the site, the author and the date of publication which may be manually entered by the user for each result. The BuzzMonitor application generates for each result the total number of incoming links and also displays this item at the report. The second report is the automated report, the only difference from the default report is that instead of inserting the manual snippets in the report it will retrieve the automatic snippet. The automated report is useful if the researcher is looking for a brief glimpse of what results she will get from the terms she picked. This may help the researcher to refine her search, tunning her terms or to rapidly generate a preliminary buzz report.

4.1 BuzzMonitor Technology

Our first version of BuzzMonitor was developed in Java using IBM open-source IDE Eclipse. BuzzMonitor is organized as three-tier architecture: the presentation or user interface tier, the business tier and the access data tier. The interface relies on JSP (Java Server Pages) for making it possible to implement several advanced features such as expanding and contracting the tree of urls results, tagging such results and generating html reports dynamically. The business tier uses the Standard Java package and the database tier runs on the open-source MySQL database. Figure 4 shows the basic class diagram for the application.
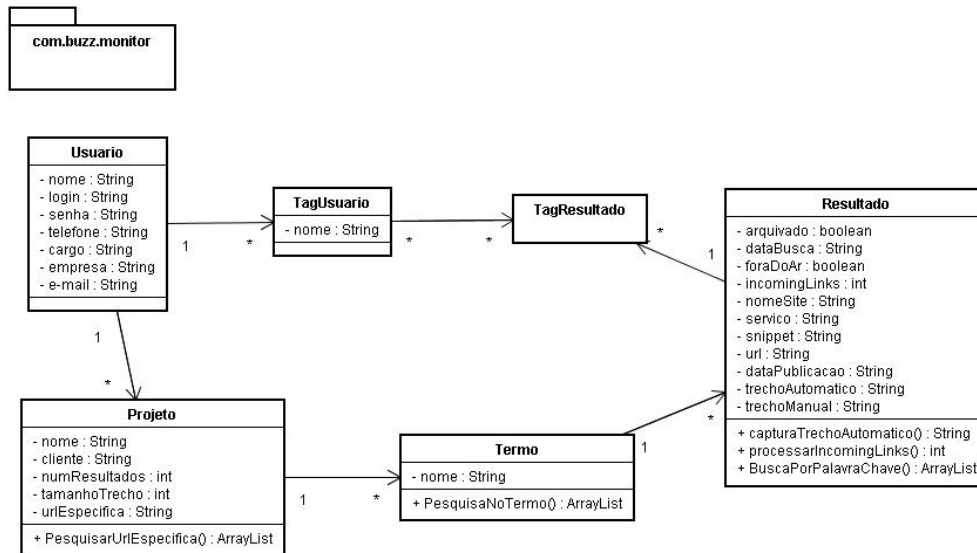
Figure 4. Basic BuzzMonitor Class Diagram

The system works basically processing requests from the user and then launches html pages dynamically with the results. Whenever a user sends a request through her browser, this request is sent to the business tier where it is processed most of the time by writing or reading information on the MySQL database.

A significant feature of BuzzMonitor is the use of Google APIs service. Google is currently the most popular search engine that by the time of this writing indexed roughly 8 billion web pages. BuzzMonitor relies on the Java Google API freely distributed to perform searches for terms and to retrieve other important raw data such as: cached pages, number of incoming links and matched pages within specific URLs. After retrieval, this data is further processed by our system (i.e. htmls tags are removed, snippets of text with user-defined size are extracted and so on) and by the user (e.g tagging and extracting manually relevant texts from cached pages) to generate the buzz monitoring reports.

5   FUTURE WORK

There are many ideas we would like to include in the system based on the theory of social maps and scale-free networks and our own findings. In future developments of BuzzMonitor we are interested in including at least two important new features:

- A pattern-matching component based on user-defined regular expressions for gathering specific data from page results. This feature will allow the user to apply filters within the results and could, for example, provide more specialized search results such as users demographic data: such as gender, age or city based on their on-line postings.
- A social map graphical representation of hubs, i.e. users that have much more incoming links than average on the market research subject. Theses maps will help to identify such users and to better understand the dynamics of word of mouth spreading through the net. For example: if a blogger

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mentions he is fond of President Lula, the user might monitor other blogs that are connected to this one and check if his linked acquaintances have some opinion about President Lula as well. If so, we will classify this opinion. In the long run we will be able not only to detect who are the influentials in many topics but whom they are influencing directly.

We also started investigating the impact of the use of a tool like BuzzMonitor on the knowledge management field. As the system lets users to store their Google searches and to further refine them, categorizing them and generating reports on the search results, we believe that BuzzMonitor could also morph into something like *Kmonitor* (K for knowledge) for helping large companies to manage the overwhelming amount of information generated everyday by their employees´ Google searches.

6. CONCLUSIONS

Our work aimed to demonstrate that it is possible to monitor word of mouth and help marketers to identify opinion leaders through their scale-free networks social maps. We believe BuzzMonitor will help companies to make systematic use of the theories related to the study of Buzz Marketing and Word of Mouth on social networks.

This work also demonstrates that it is possible to analyze on-line conversations among Internet users, not only in a qualitative way, but using quantitative data such as incoming links, presence of hubs and clusters. In the long run, systematic use of the tool will allow our group to study the implications between a social network topology and the *Fitness* of each node, as described by Barabási.

Finally we shall be concerned with user privacy when deploying these techniques and BuzzMonitor on a real world case. Knowing a person social network and making systematic use of monitored conversations may allow companies to try to influence what people talk about. These opinion leaders (hubs) will be responsible for spreading the buzz about a certain product or service. This is being called as Consumer Generated Media (CGM). Making a social network more visible implies on more lack of privacy among Internet users. Market researchers and on-line marketers should be able to make systematic use of this information without disrespecting personal privacy.

REFERENCES

[Barabási2003] BARABÁSI, Albert-Laszló. 2003. *Linked: how everything is connected to everything else and what it means for business, science and everyday life*. New York: Plume, New York.

[Ebel2003] EBEL, H.; MIELSCH, L.; BORNHOLDT, S. 2002. *Scale-free topology of e-mail networks*. Institut fur Theoretische Physik. Available at:<http://www.theo-physik.uni-kiel.de/~bornhol/pre035103.pdf.> on March, 2004.

[Gladwell2000] Gladwell, M. 2000. *The Tipping Point: How Little Things Can Make a Big Difference*. Little, Brown, New York.

[Godes2003] GODES, David; MAYZLIN, Dina. 2003. *Using Online Conversations to Study WOM Communication*. Boston. Available at: <http://www.som.yale.edu/faculty/dm324/wom2.pdf> on March, 2004.

[Milgram67] Milgram, S. 1967. *The small world problem*. Psychology Today 2, 60–67.

[Rosen2000] ROSEN, Emanuel. 2000. *The Anatomy of Buzz: How to Create WOM Marketing.* New York: Doubleday, New York.

[Watts2003] WATTS, DUNCAN J. 2003. *Six Degrees*: The Science of Connected Age. New York: W.W. Norton, New York.

[urlAnet2005] http://www.amanet.org/books/catalog/0814472958_Conversation.htm

JUKEBLOG: A RECOMMENDER SYSTEM IN MUSIC WEBLOGS

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ABSTRACT

Weblogs are very popular Internet tools. There exist weblogs on a variety of subjects, such as politics, technology and culture. Music weblogs made their apparition in 2003 and have, since then, rapidly gained in popularity. Music weblogs are like traditional weblogs, except that a song is attached to each post. There exist so many music weblogs that it is difficult for their readers to discover weblogs and posts that match their tastes. In order to help weblog readers find new interesting weblogs and posts, we introduce JukeBlog, a music weblog recommender system that uses a Feature Combination hybrid recommendation technique, combining collaborative and content based filtering.

KEYWORDS

Knowledge Management, e-Communities, Multimedia, Weblogs, Recommender Systems, Feature Combination

1. INTRODUCTION

The popularity of weblogs has increased dramatically over the last years. Technorati [URL 1] references over 9 million weblogs. Lately, we have witnessed the emergence of variants on the weblog theme. Although there is marked interest in the community for traditional weblogs (political, cultural, technological, etc.), there is increasing interest for new themes, such as photography, music and video weblogs. A music weblog, also known as MP3 blog, follows all the characteristics of a normal weblog, and adds an extra feature: posts must contain a musical file (most of the time, in the MPEG Layer-3 format). Some of the most popular music weblogs include *Teaching The Indie Kids To Dance Again* [URL 2], *Fluxblog* [URL 3] and *The Tofu Hut* [URL 4]. The purpose of music weblogs is *not* to release copyrighted songs on the Internet, but to promote new emerging artists and unknown or forgotten songs. A *music* weblog has a characteristic that distinguishes it from the majority of other weblog types: it is linked to a certain art form. Therefore, it is particularly sensitive to the *taste* (ballads, rock songs, etc.) of the reader and not just to his *interest* (cars, baseball, etc.). Today, there exist a large number of music weblogs offering a multitude of posts and information to their community, hence the need for a recommender system. Our system, JukeBlog, aims at helping users find new weblog posts by guiding their reading and listening choices. It is a feature combination hybrid recommender system using collaborative filtering and content filtering techniques in order to recommend posts.

This paper is organized as follows: Section 2 introduces the concepts of *weblogs* and *recommender systems*; Section 3 describes our system, JukeBlog: the collaborative filtering technique we used, how we implemented content filtering and the feature combination technique we developed for hybridization; Section 4 highlights the testing procedure and the results observed; and Section 5 concludes the paper and presents directions for future work.

2. CONCEPTS

In this section, we introduce two concepts that are related to our system: weblogs and recommender systems.

2.1 Weblogs

The term *weblog* (or more simply *blog*), coined by John Barger in December 1997, is used to designate a website that contains time-stamped posts. *Lessig Blog* [URL 5], *Paolo Massa Blog* [URL 6] and *Dooce* [URL 7] are examples of popular weblogs. Although the definition of a weblog is in the course of being widened, it is traditionally a web site *edited by a single person*. It contains *posts,* composed of text or any other type of content and is updated on a regular basis. The content of a weblog is *free to public access* and is organized using a *post archiving system*. Although that is not always the case, posts are usually presented to the reader in reversed chronological order. Indeed, weblogs offer great flexibility in their representation of information. A detailed definition of what constitutes a weblog can be found in [Aïmeur *et al.*, 2005].

   A great number of blog-watchers (the term used to designate people who read many blogs) visit weblogs as they would visit traditional websites. Others prefer to register the addresses of regularly read weblogs into an *aggregator*. An aggregator is a piece of software or a website that regroups a number of weblogs (chosen by the aggregator user) and puts all of their posts in one place for easy follow-ups. These tools are possible due to the existence of *syndicated* content. Syndicated content are automatically generated XML (eXtensible Markup Language) files containing post data and meta-data, updated each time weblogs are updated. These files can be of various formats, such as: **RSS** (Really Simple Syndication), **RSS2** (Really Simple Syndication 2), **RDF** (Resource Description Framework) and **Atom**.

2.2 Recommender Systems

Recommender systems are a revolution in the world of social interaction. They permit the automation of concepts such as *word of mouth* and *groups of interest*. Their goal is to target the information presented to the user so that he can make a wiser choice of items in a wide range of subjects. Recommendation algorithms can be categorized based on the information they use to make recommendations. Two commonly used types of algorithms are *collaborative filtering*, when the system bases the recommendation on the *ratings* given by other users of the system, and *content filtering*, when it bases the recommendation on the *content* of the item. A recommender system using more than one category of algorithms is called a *hybrid* system. There exist seven types of hybrid systems [Burke, 2002], including *Weighted* (two or more algorithms are applied independently and the results are then mixed by applying a weight to each of them), *Switching* (the recommender system chooses between a number of algorithms depending on the situation) and *Feature Combination* (data from different type of algorithms are combined into a single calculation). One of the most important papers that relate to feature combination is [Basu *et al.,* 1998]. The authors developed a recommender system (*Ripper*) that use content-based techniques over a data set that contains both content and collaborative data. Our system, JukeBlog, uses a feature combination hybrid approach combining collaborative filtering and content filtering by considering content data as collaborative data in the collaborative filtering equation. [Miller, 2005] introduces the idea of combining blogs and recommender systems. The article suggests that the current weblog's infrastructure could be used in order to build a platform on which a personal recommender system could run. That recommender system would not, as opposed to JukeBlog, recommend blog posts to its users. Instead, the XML infrastructure of blogs would constitute a way to ease the publication of collaborative data used in a recommender system.

3. JUKEBLOG

JukeBlog is a music weblog recommender system. It retrieves syndicated weblog information on a daily basis from the Internet and stores it into its own database. Later on, JukeBlog combines collaborative filtering and content filtering techniques into a feature combination hybrid recommender system to suggest and recommend posts to users. Figure 1 illustrates JukeBlog's user interface.

3.1 Incomplete Information

One of the issues encountered during the development of JukeBlog relates to the choice of the information included in the XML documents. That choice is up to the discretion of the weblog author, and is totally out of our control. But the majority of information retrieval algorithms are based on the analysis of complete texts. Therefore, in the eventuality that a weblog author includes only a sample of the post's content in the syndication file, its analysis becomes impossible. In order to solve this problem, we base our content filtering analysis on a user-given keyword system instead of the traditional text-analysis. Our database contains only meta-data about the posts, and includes a link to the web page of the post so that the user can view it in its original context.

3.2 JukeBlog's Approach

In JukeBlog, users are constantly presented random music weblog posts. Even when a user registers and enters the system for the first time, he is presented a random post. After having read the post (and listened to the song), the user has to rate it on a scale ranging from 1 to 5. The user is also presented the opportunity to assign up to 3 different keywords to the post (used for content filtering). After the user has given a number of ratings, JukeBlog is able to make score predictions for posts in the database. These posts are then recommended to the user in decreasing order, from the most to the least relevant.

Figure 1. JukeBlog's user interface

3.2.1 Environment

There are 3 main parts in JukeBlog's environment, each with a distinct role:

- *JukeBlog's website* acts in between the users and the items to rate. It collects ratings and performs calculations in order to provide recommendations to the users.
- The *weblogs*, defined in section 2.1, are websites that provide posts to the users. These posts act, in the recommender system, as the items to rate. While some weblog authors are also users of our website, weblogs are, conceptually speaking, completely unaware of JukeBlog's existence. They simply publish an XML file containing all of their posts, as they did even before the launch of JukeBlog.
- Last but not least, the *users* constitute the most important part of the environment. They read and rate weblog posts from JukeBlog's website. They have to explicitly register to the system in order to take part in it.

While each of these actors are an essential part of our system, this article will, from this point, mainly focus on the first one : JukeBlog's website.

3.2.2 Collaborative Filtering

The first method used to predict ratings is collaborative filtering. We used a common technique for that (used by GroupLens [Resnick *et al.*, 1994] amongst others). It is a memory-based algorithm, so it uses the whole set of ratings given by the users. Users must give a rating ranging for 1 to 5 to the posts presented to them. The system then computes the similarity between each user, using the Pearson correlation formula (Equation 1), in order to create a neighbourhood for each user:

$$corr(A,B) = \frac{\sum_j \left(v_{A,j} - \overline{v_A}\right)\left(v_{B,j} - \overline{v_B}\right)}{\sqrt{\sum_j \left(v_{A,j} - \overline{v_A}\right)^2 \sum_j \left(v_{B,j} - \overline{v_B}\right)^2}}$$

Equation 1. Pearson correlation formula

In this equation, *j* ranges over the posts, $v_{A,j}$ refers to the rating given by user *A* to post *j*, and v_A refers to the average rating given by user *A* to posts rated in common with user *B*. Once the neighbourhood of a user is computed, the prediction computation step is performed. It is based on the ratings given to an item and on the similarity indexes computed using Equation 1. The equation used is quite simple:

$$pr_{A,j} = \overline{v_A} + \frac{\sum_i \left(v_{i,j} - \overline{v_i}\right) \times corr(A,i)}{\sum_i |corr(A,i)|}$$

Equation 2. Rating prediction formula

In this equation, *i* ranges over the set of users, *corr(A,i)* refers to the similarity between user *A* and user *i* (calculated using Equation 1), v_A refers to the average of ratings given by user *A* to posts rated in common with user *i* and $v_{i,j}$ refers to the rating given to item *j* by user *i*.

3.2.3 Content Filtering and Information Retrieval

We deemed important not to base the predictions solely on collaborative filtering. A recommmender system that uses content filtering doesn't gather information about its users' *neighborhood*, but rather about their *tastes*. In a commercial application, customers' tastes are highly valuable information. In *our* system, taking into account the information on the content of a post adds a crucial new dimension to the recommender system and refines its output. However, as stated in Section 3.1, some weblog authors choose to syndicate only a sample of their posts, and text analysis based on incomplete data often results in incorrect categorization. It would have been possible to circumvent the problem by retrieving the information directly from the post's web page (*à la* web search engine such as Google) instead of retrieving the syndicated document. However, that method is not useful in our context. Web pages of posts do not only contain post-specific information, but may also contain other data such as blog-specific information, advertisers or "similar blogs" lists. Such information is irrelevant to the text analysis. The most common weblog categorization method is the association of keywords to posts. Categorization engines like *Flickr* [URL 8] and *del.icio.us* [URL 9] have developed tools that permit such a categorization. We decided to reuse the idea and let users assign keywords to posts in JukeBlog's database. An advantage of the attribution of keywords over the automated content analysis is that information collected about posts is related directly to the songs rather than the text. Although important progress has been observed in the multimedia information retrieval domain, we believe that the categorization would be more successful, especially if we let the users do it themselves. Moreover, since the source data is distributed, the system has no direct control over the music files. Therefore, it is harder (even impossible in many cases) to locate these files in order to analyse them. For example, the address may not point directly towards a file with the ".mp3" extension, but towards an address that would redirect the user towards the file. What follows is an explanation on how the socially-controlled keyword system works. When a user rates a post, the system offers him the option to choose up to 3 different keywords associated to the post. Keywords are chosen from a drop-down list of 25 words. Keywords have a double function: they help the user's taste profiling (user *A* likes humorous, happy and cheerful songs, but

hates sad and romantic songs) and they help determine the posts' content. In addition, JukeBlog will not allow a user to assign opposite terms, such as "calm" and "aggressive", to the same post.

3.2.4 Hybridization

JukeBlog uses a Feature Combination hybrid approach, combining both content and collaborative filtering. However, instead of using content filtering techniques over a collaborative filtering-aware system, as in [Basu *et al.,* 1998], we use a collaborative filtering technique on data of mixed types. Feature combination techniques let us incorporate inherent similarity considerations into the computation of predictions. Let's use an example in order to illustrate our method. Table 1 highlights all the ratings of user *A*:

Table 1. Ratings of user *A*

Post	Rating	Keyword
P1	5	Smooth
P2	1	Aggressive
P3	1	Aggressive
P4	4	Cheerful
P5	2	Cheerful

These entries are then grouped by keywords. The average of the similar keywords' ratings is assigned to that keyword. Table 2 illustrates the result of aggregating the data in Table 1.

Table 2. Aggregated ratings of user *A*

Keyword	Rating	Number of posts (n)
Smooth	5	1
Aggressive	1	2
Cheerful	3	2

Table 2 represents the "query" part of information retrieval. It is a weighted keyword query in which we ask the recommender system to retrieve posts that relate to "Smooth" music (weight of 5), and to exclude "Aggressive" (weight of 1) music. Next, during the computation of the prediction for a certain post *j*, we compare the whole set of keywords given to post *j* by all the users to the data from Table 2 (i.e. to all the keywords given by user *A* to any post). Table 3 illustrates the keywords given to post *j*:

Table 3. Keywords for post *j*

User	Keyword
B	Cheerful
C	Smooth
D	Smooth
E	Romantic

Each keyword for post *j* that corresponds to a keyword given by user *A* is considered in our calculation, as if it were another virtual user *V* that gave that rating to post *j*. In our example, we would simulate 3 users: one that gave post *j* a rating of "3" (because of the keyword *Cheerful*), and two that gave it a rating of "5" (because of the keyword *Smooth*, present twice). The advantage of our hybrid method is that it is easy to combine both types of information together: content filtering information and collaborative filtering information. We adapted Equation 2 in order to incorporate content and collaborative filtering in our prediction. Equation 3 illustrates the adapted rating prediction equation:

$$pr_{A,j} = \overline{v_A} + \frac{\sum_i \left(v_{i,j} - \overline{v_i}\right) \times corr(A,i) + \sum_k n_k (w_k - \overline{v_A})}{\sum_i |corr(A,i)| + \sum_k n_k}$$

Equation 3. Our adapted rating prediction formula

Here, *i* ranges over the users, *k* ranges over all the keywords assigned by *any* user to post *j*, w_k is the rating assigned to keyword *k* by user *A*, and n_k is the number of posts for which user *A* has assigned keyword *k*. Equation 4 illustrates an example of computation:

$$pr_{A,j} = 2 + \frac{\sum_i \left(v_{i,j} - \overline{v_i}\right) \times corr(A,i) + 2 \times (3-2) + 1 \times (5-2) + 1 \times (5-2)}{\sum_i |corr(A,i)| + 2 + 1 + 1}$$

Equation 4. Computation example

The retrieval model is a "Best Match Retrieval" (as opposed to "Exact Match Retrieval") model, because the posts returned to the users are in order of relevance to the query, and can only partially match it. We chose to recommend all the posts for which the algorithm predicts a score that is higher than the user's average rating. Algorithm 1 shows the procedure:

```
foreach (user i having rated post j)
        upper = upper + ( rating[i][j] - average( rating[i] ) )
                    * similarity( a, i )
        lower = lower + average( rating[i] )

foreach (keyword k assigned to any post p by user a)
        w[a][k] = w[a][k] + rating[a][p]
        n[a][k] = n[a][k] + 1

foreach (keyword k assigned to post j by any user)
        foreach (keyword l assigned by user a)
                if (k == l)
                        upper = upper + w[a][k]
                                - average( rating[a] )
                        lower = lower + n[a][k]

prediction[a][j] = average( rating[a] ) + upper / lower
```

Algorithm 1. Algorithm of our hybrid system

4. TESTING AND RESULTS

The aim of JukeBlog is to help music weblog community members in their browsing activity. JukeBlog can be considered a successful system if its rating predictions are close to its users' actual ratings. To test our recommender system, we limited our database to posts published on a particular day, giving us 82 posts to rate. A total of 64 users where randomly assigned to one of two cases: they were either given recommendations based solely on the collaborative filtering algorithm, or they were given recommendations based on our hybrid method. We then calculated the Mean Absolute Error (MAE) [Sarwar *et al.*, 2001] on both of these sets. The MAE calculates the average error made by the system between its predictions and the ratings given by the user. The more accurate the system is, the lower the MAE should be. The results are shown in Figure 3.
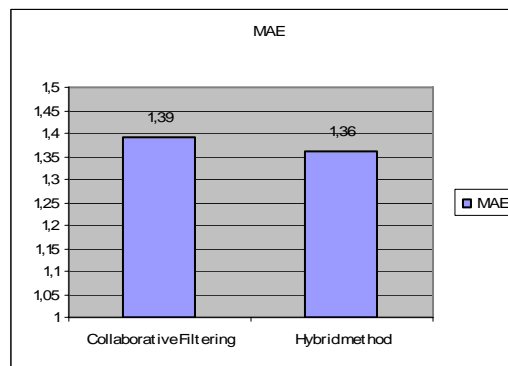
Figure 3. Mean Absolute Error

Collaborative filtering gives us a MAE of 1.39, while our hybrid method gives us 1.36. Based on these results, the Hybrid method appears to offer a small advantage over collaborative filtering. Since the content filtering part of our hybrid method is based on keywords given by the users, a rich input is needed in order to see a difference between the two algorithms. However, testing a music weblog post is a time consuming task, and most of our testers only assigned a small number of ratings and keywords. Half of them evaluated less than 10 posts, which is a low number to profile the users and posts. Therefore, these results are preliminary. More testing is required to determine the benefits of JukeBlog. On a qualitative note, JukeBlog has received very favourable reviews from some highly visited weblogs.

5. CONCLUSION

Today, the number of weblogs is very high, resulting in sub-optimal content discovery. That is why we believe that a recommender system can play an important role in the weblog community. However, traditional content filtering in the field of uncontrolled distributed items involves a number of issues. These issues range from the heterogeneous nature of the items to recommend (both in the form and in the content) to the various amount of information we get concerning each of them. That is the reason why traditional text/multimedia-analysis information retrieval techniques can hardly be put into application. Therefore, we developed a technique that makes use of the ever important "community" concept in weblogs to attach content information to posts. We then combined collaborative filtering data with content filtering data in JukeBlog, our Feature Combination hybrid recommender system. At this stage, it is still early to determine both the applicability of a recommender system to blog posts and the value of our Feature Combination hybrid, but further testing will provide better indication. The next challenge is to incorporate information about interrelation between posts to the computation of predictions (i.e. which posts link to which other posts), using data gathered by Technorati.

REFERENCES

[Aïmeur et al., 2005] Aïmeur, E., Brassard, G., Paquet, S. (2005). Personal Knowledge Publishing: Fostering Interdisciplinary Communication. *IEEE Intelligent Systems*, Vol. 20, no. 2, pp. 46-52, March/April 2005.

[Basu et al., 1998] Basu, C., Hirsh, H., Cohen, W. (1998). Recommendation as Classification: Using Social and Content Based Information in Recommendation. *Proceedings of the Fifteenth National Conference on Artificial Intelligence*. July 1998, Madison, WI, USA, pp. 714-720.

[Burke, 2002] Burke, R. (2002). Hybrid Recommender Systems: Survey and Experiments. *User Modeling and User-Adapted Interaction*, Vol. 12, no. 4, pp. 331-370, 2002.

[Miller, 2005] Miller, B. N. (2005). Toward a Personal Recommender System. *Workshop: Beyond Personalization 2005, International Conference on Intelligent User Interfaces*. January 2005, San Diego, CA, USA, pp. 97-98.

[Resnick et al., 1994] Resnick, P., Iacovou, N., Sushak, M., Bergstrom, P., Riedl, J. (1994). GroupLens: An Open Architecture for Collaborative Filtering of Netnews. *Proceedings of the 1994 Computer Supported Collaborative Work Conference*. October 1994, Chapel Hill, NC, USA, pp. 175-186.

[Sarwar et al., 2001] Sarwar, B., Karypis, G., Konstant, J., Riedl, J. (2001). Item-based Collaborative Filtering Recommendation Algorithms. *Proceedings of the Tenth International Conference on World Wide Web*. May 2001, Hong Kong, Hong Kong, pp. 285-295.

[URL 1] http://www.technorati.com/

[URL 2] http://teachingtheindiekidstodanceagain.blogspot.com/

[URL 3] http://fluxblog.org/

[URL 4] http://tofuhut.blogspot.com/

[URL 5] http://www.lessig.org/blog/

[URL 6] http://moloko.itc.it/paoloblog/

[URL 7] http://www.dooce.com/

[URL 8] http://www.flickr.com/

[URL 9] http://del.icio.us/

KNOWLEDGE ASSISTED AGENT NEGOTIATION FOR ELECTRONIC PROCUREMENT

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ABSTRACT

To automate the agent negotiation process, it has been widely accepted that two important tasks must be done: (1) formalize the negotiation process; and (2) incorporate necessary negotiation knowledge and intelligence. However, due to the fuzzy and complex nature, the lack of knowledge interoperability and knowledge-reuse in most agent-based services deployed has posed certain drawback to automated negotiation. An object-oriented ontology-based building block for knowledge representation, namely, Knowledge Bead (KB), has been proposed in [7]. It was designed as a foundation to enable automated agent negotiation in e-trading environment in a systematic way. This paper features the research work of KB on representing both knowledge and meta-knowledge, and how the use of knowledge carried by KB's assists in automated negotiation process. We anticipate the more efficient electronic commerce achieved with the support of the knowledge-empowered agent negotiation.

KEYWORDS

E-Procurement, Negotiation, Knowledge, Meta-Knowledge

1. INTRODUCTION

To tackle with the negotiation problems for developing efficient agent trading techniques for e-commerce, it is believed to be necessary in associating it with information discovery and ontology issues [2]. By imposing certain structures, rules, or conventions on the interaction between the agents, negotiation can be made easier. This suggests a sophisticated negotiation system is needed, which can do business assessment, coalition formation, criteria evaluation and knowledge management. Moreover, a common ontology for both buyer and seller agents should be built up during or even before the negotiation. Thus an integrated solution is required for solving all these problems. We proposed our integrated solution based on the definition of Knowledge Bead (KB) [7], which provides an object-oriented way to specify the knowledge in agent negotiation for B2B e-commerce. In addition to the inheritance and hierarchy features of object-oriented modeling, each KB when being used as a leaf in the tree that represents a product specification carries a set of attributes, together with weight, criteria, and rules for describing about every attribute. This makes it possible to represent the various forms of knowledge, including the specification of products, user preferences, negotiation strategies, constraints and the desired final deals in a flexible and efficient way. As virtually everything in a negotiation process is specified using KB's, a common ontology is formed by KB's to facilitate the same points of reference for the negotiation parties. For the same reason, information discovery and knowledge reuse in the online trading environment now becomes standard operations on the defined KB's.

There has been quite a lot of research work on knowledge management in agent system over these years. In particular, the main effort has been put on the knowledge representation and ontology implementation [5]. Different agent's knowledge models have been built up for e-commerce users and automated negotiations [1] [6]. However, besides user-specified preference, the various forms of business intelligence are also important for decision support for actual-world procurement scenarios [4]. Among most the existing negotiation systems, the details on how to extract, integrate, and utilize the knowledge have remained vague.

To manage business data in a variety of forms and turn it into effective knowledge, there are three steps to follow: 1) identify different forms of knowledge; 2) construct methodology for manipulating the knowledge; and 3) integrate knowledge into agent negotiation process. KB is the fundamental building block of the knowledge concerned in e-trading system. The first step is to formulate two main forms of knowledge, namely, general knowledge and meta-knowledge. The second step defines the necessary methods to manipulate a KB and the knowledge about a KB, namely, the meta-KB. The ultimate resolution is the fusion of knowledge carried by KB's into the negotiation process.

To start an electronic procurement process, a Request of Quote (RFQ) is prepared by the buyer, and sent to a group of suppliers. After receiving the quotes proposed by the suppliers, a preliminary assessment is performed by the buyer to choose a set of qualified sellers for further negotiation. A widely accepted model is to split the negotiation process into several phases, such that the negotiation progresses through pre-negotiation preparation, conduct of the negotiation, and post-negotiation settlement.

This paper is organized into three parts. In the first part, section 2 introduces the basic concept of KB and its use in representing both knowledge and meta-knowledge in e-trading environment. The methodology of KB's is illustrated via an example. In the second part, section 3 addresses the fusion of both types of knowledge carried by KB's in the agent negotiation process. The third part in section 4 then talks about knowledge management in post-negotiation phase.

2. KNOWLEDGE REPRESENTATION USING KNOWLEDGE BEADS

Throughout the trading process, there is a large amount of data which must be collected and processed. Each trader, i.e. buyer or seller, maintains its own database and knowledge base, and is represented by an agent that has access to the data and knowledge. Every negotiation process includes the requests for quotes (RFQs), quotes received from suppliers, buyer's concern and additional constraints, participating supplier's information, applicable business rules, and the final contract if dealt successfully. The whole process requires knowledge in a variety of forms to make a good deal.

Knowledge is the information extracted from raw data. In principle, there are two different forms of knowledge: *general knowledge*, and *meta-knowledge*. General knowledge provides the specification of different categories of objects in the e-commerce domain, which forms the basis of the knowledge space. As far as e-procurement is concerned, the general knowledge in general includes product templates, information about traders, RFQs, quotes and contracts. Business intelligence used in negotiation process is represented as meta-knowledge, which is the knowledge about knowledge. It includes the appropriate links to traders' preference, constraints and criteria, conventional rules for business negotiation, statistics of similar deals, and past trading records. It specifies different forms of dependency existed among attributes defined in KB's. Moreover, meta-knowledge can also present any affinity related with the current KB to a certain dataset. To specify dependency, meta-knowledge can be associated to attributes in a KB. To refer to other knowledge scope, meta-knowledge can be represented in a meta-KB of the current KB with different tags.

2.1 General Knowledge

To illustrate, we use a RFQ represented in KB as an example. A RFQ is prepared by a buyer to start the e-procurement process. It contains the initial information of the requested products. The example shown in Table 1 depicts a KB filled for purchasing a digital camera. Although there are much more details that should be considered in the real situation when buying a camera, here we just briefly specify some of them for illustration only. We will talk more about how to make use of the KB in automated negotiation later in the paper. In many circumstances a buyer may have its own concern on the requested products which is not written in

the RFQ. For example, the buyer may not want the sellers know he/she has the upper limit on the price (so to have a better deal). Instead, this information will be used when the collected quotes are assessed and during further negotiation. Buyer's concern is thus hidden for own use and separated from the RFQ which is made public to all participating sellers. As an extended part of the corresponding RFQ, it is represented using a sub-KB which is associated to the KB defined for the RFQ.

KB's describing traders and deals also belong to data-oriented taxonomy. They have a different domain space other than the product space, but with the same category hierarchical structure.

Table 1. A RFQ KB filled for purchasing digital camera (DC)

KB#RFQ_DC_1			
Attribute	Value	Weights	Negotiable
Resolution	>= 340,000	10	NOT
Removable Memory	Yes	10	
Features		7	NOT
Display Size	>=1.5 Inches	3	
Tripod Mount	Not Required	0	
Batteries	Lithium Ion	5	NOT
Size	Pocket Size	8	
Delivery_Date	Before Aug.1	10	
Hidden Part			
Price	<=$400		Rule#Price_1
Quantity	[1, 5]		
Delivery_Date			Rule#Delivery_1

2.2 Meta-Knowledge

After data-oriented taxonomy has been created for general knowledge, meta-knowledge is to be arranged to assist automated negotiation. Traders represent and obtain the general knowledge through the attributes value specified in a KB template. For meta-knowledge, the goal is to identify and then make use of the existing dependency and affinity among attributes and among KB objects.

Meta-knowledge of dependency is about the business trading rules and other constraints specified by the trader on the current KB. There are two types of *constraints*. The fundamental one is either the valid range specified for an individual attribute or an inter-attribute constraint specified for multiple attributes within the same KB. Another type is a constraint between the current KB object and other related ones. For example, a BOM consists of several RFQs for multiple different product items. A constraint says that the delivery date of two specific items, among all the RFQs, should be the same. The buyer can then define '*delivery_date*' as an attribute with the constraint in both of the two RFQs. The attribute thus becomes a **pivot** attribute to link between the two RFQs. Besides constraints, trading rules are also important forms of dependency in meta-knowledge. It is a natural way to represent these knowledge using *if-then* rules. In principle, an *if-then* rule is represented as an action triggered by a certain condition. Conditions are pre-defined on attributes in a KB template, which are referred as pivot attributes. Once a condition is satisfied on a pivot attribute, a change to an attribute value or even the transition from the current KB to another KB will be triggered, depending on the action specified in the rule. They are present in a KB to reveal the dependency between the current KB and another. One example is: *if the Delivery_Date in a quote offered by a seller is late but less than 5 days, then the buyer can further ask for a reduced price with 20% off for the requested product*. Following this rule, if the condition is met, it is possible for the corresponding buyer's agent to automatically produce an updated RFQ with the new expected price. For the same RFQ example in Table 1, this rule is included in the hidden part, which is only available for the owner, as shown in the shaded part of the table. The hidden attribute '*Delivery_Date*' associated with the current RFQ is a pivot attribute. The rule *Rule#Delivery_1* is specified in the *negotiable* column, it will trigger a new RFQ when the defined condition is satisfied.

While dependency is about the relationship among attributes, affinity is about the inherent ontology among objects. Meta-knowledge of affinity indicates that a group of objects from different category domains share the same characteristic. It can be present in different forms. For example, a supplier in the category of '*electronics and computers*', also provides lamps which belong to the '*home*' category. To represent the same supplier under different categories, each KB category is assigned a canonical name, which is the primary category name. Via the canonical name, KB's originated from different ontology domains can be linked in an effective way. The trader's preference is specified in the *preference KB*. One type of the prefer-

ence is *static*. Once specified, the static preference will be associated to the each RFQs (or, quotes) in a whole BOM if applicable. For example, a buyer may specify in the preference profile his/her regular payment method. There is also other information that can be considered as static preference, e.g. the seasonal markup of the price. Another type of preference is *dynamic*. The dynamic preference is specified as a pivot attribute in the current KB (RFQ or quote). When the trader decides to adjust the preference during negotiation, the pivot attribute helps to change from the current KB to a new KB with the preference changed and other attributes changed in consequence. The transition is represented using an *if-then* rule defined on the pivot attribute. We referred the two KB's as KB's based on different concepts. The concept-based automated negotiation model was discussed in detail in [8]. Another form of affinity is to group similar KB's into a dataset for knowledge reuse. It serves to represent various forms of business intelligence. Groups of KB's can be discovered during negotiation and afterwards. Quotes and deals based on the same rule or constraint are grouped together. For example, if the seller is negotiating with a buyer who has a past deal in the seller's trading record. Then the preference and thus the behavior of the buyer will be considered predictable by the seller's trading agent relying on the past records. This is based on the premise that people's preferences are correlated; groups have similar preferences so that the person who needs to make a choice can instead utilize the choices made by others in the group. The affinity list can be used as an additional constraint during negotiation process.

2.2.1 Meta-KB

From the foregoing discussion of meta-knowledge about different forms of affinity, it is not difficult to realize that when it is necessary to refer to the affinity, certain external datasets shall be involved. To our knowledge, most current automated negotiation systems lack the ability of specifying the explicit use of knowledge base in a systematic way, so to assist an efficient automatic negotiation process. For this purpose, we define **meta-KB** as a special meta-object for describing the affinity of a KB in concern, and the datasets to which it can refer correspondingly. In this paper, a meta-KB specifies the ontological properties which are necessary in the agent negotiation context. We define different tags for different ontological property. Note that the concept of meta-KB can be applied to a broader scope in the e-commerce domain (e.g. the logistics system). More tags can be defined appropriately to assist the use of meta-knowledge in the corresponding application context. In the meta-KB depicted in Table 2, the first tag *KB_ID* indicates the relevant KB's identifier. *CNAME* refers to the canonical name of the KB's category. *PREFERENCE* refers to the profile containing attributes applicable to the current KB. The applicable attribute is specified in the pivot column. *CONCEPT* applies the rule which is used to switch from the current KB to another KB referred with a different concept. *AFFINITY* refers to a dataset containing certain form of business intelligence. The corresponding rule specifies how to make use of the dataset.

Table 2. Meta-KB of the RFQ KB in Table 1

Meta-KB		
Tag	Value	Pivot/Rule
KB_ID	KB#RFQ_DC_1	
CNAME	../Electronics&Computers	
PREFERENCE	Buyer-Profile	PaymentMethod
CONCEPT	KB#RFQ_DC_2	Rule#Concept_1
AFFINITY	Supplier-Group#2	Rule#Supplier_1

2.2.2 An Example

In Table 2, the pivot attribute '*PaymentMethod*' is indicated as the *PREFERENCE*. We assume that the buyer use cash-on-delivery as the regular payment method. Thus the current RFQ includes 'cash-on-delivery' as its payment method automatically. The *CONCEPT* tag associates to a concept-based alternative KB with a rule '*Rule#Concept_1*', which says that "*if the Size is not pocket size, then abandon the current RFQ and switch to KB#RFQ_DC_2*", which is depicted in Table 3. Note that the new RFQ has the attributes value and weight changed in bold. The 'cash-on-delivery' payment method is also added. To handle the *AFFINITY* tag, the negotiating agent searches in the affinity group '*Supplier-Group#2*'. We assume it contains the records of suppliers of final deals with a certain discount recorded. The rule '*Rule#Supplier_1*' says that '*if it is a preferred supplier in the affinity group, then search the past records for the maximum discount, and ask for this maximum discount on the price proposed by the supplier*'. Besides the rule about the '*Deliv-*

ery_date' as described above, the buyer has also included another rule '*Rule#Price_1*', in the in the sub-KB of RFQ saying that "*if the quoted Price is higher but no more than 5% of the expected upper limit, then ask for free accessory*". The negotiating agent then compares each quoted value with the *Price* specified in the sub-KB of the buyer's concern, which is kept separately by the local information agent. If the condition on price is met, then the negotiating agent will inform the information agent to prepare a new RFQ for the next bargain. In this way, proposal and counter-proposal are exchanged until the final contract is signed, or otherwise the negotiation is aborted.

Table 3. An alternative RFQ KB

KB#RFQ_DC_2			
Attribute	Value	Weights	Negotiable
Resolution	>= 340,000	10	NOT
Removable Memory	**Not Required**	**2**	
Features		7	NOT
Display Size	>=1.5 Inches	3	
Tripod Mount	Not Required	0	
Batteries	Lithium Ion	5	NOT
Size	**Regular**	**5**	
Payment Method	**CashOnDelivery**	**N/A**	
Delivery_Date	Before Aug.1	**5**	
Hidden Part			
Price	**<=$350**		Rule#Price_1
Quantity	[1, 5]		
Delivery_Date			Rule#Delivery_1

3. AGENT NEGOTIATION

In a negotiation scenario using KB's, there are mainly three kinds of agents invoked: information agents, knowledge agents, and negotiating agents. These agents function as suggested by their names accordingly. Information agents are responsible for formulating the elementary knowledge in category-based KB's. They work locally on the trader's machine, process on the elementary information provided by the trader, and provide the general knowledge to both knowledge agents and negotiating agents whenever necessary. Knowledge agents are equipped with advanced knowledge management capabilities. It is their job to form the meta-knowledge as described above. The workspace of a knowledge agent consists of a knowledge base that keeps all the meta-KB's and affinity groups of KB's, and a rule base that maintains the rules on KB's. A knowledge agent serves negotiating agents as a back-end assistant in providing the business intelligence which is needed in a negotiation scenario. It can work on a trader's machine, or, a remote one which is dedicated for the electronic procurement. Given a complete negotiation context with all the information and knowledge specified and intelligence formulated, a negotiating agent is responsible for the following steps: 1) collect a preliminary set of quotes from suppliers' information agents; 2) perform assessment on collected quotes and screen for a negotiable set of quotes; 3) for each quote candidate, negotiate with the supplier's negotiating agent using the negotiable attributes, buyer's concern, additional constraints, together with the business intelligence in various forms; 4) done if a contract can be reached, and record the deal accordingly; abort if failed. Note that in step 3 and 4, the information agent and knowledge agent are also invoked, providing as well as updating the general knowledge and meta-knowledge needed by the negotiating agent.

3.1 Pre-negotiation Preparation

According to the procurement requirement, the information agent, on behalf of the trader, first establishes the necessary KB templates for a variety of product categories. When it is the time to prepare a RFQ from the buyer side, the buyer can choose to use a predefined KB template from a certain category for the specification on existing or new attributes, or, to build a new KB template on its own. Every filled RFQ will then be saved for quick reference when similar procurement is required in the future time. An example of a KB template filled for purchasing digital camera is given in Table 1.

A successful e-trading paradigm must allow flexible negotiation with strict constraints. In particular, trader's constraints and preferences captured during pre-negotiation preparation play an important role in

negotiation automation. Usually this comes along with the specification of product attributes in KB templates, as illustrated in Table 1, and the associated meta-KB in Table 2. Weights in the range of 0 to 10 are assigned to each attribute, where 0 indicates a least important attribute and 10 indicates a most important attribute. Assigning weights for a multi-item and multi-attribute RFQ is a tedious and time-consuming job for the buyer. The KB template allows the buyer to only assign the attribute weights when they find it important to do so. This can be a preferred attribute or a trivial attribute for the buyer. Otherwise, the default weight 5 is assigned. These weights will be used in evaluating the quote received to determine how much the quote matches the RFQ. Moreover, there are some dynamic issues to consider when filling in the KB's templates. Two types of attributes can be observed: *explicit attribute* and *implicit attribute*. Explicit attributes are those that buyers can give explicit value in the specification. Implicit attributes are those that buyers give no explicit description. For the digital camera example in Table 1, optical zoom and display size are explicitly specified, while tripod mount is specified as 'Not Required', which means that the buyer has no specific requirement in this attribute. Notice also that tripod mount has the user preference value 0, indicating it's a trivial attribute. Implicit attributes provide different extent of flexibility for the trading agents conducting negotiation. If two offers both satisfy the buyer's preferences, then the one with extra attributes fulfilled maybe considered superior. Attributes that must be satisfied are of the type *NOT Negotiable*. Others are considered negotiable. The purpose of distinguishing non-negotiable attributes from negotiable type is to speedup the procurement process by negotiating with only the negotiable attributes. There are also hidden attributes which are not to be seen by the other side. These are usually considered as different constraints on the KB's attributes set by the buyer. They can be used in either the automatic quote evaluation as a constraint, or agent negotiation via argumentation as a justification, or both, depending on the trader's business policy.

3.2 Conduct of the Negotiation using KB's

Negotiation is a strategy-based process governed by some explicit and implicit rules. For different negotiation scenarios, the negotiating agents are able to select appropriate negotiation strategies based on the current negotiation context and the history knowledge. As discussed in the section 2.2.1, the meta-KB describes the ontological property of the current KB in concern. It contains the information about both the negotiation context and the applicable history knowledge.

Before the negotiation process really takes place, there is a preliminary search for qualified offers. The buyer's negotiating agent communicates with a list of available suppliers' negotiating agents. In this preliminary phase, the non-negotiable attributes and inter-attribute constraints specified in the RFQ template are checked. Quotes with non-negotiable attributes unmatched or constraints unsatisfied are discarded. If the number of qualified quotes filtered is small, the negotiating agent can directly start to negotiate with the qualified suppliers respectively. Later close the deal with the optimal bargain. However, if the number of qualified quotes filtered is big, it is impractical to negotiate with the great number of qualified suppliers. Instead, the negotiating agent first ranks the offers. Then choose from the ranked list, a number of top offers to start negotiation. Note that the exact number of top ones to be chosen is up to the buyer. Evaluation and ranking of quotes is not addressed in this paper due to limited space.

After the buyer has got a list of negotiable suppliers, the negotiation process takes place between the buyer and each supplier, respectively. We adopt the argumentation-based negotiation approach [3]. In this approach, agents negotiate as usual by sending each other proposals and counter-proposals, these proposals are accomplished by supporting arguments (explicit justifications). The mechanism of KB's and meta-KB's associated with rules allows a flexible change made to the current RFQ (or quote), as illustrated in section 2.2.2. To automate the negotiation process, the negotiating agent performs the following steps:

1) Examine the quote. The negotiating agent checks if every attribute in the quote is of the optimal value, according to the ranking criteria, which will be presented later when we discuss the evaluation of quotes. It considers the quote as an optimal offer if all attributes have got the optimal values, abandons further negotiation, and goes to step 4. Otherwise, it starts the negotiation in the following steps.

2) Start with the negotiable attribute carrying the highest weight. Check the corresponding attribute provided by the supplier. If it is set to not negotiable by the supplier, then skip to the next negotiable attribute carrying the second highest weight. Otherwise, construct the counter-proposal for the supplier. The meta-

knowledge specified in the associated meta-KB is deployed in this step. The way to construct the counter-proposal using meta-KB will be detailed in another paper. The hidden concern of the buyer is operated in the same way, except that the limits of the hidden attributes are not exposed to the suppliers.

3) Wait for the response sent from the supplier. If the new arrived quote shows no difference compared with the previous one, it indicates that the supplier gives no more concession. The negotiation is abandoned. The negotiation agent goes to the next step. Otherwise, go back step 2 to construct the next counter-proposal.

4) Gather the quote together with others negotiated from other suppliers. Evaluate and rank the quotes. Pick the optimal one as the final deal.

4. POST-NEGOTIATION KNOWLEDGE MANAGEMENT

The main task of post-negotiation settlement is to close the deal and log the negotiation process for future reference and knowledge reuse. This makes the whole trading process a complete loop. Actually, throughout the negotiation process, the KB's database and knowledge base are successively appended and updated. For a successful e-trading cycle, efficient and effective knowledge management must be performed in this phase. There is a pretty large amount of information to be logged. For data-oriented categorization, the fundamental log is the final deal (or, a fail) and seller information, which are logged into the domain spaces of deals and suppliers, respectively. However, that simply log the deals is not enough to provide the convenient reference for future negotiation scenarios. The meta-knowledge about the deal (or, a fail) must be dug out. To our knowledge, most existing negotiation systems lack the capability of knowledge management after the negotiation process. Thus, the limited knowledge gathered from negotiation process hinders the knowledge reuse which is important in automated procurement scenarios.

Each negotiation transaction starts with a RFQ and ends with either a successful deal or a fail. During the process, quotes received and counter-proposals reconstructed are exchanged. The automation of the negotiation process is guided by the constraints and rules. Past records are referenced to assist in a better bargain. To manage the knowledge in a negotiation transaction, one task is to record the affinity groups that have been referenced in a successful deal. As specified in the meta-KB, rules are associated to a certain affinity group of KB's. Following the rules, the negotiating agent constructs the counter-proposal. If the counter-proposed value is accepted by the other side, it implies that the reference to the affinity group is helpful. For example, some products are subject to the season. During the hot season, demand goes up and the price gets higher. An affinity group can be established to include all the deals completed in the hot season. Useful information is collected such as the supplier information, price dealt and delivery status. Consider the current negotiation scenario was a similar one. By following the rule which makes reference to the affinitive past records, the counter-proposal was finally accepted by the other side. Now the successful deal can be added to the same affinity group, with the most update transaction time recorded. In the future scenario, when the affinity group is referenced again, if the rule is to search for the most update similar record, this deal would be helpful. Moreover, new affinity groups can be established if necessary. Establishing a new affinity group requires human interaction. However, the update of an existing affinity group can be done in an automatic way by the knowledge agent in the post-negotiation phase.

Throughout the discussion, we have seen that rules play the crucial role in negotiation automation. There are two kinds of rules, i.e. empirical rules and experiential rules about empirical and experiential knowledge, respectively. Empirical rules are obtained from the human interaction. Experiential rules are learnt from the past negotiation scenarios. Nevertheless, rules are subject to certain applicable scenarios. There is no guarantee of a better bargain following the predefined rules. In order to achieve a better bargain by the automated negotiation system, it is necessary to provide the flexibility for updating the rules. This is based on the observation on how successful the rule is when applied to a negotiation transaction.

Assume that we have established an affinity group of successful deals with late delivery date proposed but less than 5 days, and a discounted price offered. Applying certain data mining techniques, we can obtain the experiential rule specifying the relationship between the last delivery date and discount offered. Assume that it is the rule present in section 2.2 which says "*if the Delivery_Date in a quote offered by a seller is late but less than 5 days, then the buyer can further ask for a reduced price with 20% off for the requested product*". However, applying the same rule for similar scenario does not guarantee a positive feedback. Thus we

can further define *applicable degree* for the rules, which indicates how effective the rule is for the negotiation. For both the positive and negative feedback, the applicable result will be recorded. When the rule is first established, it is given a default applicable degree. Later, the applicable degree increases when there are more successful applications recorded, while decreases when unsuccessful applications are recorded. If the applicable degree drops to some threshold, the rule is subject to further change. The change can be obtained by applying the same data mining technique again. For example, the new mined result indicates an around *10%* off for the price in the updated affinity group. Thus, the rule will be adjusted accordingly. In this way, rules are updated to catch more negotiation knowledge every time in a different scenario. It helps the knowledge reuse and makes the automated negotiation system more practical in use. To allow most flexibility, traders can by themselves adjust the rules manually during negotiation.

5. CONCLUSIONS AND FUTURE WORK

KB allows dynamic definitions of buyer's preference and criteria that can be used as suitable building blocks for negotiation context and business intelligence during agent negotiation. Each negotiation context can be described using both knowledge and meta-knowledge represented in both KB's and meta-KB's, respectively.

When the basis of the whole e-marketplace including the participating agents is constructed using KB's, new knowledge (including business intelligence) relating to the continuous operation of e-procurements can be easily derived by using appropriate data-mining techniques. Such knowledge defined in KB's can be managed and used to do decision support, aiming at facilitating agents in the e-marketplace to do negotiation more efficiently.

A more detailed model that depicts communication protocols and knowledge management mechanisms will be developed. Prototype of such a trading agent system with knowledge management functions will be built. Then the prototype will be applied into a few study cases for demonstrating its feasibility and performance. We will investigate into how different sets of popular negotiation algorithms work well with the knowledge management system too.

REFERENCES

[1] Chunyan Miao, et al, 2002, Fuzzy Cognitive Agents for Personalized Recommendation, *Proceedings of the 3rd International Conference on Web Information systems Engineering* (WISE'02)

[2] Dickson K. W. Chiu, and et al, 2005, Facilitating e-Negotiation Process with Semantic Web Technologies, *Proceedings of the 38th Hawaii International Conference on System Sciences*, pp. 1-10

[3] Gregory E. Kersten, 2002, The Science and Engineering of E-negotiation: Review of the Emerging Field. *InterNeg Reports* 05/02

[4] Juan A. Rodriguez-Aguilar, et al, An Agent-based Decision Support for Actual-World Procurement Scenarios, *IEEE/WIC International Conference on Intelligent Agent Technology (2003)*, pp. 371-378.

[5] Sheng Li, and Qiang Yang, 2001, ActiveCBR: an agent system that integrates case-based reasoning and active databases, *Knowledge and Information Systems* (2001) 3: 225-251, Springer-Verlag London Ltd.

[6] Sheng Zhang. et al, 2004, A Hybrid Negotiation Strategy Mechanism in an Automated Negotiation System, *ACM Electronic Commerce '04*, May 17-20, pp. 256-257

[7] Simon Fong, and Zhuang Yan, 2002, *Enabling Agent Negotiation in e-Trading Environments Through Knowledge Beads*, IEEE International Conference on Intelligent Engineering Systems (May 26-28, 2002, Opatija)

[8] Zhuang Yan, and Simon Fong, 2003, Automated Negotiation with Multiple Concept-based Alternatives in Multi-agent Systems, *International Conference on Intelligent Systems and Control* (June 25-27, 2003, Salzburg)

A METHODOLOGY FOR LARGE-SCALE E-BUSINESS PROJECT MANAGEMENT

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ABSTRACT

The development of powerful and robust applications in the field of e-commerce in which a great many —human, technological and economical— resources take part require the elaboration of complex projects to not only coherently manage their life cycle in its entirety but also satisfy deadline criteria, and most importantly, adjust themselves to the ever-restricting economic criteria. In this article, we propose a methodology based on working environments in order to systematize the whole project management in accordance with the particular needs and resources —human or technological— any corporation may have. The methodology we propose will also integrate the different roles and working practices proposed by the manufacturers of the current development platforms based on distributed software.

KEYWORDS

e-business, working environment, J2EE, infrastructures, middleware platforms

1. INTRODUCTION

The Internet has become a different way of understanding business. In this environment, the different enterprises are facing new models of competition which, for the exceedingly high cost, were restricted to powerful enterprises not so long ago [8]. This revolution involves the presence of new requirements which have not been traditionally contemplated by the existing software models and forces the need to provide business process reengineering, that is, new strategies to adapt the existing business processes and software systems [17].

Most of the organizations are reluctant to move with the times, which, in some cases, can become traumatic, basically but not merely motivated by the effort required to depart from the already established way of doing business [8]. They also perceive the complexity involved in integrating their inherited systems containing vital information for the corporation, which normally deal with important investment projects [22]. Moreover, changes motivate alterations in fixed infrastructures, and the personnel must also undertake the task of learning and mastering the new ways [17]. Notwithstanding the difficulties faced by the enterprises, new corporations crop up, rapidly adapting themselves to the new situation, forcing the rest to evolve in this new direction [8].

Conventional architectures fail in providing a global solution to the needs created by the new business models because many of the requirements set in this new context were not contemplated in their design. In order to fill this gap, a new generation of software models and platforms based on components on distributed architectures (n-levels) has been born. This new generation supplies a comprehensive solution from which to tackle these new business models, and at the same time, takes advantage of the technological context the Internet provides.

For some time now, the Chief eBusiness Officer (CeO) is not expected to act as a magician nor as a perfect strategist, an expert in new technologies, capable of transmitting the importance of e-business to the corporation. He is not even supposed to lead the transition to the new economy. He is a professional. He is a professional capable of designing high-level TI infrastructure, of providing value for invested money and of understanding business key features [21].

However, the management of this type of projects is, if anything, extremely complex. It ranges from multidisciplinary resources, new information and communication technologies (ICT), to new development models in a way that it meets deadlines and budgets [17]. Because of its magnitude, any deviation in any of the parameters of the project can result in a total fiasco [18].

Doubts concerning the design of the project in terms of precise requirements and at the same time flexible enough to accommodate any alteration that may be due during its execution presupposes serious dilemmas in the CeO to carry out such projects [16].

Our goal in this paper is to propose a methodology that will systematize the whole life cycle involved in large-scale e-business projects, following the roles and working methods proposed by the new development platforms so as to suggest different working contexts and new interaction approaches from clearly established policies, facilitating not only the development and vertical and horizontal scalability of the environments but also human resources and necessary infrastructures.

2. BACKGROUND

The processes of software development define organisational activities and procedures used in the generation of software applications and their maintenance [12].

With the advent of entrepreneurial platforms introduced by the new business models [8], a change has come about in the models of software development process. An evolution has occurred from a time when the processes evolved in a linear mode —a series of sequential steps were applied to obtain a final result [16]—, towards specification of new paradigms founded upon parallel and cooperative activities.

Among the models for software development, we find the Unified Process for Software Development [2] from IBM Rational that came about after three decades' research with the final aim of obtaining robust, flexible and scalable applications.

Another model meeting the needs of developing e-business applications is the one developed by OMG named Model Driven Architecture, MDA [13]. MDA aims at providing a working frame to generate applications based on specificity, and guided by models [1].

Métrica v.3 is a working methodology for the design of software by the *Spanish Public Administration Ministry* which is founded upon standards to improve the design of software applications [14].

All the mentioned models are built from support standards to achieve their aims as it is the case of the modeled languages. These methodologies mentioned above make use of *the Unified Modeling Language* [20]. UML is a notational specification oriented towards objects. It consists of a series of diagrams which account for all the modeling requirements in the different steps of the development of software applications: ranging from the functional design resting in particular cases of use to the deployment diagram design [9].

These methodologies are used in order to guide the development of eBusiness applications in our organization; however they do not provide working policies, cooperative schemes, real scenarios and integration throughout software's several phases.

The paradigms on top of which eBusiness applications are based, as is the case of the Model-View-Controller pattern, together with the enterprise platforms foundations have led to new models and tightly-uncoupled architectures which guide the design of such applications [11][7] and distribute the required tasks in well-defined roles, thus allowing these tasks to be performed in parallel [17].

This feature introduces the need to acquire project management tools like *version control systems* which solve the problems derived from the cooperative development of applications [15].

Such systems can track the software in development so as to retrieve its current state —or previous ones—, while facilitating group work in a centralized fashion and optimizing resources [19].

In the following section we propose a project management model which is not only based in the above discussed methodologies, but also provides the CeO with a set of infrastructures and working policies so as to systematize the software developing process. Our model is aimed to guide the CeO through this complex, decision-making process and to minimize the project's impact on the overall project.

3. ENVIRONMENT-BASED MODEL

The purpose of this model is to offer a working frame which will serve as a guide in the development of e-business applications pivoting on entrepreneurial platforms all along its lifecycle to take advantage of the properties and benefits which these new architectural methods and the ICT are able to provide.

The model has been sub-divided into a set of logic entities called environments which suggest a partition over the set of states of lifecycle in the development of the application. Each environment defines a set of properties and methods over the development of the application.

Concurrently, the model establishes a relationship among the different environments, which means an ordering of the set from the lower to the highest stability of the product generated.
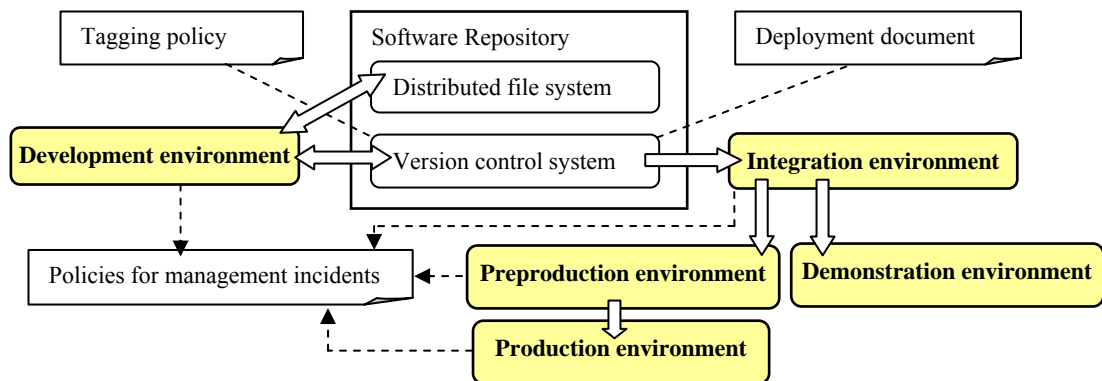
Figure 1. Working environment model.

According to the model defined in Fig.1, a software product experiences an increasing evolution towards stability and at a give time, it can be located at any of the states shown in Fig.2. We are going to analyze each of the environments proposed.
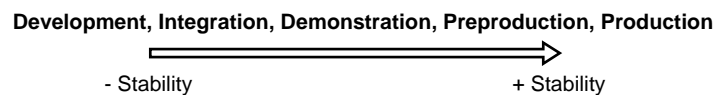
Figure 2. Relationship between application state and application stability

3.1 Development Environment

This development environment combines the wider area of tasks, and encompasses them from the beginning of the software lifecycle ―sampling requirements― to the actual obtaining of a version of the application ―or of a subset of it― with a minimum of stability.

The main tasks managed in this environment are: sampling requirements and the establishing of specifications of the application in documents to enable the involved personnel to have a general view of the application; the analysis of the architecture and technical design so as to be able to define the most adequate technology and establish a robust base from which to view the possible errors in the project before its implementation; the implementation proper pivoting on the previous task, which will reduce the complexity of the process; and finally, the unit tests which each component of the project will pass on its modules and components in its local working environment.

3.2 Integration Environment

Tasks related to combining the different elements which make up the application together with the integration tests to validate the general performance will be considered in this integration environment.

In this process the source code of the modules which have been created and validated (unit tests) is assembled in the development environment. Next, the application is put at work so as to carry out the integration tests. The deployment of the application is performed according to the documents generated in the project.

Once the application has been integrated and activated, a series of tests are carried out. The aim of these tests is to ensure that the performance of the application follows the specifications stated in the stage of sampling of requirements.

If the application satisfies the integration tests, it is ready to move onto the pre-production environment where it will undergo quality tests and then to the demostration environment so as to allow the client access. Should an error occur, an incident note must be generated via a policy of incident management previously defined to send it to the person responsible for the development of the module in which the error was detected.

3.3 Pre-production Environment

The tests performed in the previous phases are restricted to an environment and loads which do not really reflect the actual needs and are centred in spotting mistakes generated by the specificities of the project.

The development of real tests directly related to the production environment poses serious drawbacks which may in the end not render indispensable services for the economy of the organization.

So as to fill this gap and perform thorough tests to guarantee the output of the product to the real environment, we have built a mock-up model most closely adjusted to such an environment.

3.4 Production Environment

The production environment contains the active version of the application at any given moment. Since the end users have access to the implanted application in this environment, it is absolutely essential to plan and adopt the precise security cautions in accordance with the information handled by the system.

On the other hand, this environment also contains the real data, information which is vital to protect from possible mishandlings by means of a systematic application of backup copies.

The application is deployed in the production environment from the existing version in the pre-production stage. The deployment of the application is performed automatically to prevent mistakes being introduced as far as possible. At this stage the documents must be transferred into this environment and checked against the deploy ones carried out in the process of application development.

3.5 Demonstration Environment

The customers that hired our company in order to develop the application, and other potential customers, are often interested in having access to the system's functionalities so as to experience its interface and capabilities, and also to detect any divergence from the specified requirements.

In order to provide this access, a minimum operative platform must be set up. Although the application is fully operative in the preproduction and production environments, these are not suitable in order to offer a test mode access for customers, and therefore we propose to set up a scaled model of the production environment, built with the minimum necessary infrastructure and services required in order to provide a running, stable enough application which can be experienced by our customers.

3.6 Software Repository

The environment model comprises an additional logic entity called software repository. This software repository centralises the information necessary for the development of the applications and facilitates the management of the project.

The repository software is made up of:

- A set of distributed files which stores the information handled by the project: third party documentation, software applications together with any other resource that has been contemplated.

- A version control system that manages the concurrent access and the different versions of the information generated all along the project; a control system of the source code and of the general working policies. This system behaves as a central communication node among the different environments making it possible for the information to move from one to another point in an easy, uniform and controlled way.

3.7 Environments Migration Strategy

The environment migration strategy describes, for each element and environment, the preconditions required in order to transfer that element, its target environment, and how this transference should be performed. This strategy consists of a set of policies, protocols and procedures that define a univocal relationship between different environments, thus providing coverage for the software's life-cycle and enabling extra checks to ensure its correctness.

Figure 1 shows the most relevant relationships between the system's elements, which will be described in detail in the next sections.

3.7.1 Development and Integration

This is the first migration process to be carried out; although it is not the most critical one, it is tedious because of the large number of elements and resources involved: developers, deploying documents, control version systems, etc.

In order to perform the migration, developers are in charge of committing the application modules into the version control system. They are also asked to carefully tag the committed modules according to the chosen policy.

Besides, the development manager maintains a set of deploying documents which are very useful in order to detect technological mistakes or incorrect tag policy uses.

The version control system is the key for this transference, as it is used in the integration environment so as to retrieve the files required in order to build the application.

To accomplish this task, the integration manager exports the committed modules from the version control system into the integration environment.

Summarizing, the steps required in order to migrate our application from the development environment to the integration one are:

- Developers commit their modules to the control version system.
- They also tag the modules according to the chosen policy.
- The integration manager exports the committed modules, which were previously selected by their corresponding tag, into the integration environment.
- The integration team builds the application from the exported modules, following the deployment document.

3.7.2 Integration and Pre-production

The preproduction is the stage where the application is deployed and tested preceding its transfer to the production environment. Because it is a testing environment, the migration from the integration environment is not critical; however, if we need to take it back to the previous environments —in order to correct errors—, we must carefully follow the deployment documents so as to avoid any interferences between the different environments' configurations.

As in the latter case, a team member is assigned as preproduction manager, who is in charge of deploying the application following the corresponding deployment document —which lists the implied modules and their location.

3.7.3 Pre-production and Production

The migration from the preproduction stage to the production environment is the most critical phase, because the latter one holds the real world application that supports the organization's business processes, and therefore has a direct impact on its economy. Thus, an erroneous management at this stage may imply a considerable loss for enterprises.

For this reason, to avoid introducing human errors, it is necessary to automate the application transfer process base on deployment document.

After the migration, the assigned team checks if the application has been successfully transferred to the production environment; if the transference failed, the team will apply a pre-established contention policy.

4. CASE OF STUDY: A CONCRETE INSTANCE OF OUR MODEL

The authors of this paper, as ICT consultants, have acquired a valuable experience in large distributed applications —specially aimed at network management. We have also improved our knowledge through research for models and architectures that specifically support eBusiness applications and facilitate their development and maintenance. We have been using these methodologies for two years and, finally, we have materialized and refined a concretion of our model for our own applications.

The general scenario for the model's concretion is represented in figure 3, which shows the different environments and infrastructures, IT equipment and software. Although it is a concrete technological instance, the fact that it follows a generic model makes our IT instance flexible enough in order to allow the replacement of its components or the addition of new ones, and therefore it can be easily integrated with different technologies and adapted to changing business schemes.

In this section we introduce the materialization of our model, which is based on open-source, free code and built on top of the J2EE platform.

4.1 Software Repository

The software repository provides two services: the version control system and the distributed file system.
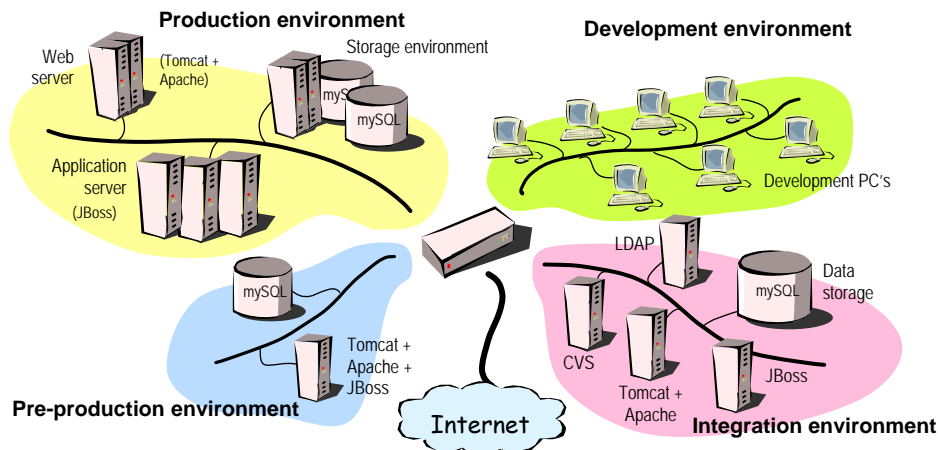
Figure 3. Infrastructures scenario for eBusiness projects' life-cycle management.

For the first service we analyzed several version control systems, and finally decided to use CVS [4] because of its maturity and also because it is licensed as open-source code and supported by a wide community. CVS is a client/server system based on an open protocol that allows remote access to the projects' files such source code, deployment instructions and other important documents. In addition, CVS supports version tagging and file locking in order to avoid conflicts in concurrent work projects. At client side, we use GUI programs (WinCVS and Cervisia) to access the CVS repository, in order to facilitate the different operations with the projects' files (commits, checkouts, tags and exports operations). Besides, CVS can operate over secure transport protocols (SSL), which encode the information exchanged between client and server, therefore avoiding possible security gaps. Finally, this version control system can be managed under a role basis, where each role has its own rights in order to operate with the projects' files.

On the other hand, the software repository also provides a file sharing service for files that do not require version control —like third-party software or external documentation. This service is provided by a network

file system based on the SMB protocol [5], which offers high interoperability through heterogeneous networks.

The control version system and the network file service are both installed on optimized Linux servers within our working environment [6].

Last, but not least, it is indispensable to safeguard the repository's information through a suitable backup policy. In order to complement the backup system, we use a network node regeneration system named GAIA [10].

4.2 Tagging Policy

Software traverses several states throughout the entire development process used in the methodology that we propose in this paper. In order to ensure the software's proper operation, it is necessary to identify which version is installed in each environment, and its maturity grade. In order to provide this identification, we propose a nomenclature (see table 1) that associates each version tag's name with the software's state and maturity for that particular version.

Table 1. Nomenclature proposed in the tagging policy for our model's instance.

Environment	Label syntax	Prefix meaning
Development	DR_ProjectName_ProjectVersion	Development Release
Integration	IR_ ProjectName _ ProjectVersion	Integration Release
Pre-production	PR_ ProjectName _ ProjectVersion	Preproduction Release
Demonstration	SR_ ProjectName _ ProjectVersion	Show Release
Production	FR_ ProjectName _ ProjectVersion	Final Release

4.3 Development Environment

The development environment's setup has been guided by a local work philosophy, where each developer uses a workstation endowed with the tools and services required in order to the assigned tasks, thus providing autonomous IT equipment so as to develop and test the application modules without interfering with other members' work.

However, some services can be shared without conflicts in concurrent development works, and thus they can be provided by a centralized server and used safely by the entire team. This is the case of the LDAP [3] directory service, where changes are introduced very seldom and they are so small that they do not interfere with each user's work; therefore, it is shared among all the users in the development and integration environments,

Finally, a GUI CVS client is installed in each developer's workstation in order to provide access to the control version system in a secure, easy way.

4.4 Integration Environment

The main task carried out at this stage is the integration of the modules committed by developers, in order to build the application. In addition, an integration test is performed so as to check the application's integrity. After that, the integrated application is submitted to a basic operating test.

For this environment to operate smoothly and efficiently, we will need the following services: A system which automatically retrieves the files required in order to build the application, based on the established tagging policy, a system that automates the application's building process, thus performing every necessary step (compilation, link, archive…) in order to obtain the application's operative files (Apache ANT) and the external applications and services required so as to run the application (Java Virtual Machine) [6].

In order to perform the operating tests, the application must be *up and running*, and therefore these tests require the above mentioned external applications and services, such as the Java Virtual Machine, the LDAP directory service, the database service, the application server together with the Web server, etc. However, these applications and services can be downsized —it is not required that they suit the real world demands [6].

4.5 Pre-production and Production Environment

Because it is the real world environment, the production environment's implementation is guided by the business' demands. This environment requires the necessary infrastructures in order to ensure the quality and availability of the provided services, avoiding system offline periods that may damage our organization's economy. For this reason, we have concreted an instance of this environment which introduces replicated servers so as to guarantee the system's continuous operation and also in order to provide scalability attending to service demand levels [6].

The reliability of the applications deployed in the real world environment is measured through a set of tests performed in the previous stage —the preproduction environment. Therefore, the preproduction environment should be an exact replica of the production environment, thus ensuring the application's quality before reaching its final stage. However, the economic cost of this replica has a strong impact and hence it is sometimes downsized to match the organization's budget [6].

Summarizing, the preproduction environment is implemented in order to perform exhaustive tests on the application before it reaches the real world environment, thus ensuring its quality and availability. To achieve this goal, we will build a replica of the production environment, scaled to match our organization's budget — although it should ideally be an exact replica.

4.6 Demonstration Environment

In many traditional markets, customers often feel the need to touch what they are buying. Because software is an intangible, ethereal product, software market's customers must satisfy this need in other ways: by accessing a prototype, functional version of the application in development. In this way, they can follow the development's progress and also check that the application meets their requirements.

Therefore, we should always have an operative version of the application running, which could be accessed by our customers. This is the demo environment's goal.

Although the application is completely functional only in the preproduction and production environments, none of these are appropriate in order to offer a test mode access for our customers. For this reason, we build a scale model of the production environment, downsized in IT equipment and data collections. It is also important to keep only dummy data in the demo environment, in order to ensure the privacy and security of our application.

Finally, the choice of which version of our application must be deployed in the demo environment should be guided by stability and maturity criteria —and not by the most recent's one.

5. CONCLUSIONS

In this work we have analyzed the impact of the new enterprise models and IT technologies on the development of large Internet applications; we have remarked the complexity derived from the specification and management tasks in projects of such dimensions —which often results in colossal work for the company's CeO. Due to the time and resources demanded by these projects, they require well-defined working models that support the software process' different stages and incorporate the technologies and tools used throughout this process.

Starting from these premises, we have proposed a working methodology based on several environments that facilitate the complex tasks involved in the software's process. Our proposal has been developed from its initial, most generic conception to a concrete instance based on our group's experience in the development of large distributed applications. This implementation is sustained by free, open-source software and provides a global environment which can be easily adapted to any project's needs.

Besides, the proposed methodology follows several standards and platform guidelines which are widely used in the software market. It also provides the means to adapt each environment to the specific needs for each of the applications' life-cycle stage, without diverting from the global project's goals.

The presented case of use is the current framework of our groups' activities and we are decided to continue its development so as to improve its qualities and introduce new features which further automate the software process.

REFERENCES

[1] Atkinson, C. and Kühne, T., 2003. *Model-Driven Development: A Metamodeling Foundation.* IEEE Software, Vol. 20, No. 5, pp. 36-41.

[2] Booch, G. et al, 1999. *El proceso unificado de desarrollo del software.* Addison-Wesley.

[3] Carter, G., 2003. *Ldap System Administration.* O'Reilly.

[4] CVS, 1999. *Concurrent Versions System.* Available from : http://www.cvshome.org.

[5] Eckstein, R. et al, 1999. *Using Samba.* O'Reilly.

[6] Gilart Iglesias, V. and Capella D'alton, A., 2004. *Entorno para el desarrollo de grandes aplicaciones de gestión de redes.* Desarrollo de grandes aplicaciones distribuidas sobre Internet, pp. 187-213. Universidad de Alicante.

[7] Gilart-Iglesias, V. et al, 2005. *A model for developing J2EE applications based on design patterns.* Proceedings of the IADIS International Conference. Applied Computing 2005. Volumen I, Pág. 352-360, IADIS Press.

[8] Harmon, P. et al, 2001. *Developing E-business Systems and Architectures: A Manager's Guide.* Morgan Kaufmann Publishers.

[9] Jacobson, I. et al, 1999. *El Lenguaje Unificado de Modelado*. Addison-Wesley.

[10] Maciá Pérez, F., 2001. *Modelos de Administración de Redes Heterogéneas de Computadores. Sistema de Regeneración de Nodos de Red.* Tesis Doctoral. Universidad de Alicante.

[11] Maciá-Pérez, F. et al, 2005. *Decoupling MVC: J2EE Design Pattern Integration.* Proceedings of the 7th International Conference on Enterprise Information Systems, ICEIS 2005. Volumen III, Pág. 280-287, INSTICC Press.

[12] Maciaszek, L.A., 2004. *Requirements, analysis and system design.* Addison-Wesley.

[13] MDA, 2003. *Model Driven Architecture Guide.* OMG. Available from: http://www.omg.org

[14] Métrica3, 2000. Metodología de Planificación, Desarrollo y Mantenimiento de sistemas de información. Ministerio de Administraciones Públicas Español. Disponible en http://www.csi.map.es/csi/metrica3/index.html.

[15] Ochimizu, K. et al, 2000. *Sharing Instability of a Distributed Cooperative Work.* International Symposium on Principles of Software Evolution ISPSE2000,IEEE Press, pp.36-45

[16] Pressman, R.S., 2003. *Ingeniería del software: un enfoque práctico, quinta edición.* McGraw-Hill.

[17] Sing, I. et al, 2002. *Design Enterprise Applications with J2EE Plantaform, Second Edition.* Addison-Wesley.

[18]Sommerville, I., 2001. *Software Engineering.* Addison-Wesley.

[19] Thomas, D. and Hunt, A., 2003. *Pragmatic Version Control Using CVS*. The Pragmatic Programmers.

[20] UML, 1997. *The unified modeling language home page.* Available from: http://www.uml.org.

[21] Vering, M. et al, 2001. *The E-Business Workplace: Discovering the power of enterprise portals.* Wiley & Sons.

[22] Yee, A. and Apte, A., 2001. *Integrating your e-Business enterprise.* SAMS Publishing.

E-BUSINESS ADOPTION TRAJECTORIES OF SME's IN SCOTLAND

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1. INTRODUCTION

The Scottish Executive has been active in encouraging small and medium sized enterprises (SME's) to engage with e-business as part of their aim of developing the knowledge economy in Scotland. However, there have been few empirically-based studies undertaken that enhance understanding of the extent of e-business adoption among SME's or, more pertinently, the adoption trajectories that SME's follow as part of their e-business strategy. This paper addresses the gap in understanding by focusing an investigation on the e-business adoption trajectories of SME's in Scotland. The objective of the study is to use a staged model to determine the current and intended adoption trajectories of SME's in Scotland using a questionnaire survey. As Dosi (1982) noted, technological trajectories tend to suggest a sequential increase in innovation. In a study of e-commerce adoption of SME's in the UK, Daniel et.al (2002) postulate that e-business and e-commerce can be viewed as "clusters of separate innovations" and extol the benefits of using a staged model as a basis for analysis. Specifically, the staged model sets a framework for determining progressively more complex e-business applications. From this it is possible to discern trends in e-business adoption. This attribute underpins the suitability of the staged model in determining e-business adoption trajectories. The analysis that follows articulates the gradual process of e-business adoption of SME's in Scotland and provides a valuable insight into the evolution of e-business in Scotland. Firstly, however, it is useful to address the previous literature on the concept of e-business adoption.

2. PERSPECTIVES ON E-BUSINESS ADOPTION

There has been some significant academic output relating to SME's adoption of e-business. Venkatraman (1994) proposed a model of ICT-enabled business transformation that focuses investigation on a range of potential benefits from employing ICT and the extent of business transformation that can result from it. The model suggests a 'bottom up' approach to ICT development where the organisation progresses through five sequential stages. Importantly, the model recognises that each organisation is different and will pass through the stages at different speeds according to capability, internal structures, resources and the characteristics of external competition. However, the model does not account for different sizes of organisations or geographical dispersal of organisations.

Poon and Swatman (1997) also propose a staged model of developing ICT in organisations but differ from Venkatraman (1994) by arguing that a 'top down' approach from an industry-wide perspective is more appropriate for SME's. However, there is insufficient evidence to suggest that SME's are achieving strategic goals of efficiency and effectiveness by adopting and implementing ICT (Feher and Towell, 1997). Although there have been studies into e-business adoption by SME's, they have been relatively few in number, thereby leaving the staged model largely under-utilised and untested. This present research addresses the gap in knowledge by adding to the number of e-business adoption studies of SME's such that some conclusions on trends may be discerned.

In contrast to empirical work on e-business adoption there is a significant amount of literature on theoretical perspectives that are relevant in an e-business context. Nelson and Winter (1982) use evolutionary theory to address dynamic behaviour over a period of time. Two key concepts arise here. Firstly, e-business adoption is viewed as path-dependent. That is, the outcome depends on how adoptions build up over time (Arthur, 1987). The exploitation of new knowledge is dependent on prior experience and the knowledge

gained from that experience (Cohen and Levinthal, 1990). Thus, path-dependency is a continuous process of learning that informs behaviour. The second key concept forms the basis for undertaking further investigations of e-business adoption. As noted previously, there is research that provides evidence of sequential adoption of technology (Daniel, et.al. 2002) and supports a staged model for analysis. The staged model proposed for this investigation clarifies the distinction between these two perspectives in favour of the latter. Table 1 outlines the criteria underpinning the staged model of e-business adoption

3. THE STAGED MODEL

Table 1. Staged model of e-business adoption

STAGE 1:	**Electronic information search and content creation** Find new suppliers Find products and services Advertise the company and/or its products and services Find new customers Provide information on products and services
STAGE 2:	**Electronic transactions** Purchase products and services online Sell products and services online Order products and services from suppliers Access suppliers database of products and services Process customer orders Provide after-sales service to customers
STAGE 3:	**Complex electronic transactions** Buy products and services via electronic auctions Sell products and services via electronic auctions Buy products and services via electronic call for tenders Sell products and services via electronic call for tenders Negotiate contracts with suppliers Negotiate contracts with customers Make electronic payments to suppliers Receive electronic payments from customers Allow access to company inventories Gain access to customers' inventories
STAGE 4:	**Electronic collaboration in product design, distribution and Logistics** Transfer documents to customers Transfer documents to suppliers Undertake collaborative online customisation with suppliers Undertake collaborative online customisation with customers

Stage 1 represents the first move by SME's to capitalise on the potential of Internet applications in their business by undertaking a range of search activities and providing information about the company and its products and services on a Website. Stage 2 provides evidence that SME's have moved towards adopting electronic transactions as part of their e-business activities and includes the process of buying and selling products and services online as well as providing after-sales service for customers. Stage 3 represents a distinct move towards more sophisticated methods of applying e-business. This stage includes identifying the specific type of transactions undertaken; confirmation that those transactions have taken place electronically and that business partners have been involved in the transaction process electronically. The final stage provides evidence of collaboration between SME's and their business partners and customers in the design of

products, distribution and logistics. Two other stages are included to account for SME's that either have no interest in e-business (00) or SME's that express an interest in adopting e-business but have yet to do so (0).

4. RESEARCH METHODOLOGY

For the purposes of this investigation SME's are regarded as firms with less than 250 employees. The indicators of e-business adoption amongst SME's were undertaken using three methods. These included: (i) a thorough review of previous studies of e-business adoption; (ii) a simulation of e-business applications by one manager from each of the industry sectors chosen (excluding forestry and agriculture) to validate the stages of e-business adoption and (iii) a questionnaire survey of a sample of 511 SME's across seven industry sectors in Scotland. The reason for choosing seven different industry sectors was to broaden the range of business processes that could be examined across different types of businesses. It is recognised that different industry sectors afford different levels of importance to e-business applications in their operations. The data for business connectivity in Scotland was derived from Scottish Enterprise's Scottish e-Business Surveys 2002 and 2003.

Five managers took part in the validation exercise. Two undertook simulations at Stage 2 of the Stage Model, one undertook a simulation at Stage 3 and one at Stage 4. For the survey 511 SME's in Scotland were sent questionnaires. Of those 400 were sent electronic versions while 111 (non-adopters) were sent hard copy versions. The electronic versions had the advantage of incorporating an interactive element to the survey as well as reducing time and cost for both researcher and respondent. These outcomes concur with the findings of Selwyn and Robson (1998) in a survey of academic researchers using e-mail as a research tool where ease of access to worldwide samples, low administration costs and unobtrusiveness to respondents were the three main advantages cited. Frankfort-Nachmias and Nachmias (1996) reported a 'very favourable response rate' to electronic questionnaires compared to conventional mail surveys. Mehta and Sivadas (1995) compared a conventional mailed questionnaire with an e-mail equivalent and found that the unsolicited mail questionnaire achieved a 45 per cent rate of return compared to the 40 per cent response rate for its e-mail equivalent. However, the researchers found that the e-mail response rate increased to 63 per cent if an initial e-mail was sent requesting participation in the study. In this present research, responses to electronic versions of the questionnaire were much faster than those who received hard copy versions. Hard copy versions were sent to SME's with no e-mail address in an attempt to widen participation as much as possible given the resources available. Of the 511 questionnaires sent, 48 non-adopters replied and 184 e-business adopters replied.

5. SURVEY RESULTS

Current and intended adoption trajectories of SME's in Scotland are analysed using the questionnaire survey based around a staged model as outlined in Table 2. All non-adopters with an interest in e-business (Stage 0) intend to move towards either Stage 1 (36 firms) or Stage 4 (4 firms) within 12 months of the survey (to June 2005). Their interest in e-business is likely to translate into future action and follows a predominantly path dependent trajectory.

Table 2 Stages of e-business adoption among Scottish SME's

	STAGE 00 Non-adopters - no interest collaboration in e-business	STAGE 0 Non-adopters with interest in e-business	STAGE 1 Electronic information search and Website	STAGE 2 Electronic transactions	STAGE 3 Complex electronic transactions	STAGE 4 Electronic
No. of SME's	8	40	106	66	10	2

There are 106 firms at Stage 1. Of these, 8 intend to stay at that stage while the vast majority (84) of firms intend to move to Stage 2 in the following 12 months from the survey. Of the remaining firms 10 intend to move to Stage 3 and 4 firms intend to move to Stage 4. The reasons for making the leap beyond the next stage for these firms may stem from the inexperience of managers in dealing with e-business solutions for their business. Firms new to e-business who follow a non-linear pathway either lack the managerial expertise to develop and implement e-business applications in line with organisational learning or they have been fast-tracked into more sophisticated e-business applications by collaborating firms who are further along the learning curve. Table 3 gives data according to the number of years firms in each stage have accumulated in e-business.

Table 3 Experience of E-business activity (years)

	Number of firms	**< 2 years**	**2-5 years**	**5-10 years**
STAGE 1 FIRMS	106	71	28	7
STAGE 2 FIRMS	66	21	36	9
STAGE 3 FIRMS	10	4	3	3
STAGE 4 FIRMS	2	0	1	1

Of the 106 firms at Stage 1, 71 have less than two years experience of e-business, 28 have between two and five years experience and only seven have more than five years experience. Only ten firms expressed an intention to leap from Stage 1 to stage 3. Eight of the ten firms had less than two years experience of e-business and the other two had between two and five years experience of e-business. Only four firms intended to leap from Stage 1 to Stage 4. These four firms had less than two years experience of e-business. The evidence points to the conclusion that those firms in Stage 1 who do not follow a linear trajectory in e-business adoption do so because they lack experience of developing e-business applications in line with organisational learning. None of the firms who intend to leap from Stage 1 to Stage 4 reported any intention to form collaborations with partners. This further suggests a lack of strategic coherence in the adoption of e-business trajectories among these firms.

Of the 66 firms at Stage 2 only seven intend to remain there. 41 firms intend to move to Stage 3 with 18 intending to move to Stage 4. The majority of firms at Stage 2 have between two and five years experience of e-business (36 firms). Of the 18 firms intending to move to Stage 4, 15 have between two and five years experience of e-business and three have over five years experience. These firms tend to have more experience of e-business and the leap from Stage 2 to Stage 4 does not represent the same level of risk for less experienced firms who leap from Stage 1 to Stage 4. Significantly, the 18 firms intending to leap from Stage 2 to Stage 4, all reported their intention to collaborate with partners in the next twelve months. There are ten firms at Stage 3 and eight intend to remain there. Of the ten firms, seven have between two and five years experience of e-business and three have more than five years experience. Two firms intend to move towards Stage 4. The 2 firms already at Stage 4 obviously intend to remain at that stage. Both these firms have more than five years experience of e-business and already collaborate with partners. Figure 1 graphically illustrates the e-business adoption trajectories by stages of the firms surveyed. The findings from the survey strongly suggest an evolutionary approach to e-business adoption by Scottish SME's.

6. CONCLUSIONS

This study has made two important contributions. Firstly, the stage model of e-business adoption has proved a valuable mechanism for capturing an important dimension of the knowledge economy in Scotland. Secondly, the findings suggest that a considerable number of Scottish SME's follow an evolutionary pathway to adoption of e-business applications. This has important implications for small business and policy makers as awareness of the importance of the knowledge economy in Scotland becomes more widespread.
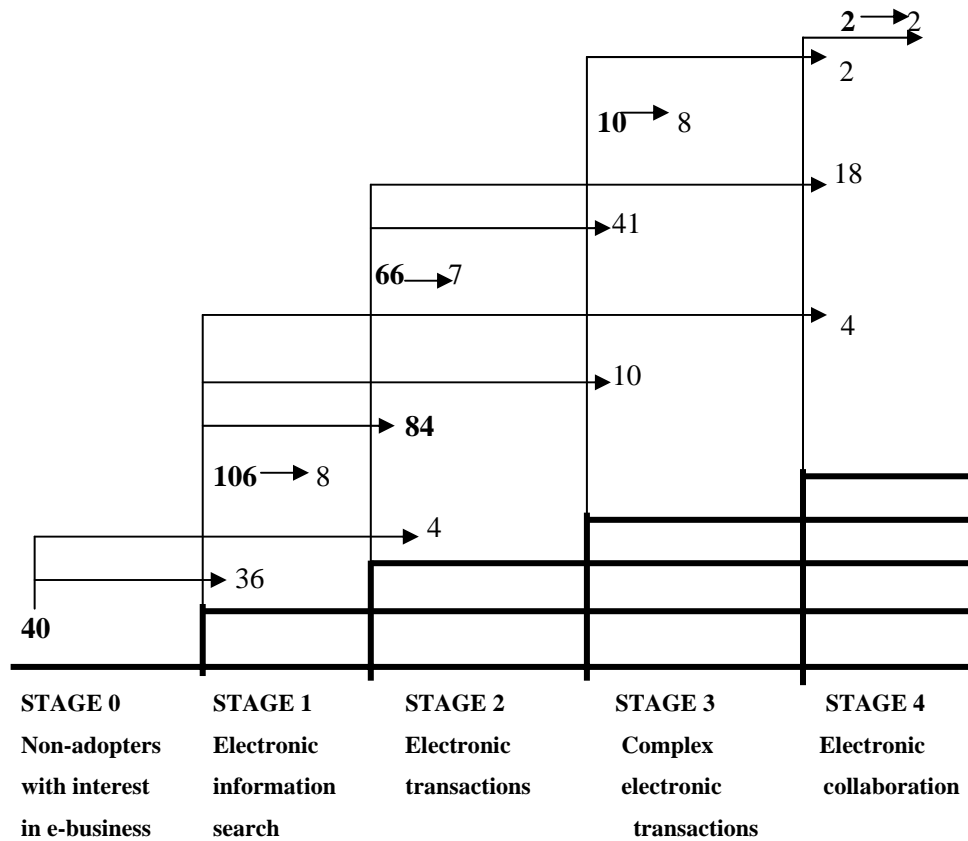
Bold numbers = **current position** Non-bold numbers = intended position

Figure 1. E-business Adoption Trajectories

REFERENCES

Arthur, W.B. (1987) Competing Technologies: An Overview. In Dosi, G. (ed) *Technical Change and Economic Theory*, New York, Columbia University Press.

Cohen, W.M. and Levinthal, D.A. (1990) Absorptive capacity: A New perspective and Learning and Innovation, *Administrative Science Quarterly*, Vol.35, pp 128-152.

Daniel, E., Wilson, H. and Myers, A. (2002) Adoption of E-Commerce by SME's in the UK, Towards a Stage Model, International Small Business Journal, Vol.20, No.3, pp 253-270.

Dosi, G. (1982) Technological paradigms and Technological Trajectories, *Research Policy*, Vol.11, pp 147-162.

Feher, A. and Towell, E. (1997) Business use of the Internet, *Internet Research: Electronic Networking Applications and Policy*, Vol.7, No.3.

Frankfort-Nachmias, C. and Nachmias, D. (1996) Research Methods in the Social Sciences (5th Edition) Arnold, London.

Mehta, R. and Sivadas, E. (1995) Comparing Response Rates and Response Content in Mail versus Electronic Mail Surveys, *Journal of the Market Research Society*, 37, 4, pp 52-53.

Nelson, R.R. and Winter, S. (1982) *An Evolutionary Theory of Economic Change*, Cambridge, MA, Harvard Business Press.

Poon, S. and Swatman, P.M.C. (1997) Small business use of the Internet: findings from the Australian case studies, International Marketing Review, Vol.14, No.5, pp 385-402.

Selwyn, N. and Robson, K. (1998) Using e-mail as a research tool, *Social Research Update*, Issue 21, University of Surrey, Guildford, Surrey.

Venkatraman, N. (1994) IT-enabled business transformation: From automation to business scope redefinition, Sloan Management Review, Winter, pp 73-87.

RISK AND E-BUSINESS DEVELOPMENT PROJECTS: IN SEARCH OF A NEW METRIC

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ABSTRACT

Projects involving the development of information infrastructure supporting e-business activities are complex, especially where the integration of systems of various types are involved. In particular, large projects involving the creation of Value-Added Communities (VACs) are classed as being not only complex, but highly innovative, thus increasing the level of inherent risk.

Risk is a key factor where estimates of time and effort to complete a project are required. In the case of VACs such estimates are extremely important as to the viability of launching the VAC. In such cases risk is compounded by both technical and business factors alike.

The discussion in this paper focuses on the analysis of a first set of results of an experiment aimed at establishing an extension to existing risk taxonomies specific to VAC development projects. It attempts to establish the validity of risks identified by canvassing expert opinion and attempts to relate those risks to project size and project complexity.

KEYWORDS

E-business, Value-Added Communities, Risk evaluation, Risk Taxonomies, Software Estimation, Project Estimation.

1. INTRODUCTION: VALUE-ADDED COMMUNITIES

Value-added communities (VACs) are groups of businesses that function at the various points of the supply chain and are connected electronically to enable optimal response to customer demand. At the same time this electronic network should offer maximum return for the community as a whole. This is done through the establishment of a series of communicating computer systems that support the key activities of each of the participating businesses across the supply chain (Lam et al 2004, Starr et al 2003, Andal-Ancion et al 2003). Customer demand is used as the empowering input for all the above systems. Through the electronic business facility of the trading organization (brand-owning company) information is processed, filtered and forwarded through the relevant networks to other computer systems such as MRP, MRPII, ERP, that each may support the function of one of the members of the community. Thus planning and coordination of activities within the community can be performed according to evolving market trends and continuously revised on a real time basis (Kan 2003, Dyer et al 2004).

E-business developments and especially the above concept of VACs involve a considerable level of uncertainty and risk. This is mainly due to the complexity of the systems developed and integrated. The higher complexity and levels of risk involved increase the difficulty of accurately estimating effort, and hence, cost and duration of such projects. This is considered extremely crucial for any e-business as it might affect the launch time and level of readiness of the business which, in turn, could result in loss of confidence by clientele and partners.

The work discussed in this paper considers risk to large and complex e-business development projects from the developers' point of view. The ultimate target of this research is to establish a metric for the effect of such risks on the accuracy of effort and cost estimation in VAC development projects.

Section 2 of the paper discusses risks and associated research related to e-business development projects. Section 3 presents the approach taken to identify and refine the risk list central to this paper. Section 4 discusses the results of the first phase of this ongoing research, identifying early findings and suggesting further points to be investigated during subsequent stages of the research. Section 5 provides a link to the next phases of the research with indications of the early results. The final section summarises the key findings and main points of the discussion.

2. RISK AND ESTIMATION

The concept of risk originated from mathematics related to gambling and dates back to the seventeenth century. During the latter part of the twentieth century the perception of risk has solidified as the negative outcomes in finance, engineering or science due to hazards posed by modern technological developments (Frosdick 1997). In information systems development terms, risk can simply be defined as the probability of failing (uncertainty) to achieve particular cost, performance, and schedule objectives, and the consequence (cost) of failing to achieve those objectives (Conrow et al 1997).

E-Business development projects have some of the most extreme characteristics of information systems and large scale development projects combined:

1. They often involve the undertaking of massive reorganization of the business processes.
2. They are highly innovative in the sense that they are projects encompassing new technologies and implementing new business models.
3. They are constantly susceptible to changes of requirements and targets as they evolve along with the development of the business model.
4. Success of an E-Business relies very much on public perception and therefore development projects must run on very tight schedules and are often on tight deadlines due to business imperatives.
5. They are extremely sensitive to market or political changes.

From the above it is evident that e-Business development projects rank very high in terms of exposure to risk. Therefore risk management is of particular importance to the successful management of such projects (Sherer 2004, Schoberth et al 2003). With such complex and innovative projects risk identification cannot rely on existing risk taxonomies or the experience and thorough knowledge of the development team. In particular, cost and level of commitment on behalf of organizations in such projects requires an early assessment. This could only come from considering the project as a whole at the conception stage rather than expecting to identify risk by focusing on particularities of the design or the development process at a much later stage. The success of an e-business, and to this extent of a *value-added community,* relies heavily on reputation, created initially through pre-launch publicity. Failure to launch on time or to handle early high volumes of business (or launching ill prepared) leads to catastrophic results, which may terminally damage the reputation and even the survival chances of the organization. Such examples include:

✓ The dramatic failure of fashion online retailer Boo.com; the Company launched with a five-month delay following software integration problems, in November 1999. Originally the site was criticised for its slow speed and incomplete links. Despite having invested heavily and having build an advanced business-to-business infrastructure to support virtual trading with a supply chain covering 18 countries and seven languages by May 2000, the company still failed due to its earlier shortcomings and the ill reputation that followed.

✓ Customers of the online bank Egg had been unable to access personal account details on the site for over four days, in January 2001, but were left in the dark as to why. In 1998 its launch had been swamped due to overwhelming demand. The company would not have survived without the backing of the parent company Prudential, one of the UK's biggest insurance and financial services organizations.

✓ In January 2000 the UK supermarket chain Tesco was humiliated after its website was unavailable to many Internet users for more than an hour on the day it was named top performer in a survey of leading websites, performed by the London School of Economics. The crash was attributed to inability to handle overwhelming demand.

✓ First-e, another Internet bank, went out of business in September 2001. The failure was attributed to poor technology decisions when the business was launched. These limited the company's ability to respond to competitively priced products offered by the competition.

Successful project management, coordination of all subprojects and timely completion of the integrated community infrastructure is essential to sustain the precious reputation and to enable the community to realize it objectives. Central to successful project management is the issue of project estimation; allowing for a realizable target date and a realistic budget to be assigned to the project (Pimenidis et al 2002).

To this effect Keil et al (1998) have cautioned project managers not to restrict their attention to project execution risks only.

3. IN SEARCH OF AN E-BUSINESS RISK TAXONOMY

In our approach to identify and verify risks that would complement existing risk taxonomies by adding elements relating to e-business and, more specifically, to VAC development projects, the following three-phase approach was followed:

•Literature sources were used to identify relevant risk lists and taxonomies. From those a preliminary list of elements that were mostly related to business or integration issues was compiled.

•This preliminary list of risks was then refined by incorporating the views of experts which provided a first level of verification. The resulting list is that discussed in section below.

•Finally a questionnaire was used to experimentally test the proposed list. The data collected was used as means of validating the proposed risks through a wider expert panel and at the same time rank those risks as to order of significance.

In the case of this research the experts involved came from a variety of fields across the business and local authority sectors.

Local authorities offer a particular fortuitous advantage in that they are all currently facing e-business pressures and have similar agendas. These parallel developments offer greater statistical stability and, so, greater predictive power.

3.1 Sample Risk List from the Literature

Our first step was based on Aladwani (2002) who considers project uncertainty focusing on three variables namely size, complexity and diversity of the implementation project. Thus risks relating to VAC development were sought along those three axes. This approach was combined with the proposal by Addison and Vallabh (2002) whereby risk factors have been categorized according to project manager experience. Finally the work by Reifer (2002) which compares traditional and Internet/Intranet development risks was also consulted. This proved useful in confirming that traditional risks such as those primarily relating to the technical issues of an Internet related project are still relevant. *Personnel shortfalls, volatile requirements and new methods and unstable tools* are the key risks identified by Reifer. Murthi's (2002) list of risks extending beyond traditional sources helped identify issues relating to integration of systems.

3.2 Acquiring Expert Opinion

Our preliminary list of additional risks was further complemented, confirmed and reviewed through interviews with four project managers with considerable experience on e-business development projects who between them have experience of implementing VAC projects in seven different countries in Europe and the U.S.A. One came from the banking sector, one from the manufacturing industry, and the other two from retail. The results of the interviews were used to refine the draft list to the following.

Table 1. Risk descriptions

New systems to be integrated but not previously tested.
Low commitment of individual partners.
Loss of expert resources (members of the development team).
Legacy systems not compatible with modern technology.
Inexperience of development team.
Different priorities in terms of launch time.
Difference in readiness of partners to function on the e-business model.

The first five risks listed above are generic to large-scale and complex projects (Houston et al 2001, De Oliveira et al 2004), however, the authors are seeking to evaluate the hypothesis that these risks have enhanced significance in the context of VAC development projects.

3.3 Validating the Proposed List of Risk Factors

Following the compilation of the above list a questionnaire was constructed and distributed to a large number of project managers or sponsors of VAC projects in order to test the validity of the proposed new risk categories. The questionnaire was distributed electronically, as an attachment to emails sent to potential respondents. A considerable number of the eventual respondents were initially contacted by telephone and some via email in order to explain the purpose of the questionnaire and possibly assess the suitability of the potential respondent. Those not contacted were all project managers whom the authors knew to have appropriate experience. Ensuring the suitability of respondents was considered an essential step in confirming that data was obtained from appropriate sources. The target in devising the questionnaire was to classify the risks identified according to their impact and to assess their probability of occurrence, thus providing a means of ranking the risk factors identified. The work by Fehlman (2002) and Willis (2002), providing the business perspective in terms of risk factors in e-commerce was particularly useful in this part of the work.

Sixty nine project managers were asked to participate in the experiment yielding thirty five responses in total, all of which we deemed to be usable. Of those twenty one came from various respondents who have been involved with projects in the business sector, while another fourteen were received from project managers involved with e-business projects in the local authorities sector.

4. DISCUSSION OF RESULTS

4.1 Analysing the Data

To summarise the respondents' perception of the above list of risks the results were aggregated by assigning a frequency and severity weighting of 1 to 4.

The Frequency rating of 1-4 is assigned in the order of Extremely Unlikely to Frequent, while the Severity rating of 1-4 is assigned in the order of Negligible to Catastrophic. To produce a first feel for an overall rating of the risks in this list the weighted sum of each was calculated according to the following formula. All of this follows the approaches of Willis (2002), Khan (2003) and Pandian (2004):

Risk Rating =
$$[\sum_{i=1..4} [(w_i * nf_i)]/Nf] * [\sum_{i=1..4} [(w_i * ns_i)]/Ns]$$
where

nf_i = number of frequency i values
Nf = total number of occurrences for frequency
ns_i = number of severity i values
Ns = total number of occurrences for severity
w_i = weighting factor ($w_i = i$)

4.2 Initial Ratings

The results obtained have been normalised and are shown in table 2 below. This has been sorted according to the overall rating achieved for each of the proposed risks. Although simple, this first set of results seem to suggest that all risks identified in the original list are seen as significant and so qualified to be included, and also provide an initial ranking and confirms the appraisal process.

Table 2. Combined risk ratings ($w_i = i$)

RISK	Normalised Rating
New systems to be integrated but not previously tested. (A)	0.52
Inexperience of development team (B)	0.50
Loss of expert resources (members of the development team). (C)	0.47
Different priorities in terms of launch time. (D)	0.40
Legacy systems not compatible with modern technology. (E)	0.39
Difference in readiness of partners to function on the e-business model. (F)	0.36
Low commitment of individual partners. (G)	0.34

4.3 Business versus Councils Sectors

To accentuate the significance of extreme ratings (e.g. "catastrophic") the ratings calculations were repeated with a weighting of $w_i = i^2$. Figure 1, shows the revised results which have also been segregated to distinguish the business and local government sectors.
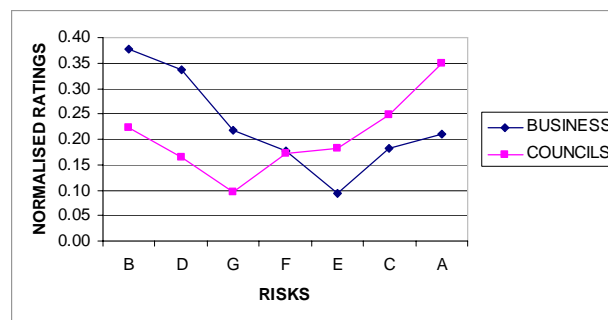
Figure 1.Risk ratings versus risks ($w_i = i^2$)

The different values obtained for the two sectors demonstrate the differences in perception. In the business sector the risk of having an inexperienced team is considered of as the top rated one. The perception in the councils sector the councils sector is much different with the risk of having new systems integrated into the VAC without any prior testing achieving the highest rating. Such differences should not cause a great surprise as the needs and priorities are quite distinct within the two sectors. For the business sector the emphasis is on the successful launch on the publicised date and any diversion from that could be catastrophic. The involvement of an inexperienced team is likely to induce delays and these must be avoided at all costs (Starr et al 2003). Councils on the other hand normally have less financial resources available in comparison to business led VACs and any major rework at a latter stage of the project is going to have a severe impact on the cost. Thus they perceive the risk of integrating previously untested new systems as the most dangerous one; being closer to the main constraint.

The two curves cross at a single point though, and the interesting point of this coincidence of perception is that it involves the risk that is least likely to be affected by the size or the complexity of the project. *Legacy systems not compatible with new technology* could affect the success of the project regardless of the project size or the sector involved. This is why the rating is almost identical for the two sectors, regardless of the differences in perception as to the rest of the risks. Figure 1 should be further considered along with the data presented in table 3 below and in conjunction with the graphs shown in figures 2-5 below.

4.4 Project Size and Complexity

The questionnaire asked respondents to comment on the size and also the complexity of the projects on which they based their assessment. Table 3 below shows the average values for each sector of the size and complexity of the project (McAfee 2005, Pimenidis et al 2002, Pimenidis et al 2004). The number of systems integrated per project and the number of development teams involved in each project represents the size of the project, while the number of different types of systems and the number of different organizations involved indicates the complexity.

Table 3. Project Size and Complexity factors

AVERAGE NUMBER OF	BUSINESS	COUNCILS
Systems integrated	4.05	2.42
Organizations involved	3.00	2.57
Types of different systems involved	3.57	1.93
Development teams	2.57	2.29

The business sector values are higher than the councils in both categories. The hypothesis behind this research is that risk can be directly related to the size and complexity in VAC development projects (Pimenidis et al 2002). Based on this and given the data in table 3, the individual risk ratings obtained from the business sector should be a lot higher than those obtained from the councils sector. This can be partly confirmed in figure 1, but the four graphical representations shown in figures 2-5 below provide further analysis of the variation of risk perception in conjunction with two of the four size and complexity factors shown above.

In figure 2 normalised risk ratings are plotted against the number of systems integrated per VAC project. As the number of systems increases the rating increases though with some variation in slope. However different risks are perceived differently as the size of the project evolves. Risks directly related to technical expertise (Inexperience of development team and Loss of expert resources) are perceived as increasingly more dangerous as the size increases and in particular as the number of systems exceed five. Similar comments apply to the councils sector (figure 3). The picture there is slightly incomplete due to project sizes being considerably smaller (none exceeded four systems) but the slopes of the curves appear to increase more steeply.
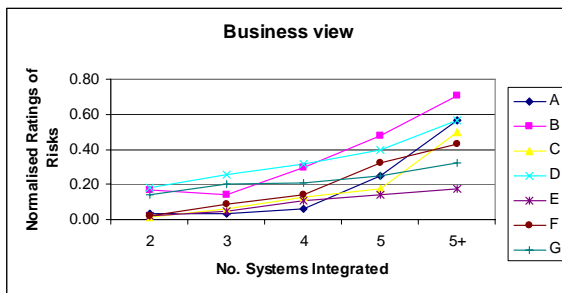
Figure 2. Normalised ratings versus number of systems integrated - Business sector
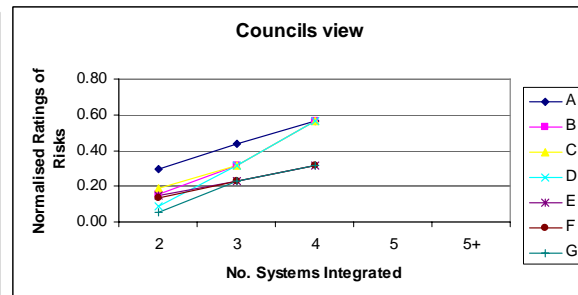
Figure 3. Normalised ratings versus number of systems integrated - Councils sector

Figures 4 and 5 show the variation of risk rating as the number of different systems integrated in the VAC increase. Again here the two sectors appear to share a common behaviour. By studying figure 4 one can see that apart from the previous two risks, different priorities in terms of launch time appear to be considered as an increasing threat to the project once the project starts involving more than four different types of systems. Furthermore, figures 3 and 5 confirm what figure 1 had shown earlier on that risk A is considered a much bigger threat in the councils sector than in the business.
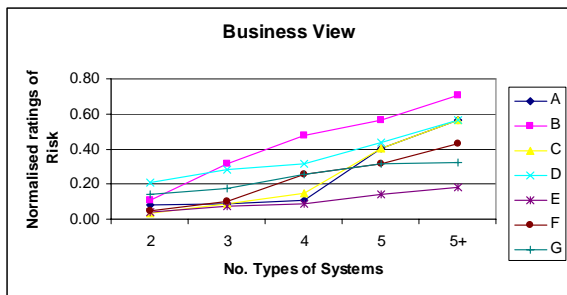
Figure 4. Normalised ratings versus number of different types of systems involved – Business sector
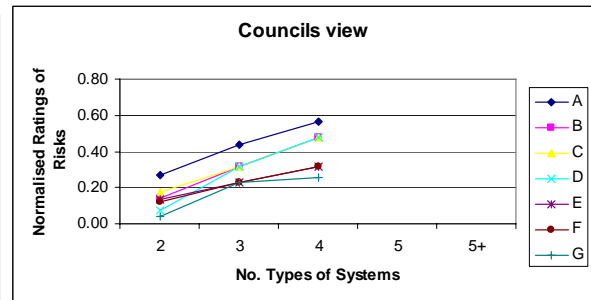
Figure 5. Normalised ratings versus number of different types of systems involved – Councils sector

4.5 Questions Raised

The trends witnessed in the graphs shown in figures 1 to 5 above support the hypothesis that the risks discussed here can be considered as directly related to the size and complexity of the project. The difference in risk perception between the two sectors identified can possibly be attributed to the pressing needs of the project completing on time which is more prevalent in the business sector as opposed to councils (Christiaanse et al 2003).

The sample size examined here is rather small and, coming from two different sectors with not necessarily the same expectations and the same needs, does not allow for solid conclusions. One of the positive outcomes from this phase of the research is that all risks examined here appear to be relevant.

The interesting question that arises is whether the differences in risk perception between the two sectors, that appear to have surfaced from the study of the above graphs, indicate that the two categories are not compatible and so a common risk taxonomy is not a wise or plausible expectation.

5. FURTHER WORK

The next phase of this work, currently in its final stages, under way, will seek to confirm the provisional results by revisiting and repeating the initial survey with larger target groups; by extending the range into Higher education and Health Authorities.

Universities and other educational institutions which have implemented e-learning systems will be asked to contribute to this second stage of the research. They are currently facing the challenges of developing systems for distributed educational services (Barker 2000). For the large majority, this is new and the demands on their computer based systems, internal and external partnerships and cooperations strongly resemble those of VACs (Starr et al 2003). As with local councils, the fact that there are many near equivalent universities pursuing similar agendas brings the prospect of greater statistical significance of observations. Similarly, health trusts are currently undergoing continuous development and changes. Unlike businesses, but like local authorities, all universities and, similarly, all health trusts appear to be facing challenges very similar to one another, with some variation introduced due to location or the population they serve. By extending the scope of the experiment to more sectors it is expected that the question raised in the discussion section as to the need for separate taxonomies can be answered.

The main aim behind this work is to tackle project estimation. The results from the second phase will be utilised in conjunction with the estimation by analogy method (Shepperd et al 1997), to identify analogies and provide estimates of risk. It is hoped that this will lead to improved analogies and, in turn, lead to better project estimation, based on more accurate identification and assessment of project risks for e-business development projects.

The preliminary results of the above experiment, canvassing over a wider basis, indicate that the initial assessment of risks and the above classification are confirmed and again show the differences between the

business and local authority / government sectors. A detailed analysis of these results is under way and is expected to shed more light on the nature and causes of those differences.

6. CONCLUSIONS

The process of constructing and validating a provisional list of risks relevant to VAC development projects, and of interpreting the importance of those risks has been presented and the results of the first phase of the experimental work have been discussed. The list proposed here is an extension of traditional risk taxonomies.

Although the results are yet at only an intermediate stage requiring further validation and refinement, confidence in them is quite high for the following reasons.

1. All proposed risks have attained a reasonable rating amongst experts; none having been rejected.
2. The results display some statistical strength, with half of the data collected coming from a highly coherent sector.
3. Further analysis has shown that the results indicate that a relationship between project size, complexity and risk perception can be established.

The question of the universal applicability of the proposed list versus the need for sector specific lists has been raised. The next phase of investigation will widen the basis of the experiment, seek to reproduce and extend these results and resolve this question.

REFERENCES

Addison T., Vallabh S. (2002), Controlling Software Project Risks – an Empirical Study of Methods used by Experienced Project Managers, *in Proceedings of 2002 Annual Conference of the South African Institute of Computer Scientists & Information Technologists (SAICSIT 2002)*, pp.128-140.

Aladwani A. M. (2002), IT project uncertainty, planning and success: An empirical investigation from Kuwait, *Information Technology & People*, Vol. 15 No. 3, 2002, pp. 210-226.

Andal-Ancion A., Cartwright P.A. and Yip G.S. (2003), The Digital Transformation of Traditional Businesses, *Sloan Management Review*, Vol. 44, No. 4, pp. 34–41

Barker M., (2000) E-education is the New-New Thing, *Strategy and Business*, Issue 18, pp. 106-115.

Christiaanse E., Lynne Markus M. (2003) Participation in Collaboration Electronic Marketplaces, *in Proceedings of the 36th Hawaii International Conference on System Sciences (HICSS'03)*, IEEE.

Conrow E. H., Shishido P. S. (1997), Implementing Risk Management on Software Intensive Projects, *IEEE Software*, Vol. 14, no. 3, pp. 83-89.

De Oliveira Barros M., Werner C. M. L. and Travassos G. H. (2004) Supporting risks in software project management, *Journal of Systems and Software,* Volume 70, Issues 1-2,, pp. 21-35.

Dyer J.H. and Hatch N.W. (2004) Using Supplier Networks To Learn Faster, *Sloan Management Review*, Vol. 45, No. 3, pp. 57–63

Fehlmann T. (2002), Business-Oriented Testing in E-Commerce, Software Quality and Software Testing in Internet Times, *Springer-Verlag*, pp. 117-137.

Frosdick S. (1997) The techniques of risk analysis are insufficient in themselves, *Disaster Prevention and Management*, Vol. 6, No. 3, pp. 165–177

Houston D. X., Mackulak G. T. and Collofello J. S. (2001), Stochastic simulation of risk factor potential effects for software development risk management, *Journal of Systems and Software*, Volume 59, issue3, pp. 247-257.

Kan S. H. (2003), Metrics and Models in Software Quality Engineering, 2nd edition, Addison-Wesley, Boston.

Keil M., Cule P. E., Lyytinen K., Schmidt R. C. (1998), A Framework for Identifying Software Project Risk, *Communications of the ACM*, Vol. 41, No. 11, pp. 76-83.

Lam W., Shankararaman V. (2004), An Enterprise Integration Methodology, *IEEE IT Pro*, Vol. 6, no. 2, pp. 40-48.

McAfee A. (2005), Will Web Services Really Transform Collaboration, *Sloan Management Review*, Winter 2005, Vol. 46, No 2, pp 78-84.

Murthi S. (2002), Preventive Risk Management for Software Projects, *IEEE IT Pro*, Vol. 4, no.5, pp. 9-15.

Pandian C. R. (2004), Software Metrics, Auerbach Publications.

Pimenidis E., Miller C. J., MacEachen C. F. (2002) A New Look at Project Estimation for E-Business, *in Proceedings of the International Conference on Project Management (ProMAC2002)*, Singapore Nanyang Technological University and The Society of Project Management - Japan, Singapore, Vol.1, pp. 353-358..

Pimenidis E., Miller C. J., MacEachen C. F. (2004) Identifying Risk for e-Business Development, *in Proceedings of the European Conference on Information Technology Evaluation (ECITE2004)*, 11-12 November 2004, Royal Netherlands Academy of Arts and Sciences, Amsterdam, The Netherlands, pp. 349-358.

Reifer D. (2002), Ten Deadly Risks in Internet and Intranet Software Development, *IEEE Software*, Vol. 19, no. 2, pp. 12-14.

Schoberth T., Preece J., Heinzl A. (2003), Online Communities: A Longitudinal Analysis of Communication Activities, *in Proceedings of the 36th Hawaii International Conference on System Sciences (HICSS'03)*, IEEE.

Shepperd M., Schofield C. (1997), Estimating Software Project Effort Using Analogies, *IEEE Transactions on Software Engineering,* Vol. 23, No. 12, November 1997, pp. 736 – 743.

Sherer S. A. (2004), Managing Risk beyond the Control of IS Managers: The Role of Business Management, *in Proceedings of the 37th Hawaii International Conference on System Sciences (HICSS'04)*, IEEE.

Starr R., Newfrock J. and Delurey M. (2003), Enterprise Resilience: Managing Risk in the Networked Economy, *Strategy and Business*, Issue 30, pp 70-79.

Willis S. (2002), Using QA for Risk Management in Web Projects, Software Quality and Software Testing in Internet Times, *Springer-Verlag*, pp. 31-48

Short Papers

ABORT, DELETE, OR IGNORE? ASSESSING THE IMPLICATIONS OF UNSOLICITED COMMERCIAL COMMUNICATION (SPAM) FOR E-COMMERCE

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ABSTRACT

Although e-mail has proved to be an effective marketing tool, its misuse could potentially erode its appeal, popularity and usage and pose a fundamental threat to consumer confidence in e-commerce. Unsolicited Commercial Communication (UCE), commonly known as spam, impinges on the privacy of individual Internet users. It also costs users time spent reading and deleting the messages, as well as in a traditional economic sense, where users pay time-based connection fees. Spam, which most frequently takes the form of mass mailing, is a violation of Internet etiquette. This paper explores the implications of UCE for the growth of global e-commerce. It specifically assesses how multiple parties such as individual users, corporations and internet service providers are affected by UCE. Finally it identifies specific techniques used for UCE, and suggests some preliminary approaches to address them.

KEYWORDS

Spam, UCE, corporate e-mail policies

1. INTRODUCTION

The phenomenal growth of the global Internet and e-mail as the new means of communication enables the world to share data more easily and efficiently than ever before. E-mail is already a popular means for advertising to and soliciting customers, as well as for selling products. It has proved to be successful not only in the business arena, but also for the millions of families and home users. An International Data Corporation (IDC) report estimates that email messages sent per year will increase from 9.7 billion in 2000 to 35 billion in 2005 (International Data Corporation, 2000). Apart from large businesses, the use of email provides a cost-effective mechanism for small and medium sized firms to reach a larger section of customers. According to 'GartnerGroup' email messaging has increased at a compound annual growth rate (CAGR) of 40% since 1981 (GartnerGroup, 2001). Although e-mail has proved to be an effective marketing tool (Chaffey, 2003), its misuse could potentially erode its appeal, popularity and usage (WSIS Declaration, 2005) and pose a fundamental threat to consumer confidence in e-commerce. Unsolicited Commercial Communication (UCE), commonly known as spam, impinges on the privacy of individual Internet users. It can also cost users time spent reading and deleting the messages, as well as in a traditional economic sense where users pay time-based connection fees. Spam, which most frequently takes the form of mass mailing, is a violation of Internet

etiquette (Koppanyi, 2003). This paper explores the implications of UCE for the growth of global e-commerce. It specifically assesses how multiple parties such as individual users, corporations and internet service providers are affected by UCE. Finally, it identifies specific techniques used for UCE and suggests some preliminary approaches for tackling spam.

2. UNSOLICITED COMMERICAL EMAIL: A GLOBAL ISSUE

There is no universal definition of spam. In 2002, the Australian National Office for the Information Economy (NOIE) encountered the difficulty of trying to define the term spam, when it conducted an extensive review of the spam issue. The working definition provided by NOIE referred to UCE or spam as an e-mail communication that could not be reasonably assumed to be wanted or expected by a recipient. In June 1997, the United States' Federal Trade Commission's Workshop on Consumer Privacy, marked the beginning of a focused discussion of the problems associated with UCE (Centre for Democratic Technology, 2003). This workshop identified spam as one of the most intractable consumer protection problems the US Government has ever faced (FTC, 2005). The extremely low cost of sending email makes it a very appealing marketing channel. However low costs, associated with potential anonymity in cyberspace makes spam an attractive vehicle for conducting illegal as well as commercial activities that are difficult to conduct in the traditional way. A 2003 FTC staff survey revealed that two-thirds of spam in its sample contained facial indications of falsity (FTC, 2003).

Internet subscribers world-wide are unwittingly paying an estimated €10 billion a year in connection costs just to receive "junk" e-mails, according to a study undertaken for the European Commission (European Commission Report, 2003). The study, which provides detailed information on the junk mail phenomenon in both the US and the European Union, forms part of the Commission's ongoing efforts to ensure that the development of the Internet and e-commerce does not undermine Europe's rules on Internet privacy and data protection. Spam is a major problem for developed countries, but perhaps is even worse for developing and least developed countries (LDCs), where, because of limited available Internet resources, many users rely on free web-based email services with limits on free storage, which are particularly targeted by spammers (World Summit on the Information Society, 2004).

3. IMPACT OF UCE ON CONSUMERS AND CORPORATIONS

Spam creates a variety of problems for consumers, businesses, ISPs and legitimate marketers (Competitive Enterprise Institute, 2003). The problems with spam are that firstly consumers have to spend on-line time downloading, reading and responding to the spam. As most consumers bear the costs of access they are in effect funding the reception of something they did not want in the first place. Due to inadequacy of the anti-spam legislation to provide protection for personal information, individuals act to protect themselves and their privacy. The cost incurred by individuals to protect themselves from unwanted e-mail messages is significant. The privacy toll includes costs associated with stopping junk mail, avoiding identity theft and protecting privacy on the Internet. A privacy sensitive family could spend between $200 and $300 and many hours annually to protect their privacy (Gellman Robert, 2002).

Secondly, Spam burdens ISPs who bear much more of the cost of providing the infrastructure than the sender does and frustrates their customers who have to suffer poorer performance levels (Vint Cerf, 2002). Moreover it creates support overheads for ISPs who must deal with spam complaints from their customers. In the case of AOL vs. Prime Data Worldnet Systems Inc., the plaintiff claimed and won direct computer costs of 78/1000 of a penny per message (AOL Legal Department, 2003).

Lost productivity is another negative effect of spam. For organisations, a percentage of their labour cost is lost due to employee time spent on junk mails, apart from the additional workload to their data centre and MIS staff (Nucleus Research, 2003). There are other productivity drains as well: on legal front, there have been instances of lawsuits as a result of pornographic and other messages circulated via email in the workplace. According to the 2004 National Technology Readiness Survey (NTRS), an annual survey that tracks U.S. consumers' technology opinions and behaviours, online users in the United States spend an average of three minutes deleting spam each day they check e-mail. Aggregating their usage across the 169.4

million online adults in the United States, this equals 22.9 million hours a week, or \$21.58 billion annually when based on the average working wage (National Technology Readiness Survey, 2004).

UCE is also increasingly used as a vehicle for spreading computer viruses and worms. Spam and e-mail-born viruses can no longer be treated as separate problems. One the biggest problems of Unsolicited Commercial Communication is that more than 98% (Tony Dearsley, 2004) of computer viruses now arrive via spam, cleverly camouflaged with introductory messages like 'I love you' or tempting picture attachments of Britney Spears, Madonna or Anna Kournikova. The Melissa virus was significant in that it was the first major example of spam effectively "hijacking" the user's computer.

The issue of UCE extends beyond passive, less-harmful impacts to more negative outcomes. There is a direct relation between Spam and Cyber-crime techniques, such as phishing (i.e., creating fake identities using spoofs of well-known names). Phishing has become an increasingly sophisticated method that fools the user into providing personal information such as financial data, bank account numbers and passwords (Graham, 2004). A significant proportion of UCE contains fictitious information about the sender, misleading subject lines or performance claims, advertisements for pornographic web sites, software offers for collecting email addresses, quack products and illegally pirated software. Therefore, the problem of UCE poses a fundamental threat to e-commerce (Industry Canada, 2005). EU Enterprise Commissionaire Erkki Liikanen said that 'spam undermines consumer confidence, while consumer confidence is a prerequisite for the success of e-commerce and, indeed, for the Information Society' (EU Business, 2005).

The theft of identity and financial information is a growing problem, in terms of a magnitude and awareness. The targets are expanding from financial services to all organisations with financial information online (Symantec, 2004). Financial identity theft occurs when personal information is used by a third party without the permission or knowledge of the owner. According to the UK Government it is estimated that more than 100,000 people are affected by identity theft in the UK each year, costing the British economy over £1.3 billion annually (Cabinet Office, 2002). Figures show that 4% of the UK's online account holders automatically respond to e-mails that appear to come from their bank. In addition, technical security measures are not used – roughly 25% have no updated virus checker on their computers, while more than 40% do not have an active firewall (Identity Theft Prevention Office, 2004). However it is not just the UK that is being targeted. USA, Australia, New Zealand and Canada are also included in the scams. According to the United States Federal Trade Commission, identity theft is America's fastest growing crime where losses are estimated to be billions of dollars each year (FTC, 2003). MailFrontier Research has identified that 20 percent of all phishing attacks are targeting e-commerce sites. On November 18th, 2004 'MailFrontier' (an email security provider of anti-spam and anti-phishing solutions) announced the results of a consumer survey that highlighted the impact of email phishing scams on online holiday retail sales. The survey found that 29% of consumers said they would avoid shopping online for the holiday season due to the rise of email phishing scams (MailFrontier 2004). While many high profile financial organisations and large Internet businesses have taken some steps towards increasing their customers' awareness, most organisations have done very little to actively combat phishers. Taking measures to reduce the growth of on-line identity theft has become a top priority for any organization that wishes to leverage the internet to extend services to customers and trusted third parties.

4. SPAMMER'S TECHNIQUES TO SELECT E-MAIL ADDRESSES AND WAYS TO TACKLE THE PROBLEM

Spammers use various techniques to locate e-mail addresses on the Internet. 'E-mail harvesting' is the method of surreptitiously collecting bulk e-mail addresses from public or private sources. Professional spammers employ search bots that navigate the Internet and automatically retrieve an e-mail address from public areas such as web-pages, chat rooms, e-mailing lists, newsgroups and online directories. These e-mail addresses are then collected for use by the spammer. Every web page has a source code which instructs the web browser how to display the content. Search bots scan the source code of web pages for normal text e-mail addresses (i.e. e.moustakas@mdx.ac.uk.) 'Sam Spade' is a tool that can search websites for e-mail addresses. In order for spammers to identify whether or not an e-mail address is valid they use scripts to open a connection to the target mail server, submit millions of random e-mail addresses and then use the 'VRFY' command to verify if addresses are live. Another method known as 'Dictionary attack' was

used several times against Hotmail web-mail accounts. Search engines such as Google could also be a great resource from Spammers to collect e-mail addresses to send Unsolicited Communication. Spam can bypass content filtering tools by using 'hash busting' techniques like hyphens to break known search terms. For example a computer will not identify the words *V-i-a-g-r-a* and *viagra* as the same but a human will interpret them the same.

There are a number of steps that could be followed in order to prevent an e-mail address from being scanned by search bots:

4.1 Corporate Email Policies

E-mail addresses should not be allowed to be given by employees, to third parties across public forums such as chat rooms or newsgroups. An appropriate e-mail policy is essential to regulate this in the workplace. To avoid inappropriate e-mail usage, it is important to clarify what is permitted at the organisation and what is not, in a written record by introducing an e-mail policy (ePolicy Institute, 2004). Since e-mail policies usually describe what employees are not allowed to do (i.e. access adult content using corporate infrastructure), prevention would appear to be the primary purpose of a corporate e-mail policy (Forsite Group, 2004). However, the major objective of a corporate e-mail policy is to protect the organisation from various internal or external threats and act as the element that binds all aspects of information security management (Department of Trade and Industry (DTI), 2004).

While most organisations have developed e-mail policies, many of those lack the specific detail required to inform employees how to deal with inappropriate email (Mark Haftke, 2000). According to the 2003 research published by Clearswift, a company responsible for managing and securing electronic communications, shows that despite the serious concerns over reduced productivity levels, over one third (37 per cent) of UK organisations do not have a policy in place to fight spam (Clearswift, 2003). The survey reveals that while action is being taken at a government and industry level to raise awareness of the implications of spam for the wider economy, businesses are failing to establish e-policies, educate employees and implement advanced counter-spam solutions.

4.2 Technical Measures

A number of techniques that could be used to prevent spammers from capturing e-mail addresses are discussed in the following paragraphs.

4.2.1 The 'Munging' Technique

Individuals can add few letters or spaces to the e-mail address in order to confuse search bots. (e.moustakas@mdx.REMOVE-THIS.ac.uk or e.moustakas @ mdx ac uk) mind the spaces before and after the "@". This is called "Munging". On-line readers may remove the word "REMOVE-THIS" in the e-mail address or ignore the spaces. However this technique is not 100% effective since several spamming programs automatically remove words such as "REMOVE-THIS" and "NO-SPAM" from e-mail addresses or remove spaces when it is appropriate.

4.2.2 Make Email Addresses Indistinct in the .html Source Code

It is recommended an e-mail address not to be displayed in normal plain text in the source code of a web page in order not to be captured easily by a search bot. The characters can be replaced either by a small image (logo) where on it the e-mail address will be displayed or replaced with the use of "hexadecimal encoding". In hexadecimal encoding the e-mail address 'e.moustakas@mdx.ac.uk' is transformed as follows in the source code: *contact*

4.2.3 Online Contract Forms

Maybe the only fool-proof technique to prevent search bots from finding e-mail addresses is by not displaying e-mail addresses at all on a web site. To ensure that Internet users can still contact the organization by means of e-mail the web-developer needs to create an online "contact form". The web-page may include the names and the positions of the staff so if a reader wishes to contact a member of the staff he needs to click on his name or a link provided for this purpose. When the Internet user clicks on the link, an online

contact form is displayed, where a message can be composed. Therefore, the e-mail address is never displayed to the Internet user or on the web page.

4.3 Anti-spam Legislation

This research paper has shown that there is a direct relation between Spam and Cyber Crime/Phishing. Given the severity of the issue and the potential damages spam can cause, legislative measures have been suggested to control and possibly eliminate spam. Spammers may not be affected by anti-spam legislation since they can change their tactics or simply move their servers to locations that that have not passed anti-spam regulations. However, action against spammers is not totally impossible. According to Spamhaus (an independent network which tracks Internet's Spammers, Spam Gangs and Spam Services), 80% of spam received by Internet users in North America and Europe is sent by a hard-core group of less than 200 spam outfits, comprising some 500-600 professional spammers (Spamhaus, 2004). Therefore, it is possible to identify and control this core group of spammers. By effectively deploying legislative tools, it might be possible to penalize, control and minimize the spam groups.

5. CONCLUSION

The issue of security for computer systems and company information is a major concern for employers who take various preventative measures to deter and combat inappropriate use of e-mail or internet by employees. The increasingly sophisticated variants of spam and the threats they pose have brought anti-spam measures to the forefront of attention of several governmental agencies, consumer groups and business cohorts worldwide. Spam affects a diverse group of stakeholders ranging from customers, small and medium sized businesses, to larger corporations and even governmental agencies. This paper provided an overview of the potential negative outcomes of UCE, and the threats to the fundamental growth of online commerce. From simple junk email messages, UCE has evolved into a more complex and sophisticated variant of cyber-crime. It affects multiple constituents of the cyber community – from consumers, corporations and governmental agencies. Each constituent needs to proactively engage in controlling and mitigating the negative outcomes of spam. Apart from implementing some technical solutions, the problems of spam can be effectively tackled by combining multiple approaches involving education, effective anti-spam legislation and spam corporate codes for electronic communication and marketing.

REFERENCES

AOL Legal Department 'Junk e-mail Decisions and Litigation' *AOL v. Prime Data Worldnet Systems, Inc. Report and Recommendation* Retrieved October 2003 from [http://legal.web.aol.com/decisions/dljunk/primereport.html]

Centre for Democratic Technology (CDT) 'Report to the Federal Trade Commission of the Ad-Hoc Working Group on UCE' Retrieved November 2003 from [http://www.cdt.org/spam] (2003)

Chaffey Dave and PR Smith 2002, *'eMarketing eXcellence The heart of eBusiness'* Second Edition

Competitive Enterprise Institute 2002 'Spam, That Ill O' The ISP: A Reality Check for Legislators'

Dearsley Tony, Computer Investigation Manager, Vogon International 'Computer and Internet Crime Conference/Exhibition (March 2004)

EU Business - Spam 'Guides for spam' Retrieved May 2005 from [http://www.eubusiness.com/guides/spam]

EuroUnion 'Spam: European Commission goes on the offensive' Retrieved July 15, 2003 from [http://www.eurunion.org/News/press/2003/2003044.htm]

Federal Trade Commission (FTC) 'FTC Measures False Claims Inherent in Random Spam' Retrieved April 29, 2003 from [http://www.ftc.gov/opa/2003/04/spamrpt.htm]

Federal Trade Commission (FTC) 'The US SAFE WEB Act: Protecting Consumers from Spam, Spyware, and Fraud. A Legislative Recommendation to Congress' Retrieved June 12, 2005 from [http://www.ftc.gov/reports/ussafeweb/USSAFEWEB.pdf]

GartnerGroup, Retrieved October 25, 2001 from [http://www4.gartner.com/Init]

Gellman Robert 2002 *How The Lack of Privacy Costs Consumers and Why Business Studies of Privacy Costs are Biased and Incomplete* Published by 'Electronic Privacy Information Center', Washington DC

Graham Paul 2002 *Hackers & Painters. Big Ideas from the Computer Age*. Published by O'Rielly, Inc.

Industry Canada 'Stopping spam, creating a stronger safer Internet' Retrieved May 12, 2005 from

[http://e-com.ic.gc.ca/epic/internet/inecic-ceac.nsf/en/h_gv00317e.html]

JANET National User Group, 'JNUG Netiquette and Junk Mail' Retrieved May 12, 2005 from [http://www.jnug.ac.uk/reports/jmail.html]

Mailfrontier 'MailFrontier Research Survey Detects Slowdown in Online Holiday Shopping' Palo Alto, Calif

Retrieved November 18, 2004 from [http://www.mailfrontier.com/press/press_holidays.html]

National Technology Readiness Survey *'Summary Report'* by Rockbridge Associates, Inc. Retrieved February 12, 2005 from [http://www.rhsmith.umd.edu/ntrs/NTRS_2004.pdf]

NHTCU National Hi-Tech Crime Unit, 2004 *'Press Statement: 13 Internet fraudsters arrested by National Hi-Tech Crime Unit'*

NUCLEUS Research *'Spam: The Silent ROI Killer'* Retrieved March 12, 2003 from

[http://www.nucleusresearch.com/research/d59.pdf]

Spamhaus 2004 *'SBL Blocklist Rationale'* Retrieved May 20, 2004 from

[http://www.spamhaus.org/sbl/sbl-rationale.html]

Symantec 2004 Kenneth Schneider, Chief Architect *'EU Workshop on Combatting Spam Brussels'*

Szabolcs Koppanyi European Commission UK 2003 *'EEMA Conference'* Dublin

The Cabinet Office *'Identity Fraud: A study'* Retrieved July 12, 2002 from

[http://www.homeoffice.gov.uk/docs/id_fraud-report.pdf]

The Identity Resource Centre *'Identity theft facts and statistics'* Retrieved April 12, 2004 from [http://www.idtheftcenter.org/facts.shtml]

US Federal Trade Commission *'ID Theft'* Retrieved September 2003 from [http://www.consumer.gov/idtheft]

[http://www.ftc.gov/bcp/conline/pubs/credit/idtheftmini.htm]

Vint Cerf Senior 2002 Vice President, MCI and acknowledged "Father of the Internet" "Spamming is the scourge of electronic-mail and newsgroups on the Internet. Spammers are, in effect, taking resources away from users and service suppliers without compensation and without authorization."

World Summit on the Information Society *'Report on the ITU WSIS Thematic Meeting on Countering Spam'* CICG, Geneva (7-9 July 2004)

GCITIZEN, GRID TECHNOLOGY FOR EGOVERNMENT SYSTEMS INTEGRATION

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ABSTRACT

In most of the countries the Public Administration manages sets of data about its citizens. Until the application of the ICT, the administrative managements had been carried out by means of paper, files, registries, etc. In the 90s, began the use of the ICT in the management of the administrative data, producing the denominated eGovernment. This data is managed by different administrative units that work with different information from the life of the citizens. This has produced different nature inconsistencies and access difficulties to the available data in different administrative scopes.
This paper proposes an evolution, using grid technology as an integration method, to gather the information about a citizen as a single unified view. It is also shown how the Administration can be understood as a Virtual Organization.

1. INTRODUCTION

Citizens address to the Public Administrations in different stages of their life. Nevertheless, the Public Administration is divided into different levels (State, Autonomic and Local) [1] and specialized sections which are distributed geographically. Furthermore, it does not exist a unique place in which the people are able to carry out any relationship associated with the different facets of their life. As a result, in the Public Administration environment, a citizen is the sum of the pieces of information which are owned by each of the parts which compose the Administration.

Traditionally, the data in the administration have been managed using papers, files, etc., but recently the governments have invested money and effort for introducing the usage of ICT in order to lower the need of paper and foster the electronic transactions. Often, this electronic information has been made available online, but seldom is offered to others than within the same administrative unit which has set up the service. Also these initiatives have arisen isolated and so, the information systems are not integrated.

This paper proposes the grid technology [2] as an integration method of information, and resources in the administration. In this sense, the proposed work supposes an advance in the electronic government by means of the use of grid technology, as well as a new scope of application of this emergent paradigm of computing.

The document is organized as follows: section 2 exposes some of the problems of the information which own the administration, independently of the usage of ICTs. In point 3, there is a review of the requirements for ICT to be used in an administrative framework. In point 4, it is shown that the Public Administration can be understood as a Virtual Organization (VO) in the context of the grid technology. Point 5 exposes a vision of gCitizen as middleware for systems integration in the Public Administration. Finally, point 6 shows some discussion about the proposed work, as well as actions for the success of the exposed ideas.

2. INFORMATION INCONSISTENCIES IN THE ADMINISTRATION

The citizen in the Administration can be envisioned as the addition of the information that each of the administrative islands in the Administration have about him.

This happens even within the same city council, where the competences are diversified in areas which handle different information about the same person.

The rise of the ICTs and the application of them to the government [3] produced the denominated Electronic Government or eGovernment. Nevertheless, the usage of electronic information has been fostered by individual initiatives, according to the budgets, sporadic funding and helps. It has produced inconsistencies in different administrative scopes. Some typical problems which happen are commented next.

- **Not consolidated data**. This situation happens when administrative units own the same data but they do not mean the same information because of errors which modify the content, the citizen provides different data to different administrative units, etc.
- **Different names for semantically equal data**. This problem happens when different administrative unit store the same data about one person, but the name used for indexing is not the same.
- **Different levels of information management**. This case depends on the procedures of data management, and is related to the diversity of ways for capturing and managing the information, and the context in which they have been obtained.

All these cases are aggravated by the fact that each administrative organization can be tempted to use the data which it owns, instead of seeking advice on the effective organization which is the legal responsible of obtaining and managing them.

3. ICTS IN ADMINISTRATION

The public administration usually applies the computing information systems in its daily work. Nevertheless, most of these systems are only used inside each organization. The main problem is that the use of ICTs has not been consolidated in the whole administration, and therefore the communication among the different units is still carried out by conventional techniques. Other reasons which difficult the interoperability of the information systems in the Public Administration are commented next.

- **Different levels of ICT deployment**. Each administration has grown in an independent way, according to its budget and needs. This turns out that some administrative units are computerized and apply different technologies, while others hardly use computers.
- **Incomplete applications**. In many cases, the computing solutions deployed have not covered all the legal or functional requirements of the administrative procedures. The users are usually deceived of these applications and so, they are reluctant to use other new tools.
- **Usage of proprietary applications**. The computing solutions proposed for the administration have been traditionally developed by companies, and so it creates a dependence on them. This dependence also limits the options when choosing among different approaches for new solutions.
- **Lack of adoption by the users**. The personnel in the administration is usually reticent to changes. These users only accept the changes when they would provide a more comfortable way to work, and do not suppose to learn about new procedures.

3.1 eGovernment Requirements

According to [3], there are some requirements for ICTs when being used in a governmental framework, but there are also some others which have been revealed insofar as these technologies have been deployed:

- **Security**. Only some people are allowed accede to some data, and in many cases need the consent of the person who is the target of the access. Therefore it is essential to identify the person who tries to accede to the information and according to legal and organizational issues, authorise or refuse the access.

- **Privacy**. The data which is stored in the administration is subject of some laws, and in most of cases the target of the data has to specifically permit the access to these data. When using ICTs, it is important to protect the data because they are vulnerable to security breakouts.
- **Interoperability**. There are many data models in the administration. Nevertheless, the administrative units may communicate and collaborate with each other, and so it is needed a high degree of interoperability among their information systems.
- **Geographically distributed resources**. The administration is physically distributed in a country, city, etc. These building are connected to each other using public networks which enable the interchange of data, but also make possible the access to external users.
- **Ubiquitous access**. Notwithstanding the geographical distribution of the resources, the access must be granted to the civil servants who are authorized to use them. It enables mobility of the users, and also enables the offering of the information contents to citizens and business.

4. THE PUBLIC ADMINISTRATION AS A VIRTUAL ORGANIZATION

In the scope of the grid technology, the VOs are composed by individuals and/or institutions that share their available resources to be used by all its members. There are some rules, permissions, restrictions, policies of usage, etc. which are agreed by the members of the VOs for the usage of these shared resources. Also, in dynamic VOs, these constraints may vary from one situation to other, according to the changes that take place in the physical organizations [4]. Notwithstanding the share of the resources, each member of the VO must retain the control on its resources and must be able to work in the habitual way.

According to this approach, the Public Administration can be seen as a VO composed by the different administrative units from each of the governmental levels (local, provincial, etc.). Each one of the organizations own resources that can be made available to the rest for working in a collaborative way.

The main objective of the Grid technology consists in providing and coordinating the use of resources geographically distributed, to be able to find solutions to the problems which appear in dynamic and multiinstitutional VO.

5. GCITIZEN, THE CITIZEN IN THE GRID

The aim of the gCitizen project is the creation of a grid middleware for the transparent management of the information about citizens in the Public Administration and the administrative procedures in which the citizens are involved, independently of the point of entry to the Administration (understood as a global entity). The vision of the project is outlined in Figure 1.

This project raises the design of a flexible and scalable prototype of a "grid citizen" which integrates the information about the citizen in the administration. The objective is to identify each piece of data which is part of the identity of a citizen in the administration, and thus identifying the citizen which are representing.
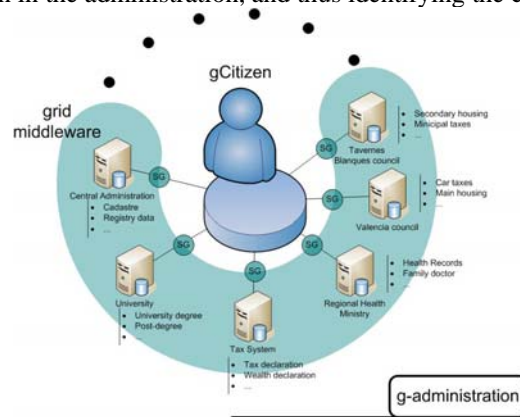
Figure 1. The "grid citizen" in the administration.

This is a system integration project, but it does not follow the classical schemes in which there are key servers which gather the information and wraps it to provide processed results. In the real administration there is a distributed maintenance, ownership and responsibility of data and procedures. But this information is shared with other parts of the administration, using regulated procedures. The aim of gCitizen is to translate this approach by using grid technology to integrate the systems of in the administration. The objective is to build up a grid VO which share knowledge about citizens for improving services to them.

One of constraints of gCitizen is not to be an intruder into the already existing systems. These systems are maintained by their owners, and are acceded using already existing applications applying already existing procedures. Nevertheless some of the resources are likely to be acceded by other parts of the administration, and grid technology is proposed for this sharing.

In this project it is designed a component oriented architecture which virtualizes the existing systems as grid resources, and provides a homogeneous access to them. This architecture would enable the development of new applications on top, which make use of a transparent access to the information in the administration. Nonetheless, the sources of this information are still being maintained using the current applications.

The middleware proposed for the construction of the grid VO is the open source Globus Toolkit (GT) [5], which is the de-facto standard for creating global grids. GT enables an authenticated access to the systems, which will grant or not the access to the information and procedures (depending on the identity and the permissions). Communications are assumed to be performed using public networks, thus they are secured by using Grid Security Infrastructure (GSI) [6].

6. CONCLUSIONS

As pointed in section "the administration as a VO", the information systems in public administration are likely to be modelled as a grid VO without introducing any artifices. From the point of view of the administration and eGovernment, the usage of grid technology opens a new framework for integrating existing data and procedures in distinct administrative entities. This integration will enable an effective collaborative work between the administrations to build up a unique administrative space.

From the point of view of grid technology, this project opens a new field for this technology, as it has been traditionally applied for gathering computation power and storage space in scientific challenges. The usage of grid for eGovernment information systems focuses the efforts of this technology in multi domain system integration.

Further than the technology challenge, this project shows again the need of creating new laws which will enable the effective interchange of data between administrations.

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REFERENCES

[1] Hooghe L., 2001. *Multi-Level Governance and European Integration.* Rowman & Littlefield Publishers.

[2] Foster, I., Kesselman, C, 2003. *The Grid: Blueprint for a new computing infrastructure.* Morgan Kaufmann Publishers, San Francisco, USA.

[3] Bangemann M.*,* 1994. *Europe and the Global Information Society, Bangemann report recommendations to the European Council.* Official Report of the European Commission. URL: *http://europa.eu.int/ISPO/infosoc/backg/bangeman.html.*

[4] Foster, I. et al, 2001. The Anatomy of the Grid - Enabling Scalable Virtual Organizations. *International J. Supercomputer Applications*, 15(3).

[5] Globus Toolkit - *http://www.globus.org/toolkit/*

[6] Grid Security Infrastructure (GSI) - *http://www-unix.globus.org/toolkit/security/*

AN APPLICATION FRAMEWORK FOR A WEB APPLICATION WITH FOCUSED CRAWLING

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ABSTRACT

When people utilize e-commerce sites, people usually wonder whether merchandise of interest are good or not for them. Word of mouth on new merchandise are useful to judge it and are often carried by blog. So, from blogs, if we can collect information only on both merchandise of interest and related merchandise to show the result of analysis of such information, effective e-commerce support system can be built. This paper presents the design and implementation of an application framework for a Web application with topic-focused crawling. Also, this paper shows some early experimental results on the performance of our framework. The hardware resource required by our framework is only one commodity PC and only one Internet connection with a few Mbps. This implies that our framework can promote development of e-commerce support system with low cost.

1. INTRODUCTION

When people utilize e-commerce sites, people usually wonder whether merchandise of interest are good or not for them. Word of mouth on new merchandise are useful to judge it and are often carried by blog. So, from blogs, if we can collect information only on both merchandise of interest and related merchandise to show the result of analysis of such information, effective e-commerce support system can be built.

This paper presents the design and implementation of an application framework for a Web application with topic-focused crawling. The hardware resource required by our framework is only one commodity PC and only one Internet connection with a few Mbps. Moore's Law [Moore65] states that the transistor density on integrated circuits doubles every couple of years. The growth of the transistor density is connected with the growth of computing power of a microprocessor. Also, Gilder's Law [Gilder00] states that the communication bandwidth of optical fiber networks grows at least three times faster than the growth of the computing power. These exponential growths result in increased performance and decreased cost of both a PC and Internet connection in the home. Now, many people have a few GFLOPS PC and at least a few Mbps Internet connection in their home. So, a single commodity PC has the prospect to be a cost effective e-commerce support system if effort to realize such a system is done.

The remainder of this paper is organized as follows. First, we review our Web crawling algorithm proposed in [Authors05] in Section 2. Next, we present our application framework in Section 3. Last, in Section 4, we show some early experimental results on the performance of our framework.

2. REVIEW OF THE PROPOSED ALGORITHM FOR FOCUSED CRAWLING WITH TIME LIMIT

Consider in what order a crawler should visit the URLs it has seen, in order to obtain more important pages first. For this purpose, PageRank [Page98] is known as an excellent ordering metric [Cho98]. To compute PageRank, we must complete to crawl all the pages in advance. However, during crawling, we have only a subset of objective pages. So, we cannot know precise PageRank during crawling. For this problem, Page et al. proposed to guess PageRank using the subset of objective pages [Cho98]. In contrast, this paper adopts quite a different approach. The proposed algorithm simply asks Google Web API [Google] about the PageRank ordering. The following is a pseudo code of the proposed algorithm:

```
Algorithm Focused Crawling with Time Limit
Input: query Q, time interval T
begin
  start = 1; n = 50; clear(url_queue); clear(hot_queue); clear(crawled_pages);
  while (not specified time T elapsed) and (not stop button pushed) do begin
    if (empty(url_queue)) begin
      url_queue = Google(Q, start, n);
      if (empty(url_queue)) exit;
      start += n;
    end
    // thread begin
    top_page = dequeue(url_queue); enqueue(hot_queue, top_page);
    while (not empty(hot_queue)) do begin
      url = dequeue(hot_queue); page = download_page(url); Analyze(page);
      enqueue(crawled_pages, url);
      if (keywords in Q appears in page except in anchor texts) begin
        url_list = extract_urls(page);
        foreach u in url_list do
          if ((u not in hot_queue) and (u not in url_queue) and (u not in crawled_pages))
            if (u and top_page are in the same site) enqueue(hot_queue, u);
      end
    end
    // thread end
  end
end
```

Function call Google(Q, start, n) asks Google Web API to retrieve Web pages relevant to query Q. Then, Google Web API returns URLs of Web pages such that PageRank ordering is from start to start+n-1. Procedure call Analyze(page) deals with the found relevant Web page.

Our originality is that our algorithm does not traverse a hyperlink if the HTML page which is currently analyzed does not include any keyword in the area except anchor texts. This is because each anchor text represents the content of not the current page but the destination page. So, an HTML page which includes keywords only in anchor texts tends to be irrelevant to the query. In particular, news sites and blog sites strongly exhibit this tendency. An exception is a page that includes many links to the pages relevant to the query. However, such a page seems to include no relevant images while the page itself is relevant to the query. If such hyperlinks are traversed, an explosive number of irrelevant pages are crawled. Such explosion exhausts the precious bandwidth of the Internet connection to crawl irrelevant pages.

3. THE PROPOSED APPLICATION FRAMEWORK

Our application framework implements our focused crawling algorithm described in Section 2 and enables a programmer to easily develop a Web application with focused crawling. The description language in our framework is C++. Our framework includes an abstract class named TGetHTML which has a virtual method named 'Analyze()'. The prototype declaration of Analyze() method is as follows:

    virtual void TGetHTML::Analyze(const htmlDocPtr htdoc);

The parameter 'htdoc' is a pointer to the parsing tree of a found Web page. Our framework adopts libxml2 [Veillard] as an HTML parser. All things that a user of our framework must do in order to develop an application is to write a class which inherits TGetHTML class and to implement 'Analyze()' method. Let MyTGetHTML be the name of the written class. During focused crawling, our framework invokes MyTGetHTML::Analyze() every time our focused crawler finds a Web page relevant to the given query.

```
class MultiThreadedFocusedWebCrawler {
  ...
public:
  void start(const string& key, const string& query, const string& lang, int threadNum);
  void stop(void);
  void finalize(void);
};
```

Each thread takes charge of crawling Web pages under a seed page given by Google Web API as annotated in the pseudo code in Section 2 (i.e., 'thread begin' and 'thread end'). To avoid too frequent access to one site, our framework never access the same site within one second after the last access. This time interval is justified by the fact that Webmaster World.com [WebmasterWorld.com] concluded that at most two accesses per second can be tolerated for a search robot [Hemenway03]. Thus, for one site, our engine can not access frequently. Instead, our engine concurrently accesses multiple sites using multi-thread facility.

The following code shows how to use our framework:

```
int main(int argc, char *argv[])
{
  MultiThreadedFocusedWebCrawler crawler;
  crawler.start(YOUR_LICENSE_KEY, "sweet white wine", "lang_en", 32);
  Sleep for the time interval specified by a user.
  crawler.stop(); crawler.finalize();
  Show the result of the above focused crawling to a user.
  return 0;
}
```

Our framework provides various convenient methods which can be used in 'MyTGetHTML::Analyze()' as described below.

- void TGetHTML::normalizeURL(string& URL) const;
  - ➤ converts URL to the corresponding absolute path representation which is unique. Absolute path representation can be passed as URL. In that case, no conversion is done. This method is very useful because hyperlinks in an HTML page are frequently written in relative path representation including parent directory notation (i.e., ``..'') and the base URL of the concerned HTML page may be changed by the base tag of HTML.
- bool TGetHTML::isDisallowed(const string& URL) const;
  - ➤ returns true iff robots.txt prohibits any Web robot from access to URL. URL must be normalized by normalizedURL() method before invocation. Invocation of this mothod does not involve communication because robots.txt is cached in the inside of our framework during the access of the currently analyzed Web page.
- const string& TGetHTML::getCurrentURL(void) const;
  - ➤ returns the URL of the Web page currently analyzed by the thread which invoked this method.
- string TGetHTML::getContentType(const string& URL);
  - ➤ returns the MIME type (e.g., "text/html; charset="utf-8"" and "image/jpeg") of the data pointed to by URL. URL is assumed to be normalized by normalizeURL(). This method returns the correct MIME type even if URL points to CGI, PHP script, and so on. This method internally has a table which holds the correspondence between major MIME types and their URL extensions. So, for such URLs, no communication is occurred. However, if the table has no information about the MIME type of a given URL, this method asks the concerned Web server about the MIME type via HTTP protocol.
- static int TGetHTML::getKeywordNum(void);
  - ➤ returns the total number of the keywords in a given query.
- static const char *TGetHTML::getKeyword(int k);

➢ returns the kth keywords in a given query.
● string TGetHTML::getRootURL(const string& URL) const;
➢ returns the string which represents the site part of URL. URL is assumed to be normalized. For example, getRootURL(``http://xxx.yyy.zzz/ddd/fff.html'') returns ``http://xxx.yyy.zzz/''.
● string TGetHTML::getURLPath(const string& URL) const;
➢ returns the string which represents the path part of URL. URL is assumed to be normalized. For example, getURLPath(``http://xxx.yyy.zzz/ddd/fff.html'') returns ``/ddd/fff.html''.

Thus, our framework hides the complexity of a highly multi-threaded Web application and free a programmer from hard and a time-consuming task.

4. EXPERIMENTS

We implemented our application framework on Microsoft Windows XP using Borland C++ Builder 6. We used asynchronous socket API (i.e., WSA* functions) in Winsock 2.0 API [Napper97] to set an arbitrary timeout period for socket communication. Our default timeout period is 2 seconds. This implies that our implementation aggressively ignore slow Web sites. Moreover, as a sample program to evaluate the performance of our implementation, we developed a Web multimedia retrieval system, which is extended from our Web image retrieval system [Author05], based on our application framework.

We evaluated our framework on 2.4GHz Intel Pentium 4 PC with 512MB RAM and 16.66Mbps effective bandwidth to the Internet. Table 1 shows how many multimedia data our system could collect in 30, 60, 120, 300, and 600 seconds in case of query 'sweet white wine'. The number of threads is 32 and the timeout period of a socket communication is 2 seconds. We gave our system keywords in English, as you see. Since our experiments were made in Japan, most Web pages which were retrieved and analyzed by our system were outside Japan. It turns out that our system can collect enough many multimedia data within reasonable amount of time. This implies that our framework is enough efficient though an application over our framework requires low cost commodity hardwares only.

Table 1. The performance of a Web multimedia retrieval system over our application framework in case of query 'sweet white wine'

given time interval (sec)	30	60	120	300	600
parsed HTML	132	222	410	757	1354
seed pages from Google	51	57	61	86	114
total multimedia data in the parsed HTML pages	176	249	422	667	973
selected multimedia data	76	98	152	273	303
total time (sec)	34.02	66.73	133.78	329.24	659.70

5. CONCLUSION

We have proposed the design of an application framework for a Web application with time limited focused crawling and implemented the framework on a commodity PC. Some early experiments have shown that our framework can be used to built an e-commerce support system with low cost.

REFERENCES

The Authors, 2005. title. *Proceedings of some conference.* Some city, Some country, pp. 209-216.
Cho, J. et al, 1998. Efficient Crawling through URL ordering. *Computer Networks and ISDN Systems,* Vol.30, No.1-7, pp.161-172.
Gilder, G., 2000. *TELECOM: How Infinite Bandwidth will Revolutionize Our World.* Free Press.
Google, *Google Web APIs (beta).* http://www.google.com/apis/.
Hemenway, K. and Calishain, T., 2003. *Spidering Hacks: 100 Industrial-Strength Tips & Tools.* O'Reilly.
Moore, G. E., 1965. Cramming More Components onto Integrated Circuits. *Electronics*, Vol.38, No.8
Napper, L., 1997. *Winsock 2.0.* John Wiley & Sons Inc.
Page, L. and Brin, S., 1998. The Anatomy of a Search Engine. *Proceedings of the 7th International WWW Conference.*
Veillard, D., *The XML C Parser and Toolkit of Gnome: libxml.* http://www.xmlsoft.org/.
WebmasterWorld.com Inc., *Webmaster world.com.* http://www.webmasterworld.com/.

GRID RENDERING SERVICE FOR E-COMMERCE APPLICATIONS

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ABSTRACT

This paper describes an e-Commerce system which adds the possibility of creating 3D realistic virtual environments. As component of the system, a Grid rendering service has been developed in order to provide the render engine to the e-Commerce application. The service has been designed in a generic way, so it can be used for any application with special quality requirements in the image generation process. A parallel version of the hierarchical radiosity algorithm has been developed inside the rendering service in order to obtain 3D navigable scenes in a short period of time.

KEYWORDS

Image Rendering, Radiosity, Grid and Parallel Computing, e-Commerce.

1. INTRODUCTION

This paper describes an e-Commerce system which adds the possibility of creating 3D realistic virtual environments. This work is a follow-up of the EU-funded research project VRE-Commerce (*http://www.grycap.upv.es/vrecommerce*) which aimed at developing all the necessary technology for the integration of low-cost fast synthetic image generation in electronic commerce applications, mainly focused in the sectors of furniture and ceramics.

This e-Commerce system offers two new functionalities to the traditional virtual stores:

- Create virtual environments, by means of a room planner. The room planner is an intuitive and easy-to-use tool which enables the customer to design his virtual environment with a standard Internet browser.
- Realistic 3D navigable scene generation, for the visualization of the virtual environment. The radiosity algorithm [10] has been used to generate the images. It produces very realistic scenes, and the obtained result is independent of the view point.

In order to use the radiosity image generation algorithm in an e-Commerce application, it is highly recommended to have a response time of not more than one or two minutes. This restriction makes the use of parallel computing necessary to reduce the response time. This may not be enough to achieve a very fast response due to the high computational cost of the image generation algorithms. So in addition some simplifications to the algorithm are required, always trying to minimize the loss of quality.

In order to enable the connection between the e-Commerce platform and the computational server, a Grid middleware has been used. This middleware provides some interesting features as uniformity, transparency, ubiquity and security, which can be very important when deploying distributed applications over the Internet.

Initially developed using Globus Toolkit 2 (GT2) [5] as the middleware layer, now it is being migrated to the new programming model of the Web Services Resource Framework (WSRF) [9] creating a new Grid service component.

The next section describes the main elements of the e-Commerce system developed. Then the main component of the system, the rendering grid service, will be explained. Finally some conclusions are exposed.

2. VRE-COMMERCE GRID SYSTEM

The VRE-Commerce system incorporates remote rendering capabilities which can be used by retailers of furniture or ceramics to support the selling process of their products. Also, the final customer has the possibility to access the system later from home and explore further alternatives to make a final decision. The VRE-Commerce system is composed of three different modules:

- **e-Commerce System**: A conventional virtual store developed with the aid of the open-source system Interchange (*http://www.icdevgroup.org*).
- **Room Planner**: A platform-independent 2D design tool, implemented in Java, that enables the user to create his environment, specifying the shape and dimensions of the room, and to place the selected elements in the scene, either products from the virtual store or auxiliary items. This part of the system is in charge of initiating the rendering request.
- **Rendering Grid Service**: The rendering service is in charge of generating the 3D scenes using the geometrical data provided by the room planner. This service has been developed using the Grid Services paradigm, trying to design a generic service that can be used in different applications, in this case, in an e-Commerce system.
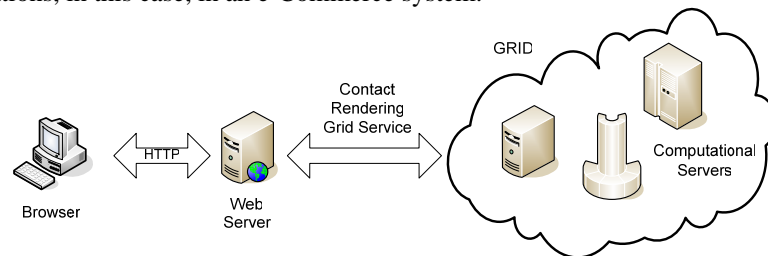
Figure 1. VRE-Commerce System

The Grid version of the VRE-Commerce system is depicted in Figure 1. The client accesses to the system via Internet by using a standard browser to connect to the web server, where he will find the company's product catalogue and will be able to choose those items that interest him.

Then he will go on to the "Room Planner" section. To create the design with the room planner the user must follow the following steps:

- Design the shape of the room: The shape can be selected from a set of predefined rooms where the user only has to chose the dimensions, or design the entire room with a graphical tool.
- Insert elements in the room: The user can select all the items chosen in the virtual store, and other auxiliary complements as doors, windows, lights etc. Lights are an important element because the radiosity algorithm uses them in order to generate the 3D scenes.

Finally, the customer makes the request of image generation. The e-Commerce application contacts with the Rendering Grid Service obtaining as a result a 3D navigable scene. Once the rendering has finished, the system will notify the conclusion and the result will be sent back to the client's browser. The result will be a navigable model in X3D format.

3. RENDERING SERVICE

The rendering service was originally developed using Globus Toolkit 2, using its services (MDS, GRAM, RLS, etc.) to launch the radiosity parallel algorithm in the available resources, providing some interesting characteristics: uniformity, transparency, reliability, ubiquity and security. The operation of the system is described in [1].

Nowadays the Grid technologies are oriented to a Grid Services paradigm, so the rendering application will use the new programming model of the WSRF using the Globus Toolkit 4 middleware layer, to take the advantages of this model.

This new paradigm enables to create a more generic component, so that the rendering service could be used from different applications that have special needs of quality in the image generation process.

Grid Service Architecture

The architecture has three layers:

- **Computational resources**: The first layer comprises the computational resources where the rendering algorithms will be finally executed. Each site can have a different number of resources with different characteristics. These features of the infrastructure layer will be used to select the suitable site to call the rendering service.
- **Middleware**: The middleware layer is installed over the computational resources. It includes the GT4 layer and the deployment of the rendering grid services. There are a number of sites with the rendering grid service installed. Each site has different image rendering algorithms implemented to generate the 3D scenes. Using some functionalities of the middleware layer (described in detail in the next section) the application will select the most suitable location depending on the algorithms implemented and the number of resources available of the previous layer.
- **Application**: The applications that will use the rendering service in order to generate the realistic 3D scenes appear in the top of the architecture.

Grid Service Operation

The rendering grid service is a "*Service Group"* [4] that groups the different services that implement each of the rendering algorithms (radiosity, ray tracing, etc.). Initially the service is empty, and waits for the image rendering services to make the registration. When a service is registered into the general rendering service, the algorithm implemented is added to the list of available algorithms in the main service.

As described in the previous section there will be different sites with the rendering service installed. All of them will be registered into a group of *Index Services* that will act as the entry point to the system. The Index Service is a component of the GT4 that enables grouping services and searching them using its resource properties. There are two classes of resource properties of the rendering service that will be used to select the most suitable service. The first one is related to the infrastructure of the computational resources layer: number of nodes, benchmark of the machines, etc. The second class is the list of rendering algorithms registered in the main service.

Once the suitable location of the rendering service has been selected, the application will call the functions of the service in order to generate the 3D scene. The application must indicate some parameters of the execution, such as the algorithm selected, quality needed in the result, and the input file (a VRML file) with the geometrical data of the initial scene. This VRML file could contain the geometrical models of furniture pieces or the tiles textures in the case of ceramics. These files belong to the different manufacturers who offer products in the application. The files are cached locally in each computational server. The grid scheme adds the possibility to update the master copies of the files by the manufacturers, as well as to add new ones. The program analyzes the scene looking for the furniture or ceramic pieces used, and then queries the Replica Manager for their location. Then the dates of remote and local files are compared so that download is only done if necessary.

The rendering request will be redirected to the service that implements the selected algorithm that will be executed in the available resources of the site. At last the system will return the rendered scene.

The same approach can be used with the implementation of the image rendering services, in those cases were there are different implementations of the algorithm. The radiosity algorithm has different variants (basic, progressive, hierarchical, etc.) that can use this approach.

Figure 2. Scene Example

4. CONCLUSIONS

This paper describes an e-Commerce system which adds the possibility of creating 3D realistic virtual environments. This work is composed by three main parts: the development of the room planner, the rendering grid service, and the parallel hierarchical radiosity algorithm.

The room planner is a platform independent 2D design tool that enables the user to create virtual environments, designing the room and placing the selected products in the virtual store. It is in charge of initiating the rendering request.

To connect the rendering engine with the e-commerce application, grid tools have been used. The use of these tools provides some interesting features: scalability, fault tolerance, security, update of geometrical files, etc. The render service was initially developed with Globus Toolkit 2, and now it is migrated to a service oriented paradigm using the WSRF implemented in the Globus Toolkit 4. Using the service programming model, a more generic service is obtained so it can be used not only in this e-Commerce application but also with other applications with special need of image rendering (CAD, Film rendering, etc.).

The last component is the parallel hierarchical radiosity algorithm, developed as part of the rendering service. This program generates 3D navigable scenes obtaining a high realistic result. Parallelization was used in order to achieve a reasonable response time so it can be used in "interactive" applications.

The migration of the grid service to GT4 is still under development, so the main objective of the future work is to complete it. It is interesting to include other rendering algorithms, and find some specific applications that could use the rendering service to obtain the rendered scenes.

ACKNOWLEDGEMENT

REFERENCES

[1]   Caballer M. et al, 2004. A Grid-Enabled Scene Rendering Application. *Lecture Notes in Computer Science 3038*, pp. 54-57.

[2]   Caballer M. et al, 2003. A Parallel Rendering Algorithm Based on Hierarchical Radiosity. *Lecture Notes in Computer Science 2565*, pp. 523-536.

[3]   Czajkowski K. et al, 2004. From Open Grid Services Infrastructure to Web Services Resource Framework: Refactoring & Evolution. *http://www.globus.org/wsrf/specs/ogsi_to_wsrf_1.0.pdf.*

[4]   Czajkowski K. et al, 2004. Web Services Service Group – Specification (WS-ServiceGroup). *http://www-106.ibm.com/developerworks/library/ws-resource/ws-servicegroup.pdf.*

[5]   Foster, I., Kesselman, C., 1997. Globus: A Metacomputing Infrastructure Toolkit. *The International Journal of Supercomputer Applications and High Performance Computing*, pp. 115-128.

[6]   Foster, I., Kesselman, C, 2003. *The Grid: Blueprint for a New ComputingIinfrastructure*. Morgan Kaufmann Publishers, San Francisco, USA.

[7]   Foster, I. et al, 2001. The Anatomy of the Grid - Enabling Scalable Virtual Organizations. *International J. Supercomputer Applications*, 15(3).

[8]   Foster, I. et al, 2002. The Physiology of the Grid: An Open Grid Services Architecture for Distributed Systems Integration. *Global Grid Forum*.

[9]   Foster   I.   et   al,   2004.   Modeling   Stateful   Resources   with   Web   Services. *http://www.ibm.com/developerworks/library/ws-resource/ws-modelingresources.pdf*

[10] Goral, C.M. et al, 1984. Modelling the Interaction of Light Between Diffuse Surfaces. *Computer Graphics*. Vol. 18, pp. 213-222.

EXPLORING ARCHITECTURAL DESIGN STRATEGIES FOR E-BUSINESS APPLICATIONS

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ABSTRACT

Architectural design is a vital phase in the development of e-business applications. A suitable compromise must be determined taking into account business requirements, quality criteria and existing constraints (e.g. presence of legacy systems). This paper adopts the view that for a particular problem context, it is possible to consider the architectural design activity as consisting of a series of choices made regarding a number of architectural design strategies. To make this feasible, we are focusing on problems within a restricted context. The problem context described in the paper is very common for a category of e-business applications that are inspired from the e-finance domain. We identify a number of design strategies for such a problem context and show the resulting architectures. We also present a design process modeled as a decision tree and show how quality models can be used to select the most appropriate architecture. The recommendations made by the models are checked against real data from existing projects.

KEYWORDS

Architectural design, e-business applications, legacy systems.

1. INTRODUCTION

Over recent years, there has been a dramatic increase in a new class of distributed applications, called e-business applications, that support the needs of business communities over the Web. Examples of application domains include electronic banking and payment systems, sales and retail, supply chain management and electronic markets. Despite the existence of different methodologies such as formal, structured, and object-oriented methodologies, existing approaches have been caught unprepared for addressing the needs of e-business applications, particularly in (1) dealing with multiple development teams, possibly working over different time periods, (2) allowing the reuse of existing assets like legacy systems and databases or integrating off-the-shelf software components, and (3) providing guidance for satisfying non-functional requirements like performance, security and fault-tolerance.

This has led to a situation where architectural design for e-business applications has become a black art with no specific rules or guidance as to how to conduct it. This paper argues that the design activity could be made more systematic by learning from real-life situations. It is often the case that the same design process is applied in a well-identified problem context which is often related to specific application domains such as e-health and e-finance. This paper explores this idea further by:

- Identifying a problem context and providing a brief description of such a context in Section 2. In other words, the context defines the *input* of the design process. This section also refers to our common architecture description that represents the *output* of the design process.
- Discussing a number of design strategies in Section 3 each of which corresponds to an alternative to a design decision. Each strategy can be considered as a step in determining the target architecture.
- Defining a formal design process that is modeled as a design decision tree in Section 4. The decisions along each path of the tree determine an architecture from the original problem context. To help users choose the optimal solution, architectures are ranked according to the non-functional requirements.
- Concluding the paper in Section 5 with discussion on a case study which is used to validate this design process together with future direction of this research.

2. BASIC ASSUMPTIONS AND NOTATIONS USED

The problem context considered in this paper is far from being an accurate representation of reality. Its purpose is only to give some idea on the number and type of business processes in the area of interest, the legacy systems in use and the most important non-functional requirements for stakeholders. The models used here are pragmatic in nature and have been based on several architectural analysis and benchmarking studies conducted on a number of legacy systems. We define four important concepts. These concepts may be defined differently elsewhere but for the sake of consistency, we provide our definitions here (See Dabous (2005) for formalization of these concepts):

Functionality: corresponds to an activity within a business process that performs a specific job (i.e. it is part of the business logic).

Equivalent functionalities: refers to a group of functionalities that have similar business logic. Our assumption here is that we cannot have two exact implementations of the same functionalities. Two "similar" implementations usually implement two equivalent (yet slightly different) functionalities.

Business process (BP): describes the requirements of an e-business application in terms of the activity flow of its constituent functionalities. An activity diagram is associated with every BP where the nodes represent functionalities and the arcs determine the execution flow across the functionalities.

Legacy system: refers to an existing architectural component that supports the implementation of a number of functionalities. We assume that the design team has not played a role in the development of the legacy systems and therefore has no access rights to the source code. Interaction with a legacy system can only be achieved through their defined interfaces.

Access method: refers to the way an architectural component is being accessed. Each access method belongs to a defined access type that is ranked according to a specific abstraction level. By definition, using a low-level access method is faster than using a high-level access method. In contrast, the development time of a client program is likely to take much more time in the case of a low-level access method than in the case of a high-level access method.

Figure 1 presents a simplified example illustrating the problem context utilized in the next section. In addition, we have selected three important non-functional requirements that play an important role in many real-life projects and for which various trade-offs exist:

Low development costs: this requirement originates from business stakeholders, for which quick deployment is a critical feature if they are to maintain some competitive advantage, exploit some market opportunity etc.

Low maintenance costs: this requirement is usually mandated by technical staff, as they would have to bear the brunt of maintaining the system.

High performance: many business processes require efficient implementations to maintain an adequate response time, process high volumes of data etc.

In (Dabous 2005), we proposed a common architecture notation for the purpose of embodying design decisions being made and facilitating the development of models that estimate the architecture's impact on the non-functional requirements. In that notation, an architecture is described in terms of a set of distributed components where each component is described according to four essential features (see figure 2): (1) the `tasks' that are supported by the component, (2) the set of components accessed by this component, (3) the set of components that access this component, and (4) the method by which each component is accessed.
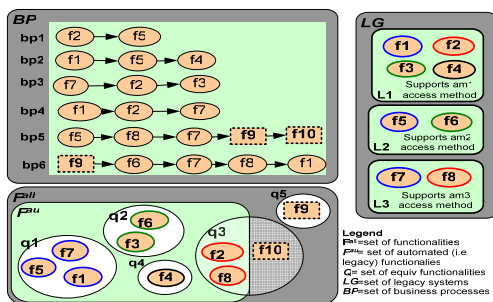
Figure 1. Example of a problem context specification
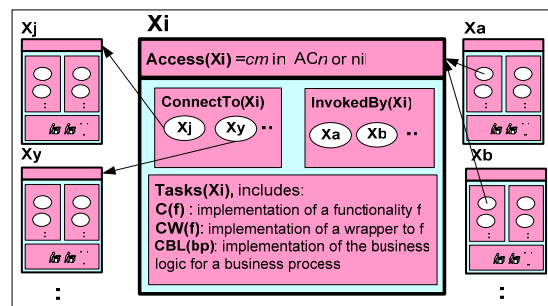
Figure 2. Generic component architecture

3. DESIGN STRATEGIES

Given a problem context, the design process starts from an empty architecture. Then, each design strategy increments the current architecture with a new set of tasks and components. This is repeated until an architecture that implements all BPs is constructed. Before we discuss the entire process, we present five design strategies that are particularly suited to the problem context. Each strategy is informally described and illustrated based on the running example in figure 1. In Dabous (2005), we formally described the algorithm used in each of such design strategies based on the common architectural notation.

"Reuse" Design Strategy

This design strategy emphasizes on the importance of leveraging the functionalities embedded in existing legacy systems and allowing them to be shared across BPs. It simply creates components each of which refers to the functionalities in a legacy system (see figure 3).
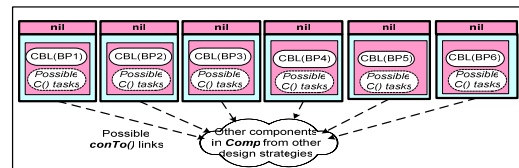
Figure 3. "Reuse" design strategy

"Automate" Design Strategy

This design strategy creates components each of which supports a new functionality (i.e. it does not exist in any of existing legacy systems). All new components provide a unified access method for these new functionalities (typically a high-level access method). This access method is given as parameters to the strategy (see figure 4).
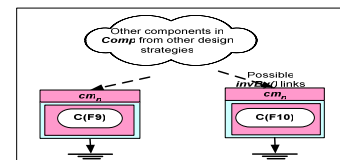
Figure 4. "Automate" design strategy

"Wrap" Design Strategy

Remotely accessing the functionalities of legacy systems is not simple and requires significant programming effort since most of such systems provide low-level access type methods. The wrapping concept is normally used to provide a higher-level method for remotely accessing legacy functionalities. This design strategy creates components each of which corresponds to a wrapper component to a single legacy functionality. This wrapper redirects all calls from component's interface (high-level) to the legacy system's interface (low-level) (see figure 5).
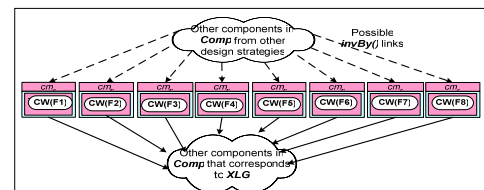
Figure 5. "Wrap" design strategy

"Migrate" Design Strategy

In cases where existing legacy systems are expected to be discarded in the near future, the corresponding functionalities can be redeveloped from scratch in a process that we refer to as "migration". There are different possibilities of re-arranging the redeveloped functionalities into new components. This design strategy implements one possible migration technique that treats all functionalities equally whether they are legacy or new functionalities. It groups each set of equivalent functionalities in one component. Each new component contains a task $C(f_k)$ for each equivalent functionality f_k. This design strategy also uses a uniform access method across all new components (typically a high-level access method). Its impact of the previous example is illustrated in figure 6.
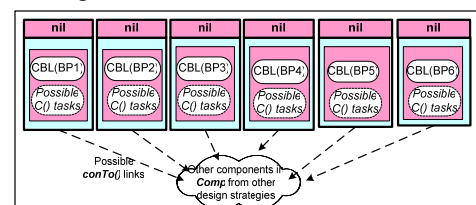
Figure 6. "Migrate" design strategy

"MinCoordinate" Design Strategy

All previous strategies only deal with how to implement functionalities. This one is specifically about enacting BPs. It works in situations where BPs of interest are unrelated and do not interact with each other. The Minimum Coordinate (MinCoordinate) design strategy gives the responsibility for the enactment of

every BP to a dedicated component *X*. For every functionality required in the BP, there are two cases. The first case is when the functionality is already supported by another existing component *Y*. In this case, a *link* is created between the components *X* and *Y*. The second case is when the functionality is not implemented by the other components of the architecture. In this case, a local task will be created on *X* to support that functionality (hence the word "Minimum" which means the strategy only creates one new component) (see figure 7).
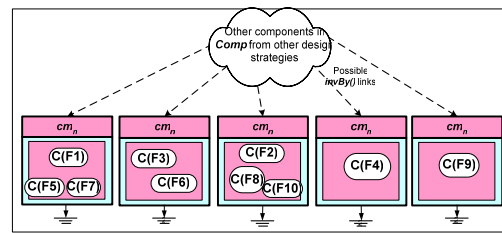
Figure 7. "MinCoordinate" design strategy

4. DESIGN PROCESS

Each of the design strategies considered earlier can be regarded as the outcome of an architectural design decision. Design decisions include whether to reuse or discard existing legacy functionality, whether to wrap existing legacy functionality or leave it as it is, implementing new functionalities using separate components or embedding them with the component that implements BPs enactment etc. Table 1 summarizes the four design decisions and the corresponding alternatives that have been considered so far. The table shows that each of DD1, DD2, and DD3 has two alternative designs (two different design strategies in DD1, and using/not using a design strategy in both DD2 and DD3). On the other hand, DD4 has only one alternative identified within the scope of this paper.

Table 1. Design decisions and alternatives vs. design strategies

Design decision	Alternatives	
	1st alternative	2nd alternative
DD1	Use 'Reuse'	Use 'Migrate'
DD2	Use 'Wrap'	Do not use 'Wrap'
DD3	Use `Automate'	Do not use `Automate'
DD4	Use 'MinCoordinate'	(out of scope, see (Dabous 2005) for extensions)

We are now in a position to show the corresponding decision tree in Figure 8. This tree shows eight paths which represent all possible architectures that can be constructed as a combination of the four design decisions. Five of these generated paths which are marked as Pt1-Pt5 correspond to architectures that are often found in practice. The other three paths correspond to architectural descriptions that are either meaningless or incomplete. For example, Pt4 corresponds the architecture generated by applying the architectural algorithm for 'Reuse' followed by 'Wrap' followed by "MinCoordinate" design strategies. Since possible architectures can now be systematically identified, non-functional requirements (part of the problem context) will play a key role in evaluating architectures and selecting the optimal one.
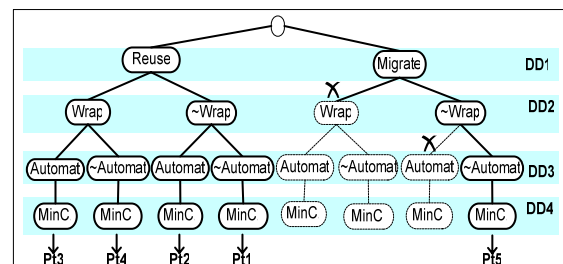
Figure 1. Architectural alternatives identification illustrated by decision tree

Quantitative models, that estimate the appropriateness of a solution in relation to every requirement, can be developed. In this paper, we will be using the models described in Dabous (2005) which can be applied to an architecture described in our notation. For example, determining development costs will take into the development of functionalities (affected by the reuse of legacy systems) and wrapper components. Once these models have been developed, search for a solution can be systematically conducted as described in Dabous (2005) and Al-Naeem et al (2005).

5. VALIDATION, CONCLUSIONS AND RELATED WORK

Validation has been conducted on a realistic case study in the area of finance particularly trading in capital markets. A large number of capital markets BPs exist whose functionalities are partially or fully facilitated by a number of domain legacy systems. We focus on a number of legacy systems that have been customized around Australian Stock Exchange (ASX) practices. There are five BPs of interest in this paper that are: BP1 (ASX trading data processing), BP2 (Visualization of ASX trading data), BP3 (Reporting surveillance alerts), BP4 (Trade strategy simulation), and BP5 (Trade strategy execution).

The validation is based on three completed projects conducted in the 2001-2004 period and funded by the Capital Markets Cooperative Research Centre (CMCRC) in Australia. These projects are denoted by project A (trade data processing and surveillance), project B (trade data visualization), and project C (trade strategy formalization and execution). Additional details about this domain problem context and the 3 projects used are discussed in Dabous (2005). The following observations have been made when applying the three quality models on the five possible architectures.

Project A: When considering reducing the maintenance effort as the major quality attribute of concern, then Pt5 has the best estimate generated by the maintenance effort model followed by equal estimates for Pt3 and Pt4 then finally by similar estimates for Pt1 and Pt2.

Project B: When considering high performance as the major non-functional requirement of concern, architectures are ranked in this order: Pt1, Pt2, Pt3, Pt4, and then Pt5. This is conformant with the project team selection of Pt1 to guide the architectural design of this project.

Project C: When considering reducing the development effort as the major non-functional requirement of concern, then the preferences generated by the model are: Pt2, Pt1, Pt4, Pt3, and then Pt5. This is conformant with the project team original selection of Pt2. The development team's plan to consider either Pt3 or Pt4 is conformant with the outcome of the development effort prediction model that is discussed in Dabous (2005). The output of such model on this case study recommends Pt4 and Pt3 as the first and second ranking respectively.

The main purpose of this paper is to provide useful insights into the architectural design process of e-business applications. The proposed approach starts from a well identified problem context and incrementally constructs the desired architecture through a number of steps, expressed as design strategies that are inspired from practice. Quality models that represent non-functional requirements can be used to direct this process towards an optimal solution. We have validated our approach through a complex real-life case study and demonstrated that our approach is not only able to confirm certain decisions that have been made but can also be useful in making various predictions when considering some 'what if' scenarios.

Related work includes tools that help designers in navigating and evaluating solutions in a design space, notably the work reported in Chung et al (1999) and Svahnberg et al (2003). Other related work includes several systematic pattern-based design approaches, notably the IBM patterns (Budinsky 1996). Few of those have been targeting distributed applications such as (Weiss 2003) for Agent Systems. To our knowledge, there is no systematic design approach specifically aimed at e-business applications from a practical and pragmatic point of view.

REFERENCES

Dabous, F.T., 2005. *Pattern-Based Approach for the Architectural Design of e-Business Applications*. PhD thesis, School of Information Systems, Technology and Management, The University of New South Wales, Australia.

Al-Naeem et al. 2005: Quantitative evaluation of enterprise integration patterns. *7th International Conference on Enterprise Information Systems (ICEIS'05)*, Miami, USA, 398–402.

Chung, L. et al, 1999. *Non-Functional Requirements in Software Engineering*. Kluwer Academic Publishing, Poston MA.

Svahnberg, M. et al, 2003.: A quality-driven decision-support method for identifying software architecture candidates. *International Journal of Software Engineering and Knowledge Engineering* **13** 547–573.

Budinsky, F.J. et al, 1996. Automatic code generation from design patterns. *IBM System Journal* **35** 151–171

Weiss, M, 2003. Pattern-driven design of agent systems: Approach and case study. *Conference on Advanced Information Systems engineering (CAiSE)*, LNCS 2681. Volume 2681 of LNCS., Springer 711–723.

COMMUNICATION LANGUAGES FOR ECOMMERCE

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ABSTRACT

This paper presents an approach to support the localization of e-Commerce web sites in different languages. This approach, to be implemented and evaluated by a pilot project, is based on an automatic translation tool and a set of online and collaborative courses to train developers and designers responsible for these tasks. The project targets students in vocational training and higher education but also professional staff from SME's in several European countries.

KEYWORDS

e-Commerce, e-Marketing, e-Learning, Language Learning, Automatic Translation, Onthologies

1. INTRODUCTION

In the course of time Internet access became easier and comfortable for an increasing number of EU citizens and the importance of this network medium has been increasing exponentially. WWW pages are a cost-effective information and advertising channel utilized by businesses of all sizes so more attention should be paid to the creation, translation and localization of e-commerce websites. However, SME-enterprises often cannot afford to make use of the services of communication professionals and have one of its own employees to create the website content. When the company wishes to have a foreign-language version of their pages, an external translator is used. A review of translated e-commerce web pages shows that designers have not always been aware of the target groups, culture and communication style or paid attention to the fact that a direct translation may convey irrelevant information that makes the prospective customer click away from the page. According to Adam Jones, director of SimulTrans, a translation company based in Silicon Valley, cited by Aoki (2000), there are five basic localization strategies:
1. Use only national language;
2. Translate portions of a given Web site into a target language;
3. Translate the entire Web site into a target language;
4. Culturally localize the site for a target audience; and,
5. Develop content in a target country independent of the national site.

The **Foreign Language Communication on eCommerce Web Sites (Languages for eCommerce)** is a LEONARDO project that aims to create directions on an holistic localization process, through:

a)   a three-part online course in how to communicate in the context of electronic commerce;

b)   an electronic dictionary for designers and translators of the websites of SME-businesses to help them draw up foreign-language versions of their commercial websites.

The focus of both products is on the target language and cross-cultural factors influencing verbal communication targeting:

-      Language and communication teachers and experts at universities/institutes of higher education
-      Students in different fields at universities/institutes of higher education
-      exporting SME-businesses that intend to internationalize their websites by translating in other languages
-      marketing and communication experts in companies

This is a language competences project, which emphasizes how to write informative texts on e-commerce websites for foreign customers. The writer has to take into account the customers' needs and cultural backgrounds. Nowadays, there is a lot of literature about communication on websites, but we have not come across learning material dealing with foreign language communication in e-commerce context. This project enhances the students' and SME employees' ability to decide about, and even to write contents in foreign languages, on companies´ web pages. Skills like this will be expected from company personnel in various positions especially in SME companies.

2.   PROJECT DESIGN AND DEVELOPMENT

At the beginning of the project teachers and experts from the participating educational institutions (Finland, Great Britain, Spain, Germany and Portugal) gathered to discuss the content of the project and to work on the design and implementation of the course in commercial multilingual web communication. Preliminary plans for the objectives and content of the course have been made by the coordinating institution but there are a number of questions, such as points of focus and assessment criteria that were settled together. The main issues relate with the concept of internationalization and localization as proposed in (Lehtola, 1996) where internationalization relates to the isolation of cultural and linguistic dependent items, which can then be adapted producing the localization of the object.

The courses will be implemented in a web-based learning environment and video conferencing facilities will also be utilized, when necessary. In the first part of the course students become familiar with the principles of multilingual e-commerce communication by reading literature and doing learning assignments, which include assessments of existing translated e-commerce web pages. In addition, aspects of cross-cultural communication relevant to international electronic commerce are introduced. The first part is concluded with an examination in the topics covered during the course. In the second part students work in small groups translating and localizing the web pages of the target companies. Principles of peer learning are utilized at this stage. Students are encouraged to consult the partners in the target country rather than their own teachers. Besides, businesses in the target country are requested to give their assessment. Corrections and alterations are made on the basis of the feedback and the final assessment of the pages is carried out. The eCommerce tool/dictionary will also be used as a learning device.

2.1 e-Learning Approach

The pedagogical approach follows the proposal (Vaz de Carvalho, 2005) that a new educational paradigm focused on the student is required but also new delivery formats that adjust to the student characteristics, constraints and requirements. ICT (and, in particular, e-learning platforms) together with pedagogical and organizational strategies can support this new way of learning, more personalized, just-in-time, more fitted to individual needs and more flexible in content and times. This approach is based on a set on guidelines that guarantee methodological coherence between the different modules:

- Learner centricity: The courses are student centric. The participating students have the opportunity to learn the target language and culture in interaction with each other. They will deal with tasks and exercises, which are realistic and demanding from the perspective of work life. Learner centricity is strongly included in the phase, in which the students translate and localize web pages in cooperation with SME companies and under the guidance of their peer group. This should bring higher education language teaching closer to the reality of working life and business needs. Studies of international e-business marketing and communication support this holistic approach.

- Peer learning: During their project exercises the participating students aim at peer learning by making good use of either native language speakers (practical part of the course Languages for e-commerce) or other foreign students (of other courses) in the peer group. Exercises will be evaluated by the peer groups. This will activate students to study each other's written presentations critically concerning not only the language but also the cultural aspects and contents. The peer learning method enhances the students' skills in giving and receiving constructive feedback and reacting to it in a multicultural environment. This is traditionally a field, which often causes misunderstandings and therefore should be practiced more as a basic vocational skill.

- Teacher manuals: Teacher manuals will be written for the courses to make it possible to instruct the courses to those who have not participated in the project or are not acquainted with peer or project learning.

- Educational e-commerce tool or electronic dictionary: The tool/dictionary will be a valuable resource, a contribution towards standardization of the language use on e-commerce web pages. It is meant for SME employees who should create contents for e-commerce web pages. The tool has a collection of good cases of texts and their translations. Also a dictionary of e-shopping and e-marketing will help authors to write texts on the web. It will also pay heed to cross-cultural issues.

Through the project, students in higher education can participate in a language learning process with high requirements. Languages, culture, marketing, communication and web site design and architecture will be integrated. The intercultural aspects have a central role in each part of the module. The students will be involved in a learning process, in which they cooperate with each other and SME companies. The exercises are practice-oriented. The added value resulting from the course development work consists of the fact that the courses can also be offered in adult and further education.

Courses will be tested and offered in an e-learning environment and also by using video conferencing, if necessary. Students' practice peer learning and peer evaluation in an international context.

2.2 Course Subjects

Course subjects have been carefully chosen to provide an integrated vision to e-commerce but can be independently taken, if students already have knowledge of a certain module. A common pedagogical and user model guarantees consistency and usability.

E-Marketing Content

Internet marketing (e-marketing) forms a crucial part of e-commerce activities and its effectiveness has a direct impact on e-commerce success. As the Internet is becoming more and more multilingual and multicultural, more companies are becoming to realize that adopting a multilingual and multicultural website is a cost-effective solution to meet the emerging needs of multilingual users and increase sales in international e-commerce. However, SMEs managers and employees do not feel empowered with the appropriate skills and expertise to market themselves internationally through the medium of the Internet.

They lack the right knowledge on how to adopt a marketing mix to different markets and are not equipped with necessary expertise to deal with cultural and linguistic issues. Therefore, the module aims to improve and develop knowledge in the domain of e-marketing with the linguistic and cultural characteristics. More specifically, it will help learners:
   1.   To develop an understanding of the concept of e-commerce and e-marketing.

2. To develop an understanding of the traditional and Internet marketing communication strategies.
3. To develop an understanding of the various marketing mix and related applications of the Internet.
4. To instill an appreciation of e-marketing for customer relationship.
5. To be familiar with the cross-cultural and cross-linguistic issues in e-marketing communications.
6. To be familiar with the cross-cultural and cross-linguistic issues in e-marketing services and quality.
7. To measure and evaluate international e-commerce effectiveness and performance.

Application Design Content

This module's goal is to equip the students with knowledge of different types of e-commerce applications focusing on the intercultural aspects and topics (and its effects on the ecommerce application environment). The secondary goal is to support the content of the other courses. The contents of the module follow the program:

1. Introduction to ecommerce applications
2. Interface methodologies/interface models
3. Cultural aspects/factors of interface design
4. International e-store development
5. Multilingual content systems
6. Localization vs. global-site
7. Cultural differences in pictorial content, typography and color

Languages for e-commerce

The course in e-commerce communication will be implemented yearly in cooperation with international partners. As English is the lingua franca of the web, it will be a permanent language in the project. Other languages are dependent on the needs of the participants. In the commercial context, German and Spanish play a central role as there are many speakers of these languages in Europe. An additional product of the course consists of a guide/tool for multilingual communication (English, German and Spanish) on the web meant for those who draw up the WWW pages of SME businesses and those who translate the pages to facilitate their work.

For this module, it is expected that…

- Learners become aware of the role and importance of the communicative aspects of electronic commerce. Learners are able to analyze the linguistic composition of an e-commerce web page.

- Learners are able to analyze the linguistic composition of an e-commerce web page

- Learners know the contribution of grammatically correct language and appropriate terminology as elements of good Web communication.

- Learners become aware of structural, conceptual and cultural differences between languages in the context of e-commerce.

- Learners develop their skills in communicating efficiently (with regard to the limited screen space) and effectively in their own language and in the target language.

- Learners develop their skills in using language to involve the user in the interaction process.

2.3 e-Commerce Tool

A multilingual dictionary will be developed. The tool will be used in the courses developed during the project. It is also meant for exporting SME companies who are interested in having foreign customers visiting their commercial web pages.

This tool will be consisting on

1. An eCommerce ontology for the domain "eCommerce", serving as a framework for the products produced during the project. Here, the ontology will be understood as an explicit specification of conceptualization of the domain eCommerce. The terminology of data security, payment systems and legislation play an important part in the ontology. The ontology will be helpful when finding best practices of language use on e-commerce web sites in target languages.

2.   eCommerce tool of the multilingual dictionary type which contains words and phrases. It will be developed for and in cooperation with SME companies to help them draw up foreign-language versions of commercial web sites. It will also be used in course developed during the project. The tool is a valuable resource, contribution towards standardization.

3. CONCLUSION

It is still early to get initial results and conclusions as this a work in progress. In the next few months course materials will be available and pilot implementations will take place across Europe. At the same time, the eCommerce tool will also be tested by SME's in different locations. By then it will thus be possible to extract data that allows to fully assessing the effectiveness of our strategy and the success of its implementation.

For the moment, what we can say is that the cultural and linguistic diversity of the project partners has already provided interesting clues on how to produce results with a European perspective. It is also expected that, through the project, a close connection between institutions of higher education and companies will also increase in the field of language teaching. This will allow extending the character and the objects of languages courses in higher education to deal also with marketing and marketing communication, which are very important subjects for many fields where services and products should be sold and exported. A link between language learning, (written skills), verbal communication skills, cross cultural issues and cultural awareness and marketing purposes will be built up.

ACKNOWLEDGEMENT

REFERENCES

Aoki, K., 2000. *Cultural Differences in E-Commerce: A Comparison Between the U.S. and Japan,* First Monday Magazine, Volume 5, Number 11, November 2005

Chaffey, D. et. al., 2002, *Internet Marketing: Strategy, Implementation and Practice*. FT Prentice Hall. (ISBN: 0273658832)

Smith, P.R., 2001. *E-marketing Excellence*. Butterworth Heinemann. (ISBN: 0750653353)

Lehtola, A., Honkela, T., 1996. *Multilinguality in Electronic Commerce – Research Issues,* Proceedings of the Workshop on Multilinguality in the Software Industry: the AI contribution – MULSAIC' 96, Budapest, pp. 21-26

Vaz de Carvalho, C., 2005. Systematic Approach to Advanced Training Through e-Learning in Higher Education Institutions, *Proceedings of CATE 2005 – 8th Conference on Computers and Advanced Technology in Education*, Orangestad, Aruba,

SUCCESS FACTORS FOR IMPLEMENTING B2B STANDARDS: ISSUES AND ADVICE

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ABSTRACT

Standards for business exchanges in electronic commerce, so called business-to-business (B2B) commerce, play an important part in enabling transactions and information flows between the involved organisations. Implementation of such standards is still a rather "un-researched" area, but the recognition of which is growing. This paper presents a study of success factors for B2B standards implementation, where the result reveals nine such factors. They are important for organisations to consider in order to better prepare for their standards usage, and to prevent mistakes from occurring during implementation.

KEYWORDS

B2B, standards, success factors, implementation

1. INTRODUCTION

Standards for business exchanges in electronic commerce, so called business-to-business (B2B) commerce, play an important part in enabling transactions and information flows between the involved organisations. A B2B standard is guidelines for how to structure and organise the information and/or business processes that constitute the exchanges (Söderström, 2004). So far, facts about the standards and the standardisation process are rather well known and researched, as is the technologies utilised for B2B. However, the way organisations implement and use the standards and/or standards-based systems is much more of a blur. This paper intends to shed some light on the implementation of B2B standards, with a particular focus on success factors for the same. We will first present a general implementation process model, derived from a combined literature and empirical study. The model displays three main phases. For each of these phases, success factors will be discussed, and analysed in comparison to related work. These factors were derived as a side track from the same study as the implementation model, and resulted in nine success factors for B2B standards implementation. The paper starts by briefly presenting the study design (Chapter 2), before the implementation process model is presented (Chapter 3). Chapter 4 focuses on the success factors derived, while Chapter 5 analyses the success factors against related work. The paper is summarised in Chapter 6, where a concluding analysis is made.

2. DESIGN OF THE STUDY

The study consists of three steps: literature review, interviews, and comparison to related work, starting with literature review. This was conducted partly in parallel to an interview study conducted with three stakeholder perspectives: six standards development organisations (SDO); four standards user organisations (SUO); and three standards software organisations (SSO). All respondents were promised anonymity, thus no person's or organisation's name occurs in the paper. Since quotes from the study are used to emphasise and illustrate the points made, all respondents were given a number. The purpose was to allow readers to more easily identify if quotes came from the same or different respondents. As a final step, results from the

interview study and the literature review were merged into one perspective. During the literature review, two sources describing barriers and success factors in particular were identified. Neither focus on B2B standards, but on success factors for related areas. These factors were analysed and compared with respect to B2B standards, and an analysis was made.

3. AN IMPLEMENTATION PROCESS MODEL FOR B2B STANDARDS

Many organisations have little knowledge of the implementation process, what to prepare for in terms of necessary activities and potential pitfalls, or how to manage the implementation projects. Few existing standards have provided an explicit process describing how to proceed. Implementation of Internet business systems is a complex undertaking (Lee et al, 2004). Preparation is important, and can be a bottleneck which keeps organisations from realising the true potential of e-business (Edifecs, 2000). A deeper investigation into the implementation process is therefore justified. Our study has shown that a general implementation process model may contain three phases: preparation, architectural and consolidation (Figure 1).
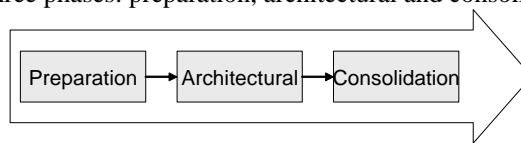
Figure 1. Main implementation process phases

Preparation concerns the activities for the planning of projects and architectural work, the negotiation with partners, etc. Architectural work concerns making the process and technical changes which will incorporate the standard into the existing infrastructure. Finally, consolidation concerns launching the standards and putting it into work, as well as evaluating and maintaining the system and expanding its use in the organisation. The order of these phases is depicted by the arrows in Figure. Preparation, architectural and consolidation each contain a series of sub-activities or sub-phases. Our model has emerged from combining the results of an interview study with the findings from a literature survey (see chapter 2). The results represent a combination of all the existing descriptions of activities during implementation, from both literature and interviews. In some respect, the implementation model also represents an ideal case. However, since the experiences from practice are included, we argue that the included phases and steps are realistic and likely to occur, and that organisations will benefit from being prepared for them.

4. SUCCESS FACTORS FOR IMPLEMENTATION

Success factors for standards implementation can be divided according to the main implementation phases: preparation, architecture and consolidation. If success factors are not met, the project may risk failure due to the problems related to implementation, as described in the previous chapter.

4.1 The Preparation Phase

Preparation consists of the steps strategic planning, process analysis, partner alignment and project planning. There are success factors in each step. Strategic planning is one of the most important aspects mentioned by most respondents and in literature (RosettaNet, 2002; Olson and Williams, 2001). It refers to having a clear, articulated vision/objective for the project: "…*I would say the initial step is to have B2B strategy in the enterprise. It sounds obvious, but it's not always the case. So the company should have a very clear and well defined B2B business strategy. And this should be sponsored at the highest level.*" (SDO1). A clear vision contributes to creating competitive advantage, which is increased by integrating e-commerce systems and processes, in particular for large companies and their supply chains (Egan et al, 2003). In process analysis, standards can be used to review current methods of working, to identify redundancies and processes where efficiency can be increased (Intel, 2003). A clear process view enables a simplified assessment of how to proceed from the current to the desired situation, and thus increases the likelihood for project success.

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The importance of project communication has been stressed in previous studies, such as in Amoako-Gyampah and Salam (2004) and their study on Enterprise Resource Planning (ERP) implementations. This is relevant to standards implementation since ERP much like B2B standards are complex systems cutting across functional and organisational borders. A common need increases the chances of partners staying committed to the hard work required in aligning processes and making standards function. It is possible to speak of commitment on different levels. Firstly, and most importantly, every project should have top management support (interview respondents; Chan and Swatman, 2002), since, for example, management assigns resources and staff for a project. Secondly, there is cross-functional team partner commitment for collaboration between partners in order to solve common issues (Chan and Swatman, 2002; Intel, 2003). A detailed project plan must be carefully prepared, in particular since more than one organisation is involved. Project management is also an important success factor. Quoting one SUO respondent: "*The overall success of the project depends on a high degree of a professional and synchronized project management.*" (SUO2). The quote points to the need for the project plan to consider all partners for a successful project outcome.

4.2 The Architectural Phase

During the *architectural* phase, project teams must pay attention to technology integration, systems testing, performance measurement, and so on (Olson and Williams, 2001): "*…end-users should be involved early, performance measures should be considered, many questions should be asked for new standards…*" End-user participation in standards implementation is essential, much like user participation is essential for SDO credibility (Jakobs et al, 1996; Jakobs et al, 2001; Fabish, 2003; Cargill, 1995). However, user participation may exist on different levels. In the development process, the user is an organisation, while in the implementation phase, the end-users are single individuals. The cross-functional teams are important during the architectural phase as well. By co-operating, the time needed to solve problems can be reduced.

4.3 The Consolidation Phase

There is one success factor in the evaluation step of the *consolidation* phase. Without evaluation, an organisation will be unable to gauge the success of the project. Intel (2003) describes one example, where evaluation helped identify freed resources that could be utilised in other parts of the company.

4.4 Summary of Success Factors

The discussion in sections 4.1 – 4.3 shows the following list of success factors for B2B standards implementation: A clearly defined implementation process; A cross-functional implementation team; A clear business strategy/vision; A clear view of business processes; Commitment on all levels; A detailed project plan; End-user inclusion; and Thorough evaluation before expansion.

5. RELATED WORK TO SUCCESS FACTORS

We will put success factors into perspective by discussing two related works in one sub-section each.

5.1 Success Factors – BPR Implementation

Planning to capacitate success factors is important, as is planning for potential barriers to successful implementation. A recent study of *BPR implementation* efforts by Attaran (2004) pointed to seven barriers to effective BPR implementation: misunderstanding of the concept; misapplication of the term; lack of proper strategy; unrealistic objectives; management failure to change; failing to recognize the importance of people, and IS failure to change. They may not be entirely comparable to B2B standards implementation, but some relations can still be made since BPR gains in importance due to inter-organisational co-operation.

Five of Attaran's (2004) barriers are relevant for B2B standards: misunderstanding of concept; lack of proper strategy; unrealistic objectives; management failure to change; and failing to recognise the importance

of people. The other two are not as relevant: misapplication of the term; and IS failure to change. Neither is discussed frequently in standards-related literature. Based on the barriers, four success factors can be derived that relate to standards implementation (table 1).

Table 2. B2B process types versus standardisation

Barrier	Success factor
Misunderstanding of the concept	A *concepts model* that ensures a common understanding
Lack of proper strategy	Including standards in the corporate strategy
Unrealistic objectives	Ensuring a high enough level of *knowledge* to enable informed organisational decisions
Management failure to change Failing to recognise the importance of people	Exploration of the *consequences of implementing B2B standards* on the employees' method(s) of working

A common concepts model is necessary, since terminology confusion may cause problems. Standards in the corporate strategy are also essential, since they constitute an important part of the method of working. A higher level of knowledge about standards will enable informed decisions and reduce the likelihood of unrealistic objectives. The final success factor relates to two barriers. It concerns thoroughly analysing the consequences of B2B standards implementations for all levels of employees.

5.2 Success Factors – Information Systems Development

Poon and Wagner (2001) define critical success factors as the conditions that need to be met to assure the success of the system. Their study utilised 10 success factors in an analysis of four IS development efforts: committed and informed executive sponsor; operating sponsor; appropriate IS staff; appropriate technology; management of data; clear link to business objectives; management of organisational resistance; management of system evolution and spread; evolutionary development methodology; and carefully defined information and systems requirements. There are many matches to our study, such as commitment from all organisational levels and partners, and the importance of the business strategy. Poon and Wagner's (2001) study mentions both choice of technology and the importance of a development methodology. Technology is central to B2B standards implementation, as the entire architectural phase is focused on internal and external system changes. In general, information systems development focuses a lot on methods, but this discussion has not yet reached the standards field to a great extent.

6. CONCLUDING ANALYSIS OF SUCCESS FACTORS

This chapter summarises the success factors that can be derived from all mentioned studies. A comparison is provided in table 2. In cases where more than one success factor has been inserted in a square, they relate strongly to one another and contribute to a common goal. One example is commitment, where management support and user commitment belong to commitment in general.

Table 2. Comparison of the three studies with respect to success factors

Our study	Attaran (2004)	Poon and Wagner (2001)
Defined implementation process		Clear development methodology
Cross-functional implementation team	Education about standards	Skilled staff Manage political resistance
Clear strategy/vision	Include standards in the business strategy	Address existing problems and/or needs
Clear (view of) business processes	Achieve a common concepts model	
Commitment on all levels	Business analysis of standardisation consequences	Management support Commitment from users
Detailed project plan		
End-user inclusion		Manage political resistance Include relevant requirements
Thorough evaluation before expansion		
		Choice of appropriate technology

Three aspects are common: appropriate skills in a cross-functional implementation team; A clear and updated business strategy/vision; and the necessity of commitment on all involved levels. All three aspects mainly concern preparation before implementation, indicating its importance. Implementation is more about strategy and organisation than about technology. The need for a defined implementation process relates to the methodology need by Poon and Wagner (2001). Both focus on the implementation process. Pairing a clear view of business processes with a common concepts model may seem odd, but a common concepts model is needed in order to achieve a clear view of business processes. End-user inclusion may prevent user resistance, and extract many user-relevant requirements. Three aspects lack relations: a detailed project plan; thorough evaluation before expansion; and choice of appropriate technology. All three, however, need to be considered in implementation.

The discussion leads to nine success factors for B2B standards implementation: a defined implementation process and approach; a skilled cross-functional implementation team; a clear business strategy/vision; a clear view of business processes and concepts; commitment on all levels; a detailed project plan; end-user inclusion; thorough evaluation before expansion; and choosing the appropriate technology. All should be considered when planning B2B standards ventures, to allow for better preparations and a more likely implementation success. As a final note, we would like to emphasise that these results need further examination and validation in order to be confirmed as truly applicable. However, the literature review, comparison and empirical basis means the probability of their usefulness is high.

REFERENCES

Söderström, E. (2004), *B2B Standards Implementation: Issues and Solutions*, PhD Thesis, Department of Computer and Systems Sciences, Stockholm University, Akademitryck, ISBN 91-7265-942-4

Lee, C., Choi, B. and Lee, H. (2004), A development environment for customer-oriented Internet business: eBizBench, *The Journal of Systems and Software*, 72 (2004), pp.163-178

Edifecs (2000), *Bridging the Great B2B Chasm: Relieving the Bottleneck to True e-Business Growth*, White paper, Edifecs Inc., September 2000

Chan, C. and Swatman, P. (2002), Management and business issues for B2B eCommerce implementation, in Proceedings of the 35th Hawaii International Conference on System Sciences, IEEE, 2002

RosettaNet (2002), Achieving Streamlined Operations Through Collaborative Forecasting and Inventory Management: STMicroelectronics E-Chain Optimization (eChO) Project, RosettaNet, as is February 10, 2004, available at http://www.rosettanet.org/RosettaNet/Doc/0/63NGGI61LP84P753UQ28VBMLA3/STMicroelectronics+White+Paper.pdf

Olson, E. and Williams, P. (2001), E-Commerce with Web-Based Standards: A Case Study in Implementing RosettaNet Process Standards at Avnet, Inc., available at:
http://www.rosettanet.org/RosettaNet/Doc/0/BMHE9II7VRKK916EJ4DPI6I635/avnetwhitepaper.pdf, PriceWaterhouseCoopers, April, 2001

Egan, T., Clancy, S. and O'Toole, T. (2003), The Integration of E-Commerce Tools into the Business Processes of SMEs, *Irish Journal of Management*, Irish Academy of Management (IAM), pp.139-152

Intel (2003), Collaborative RosettaNet Implementation: Intel and Fujitsu streamline e-Business automation across the supply chain, Intel Information Technology White Paper, October 2003

Amoako-Gyampah, K. and Salam, A. (2004), An extension of the technology acceptance model in an ERP implementation environment, *Information & Management*, 41 (2004), pp.731-745

Jakobs, K., Procter, R. and Williams, R. (1996), "Users and Standardization – Worlds Apart? The Example of Electronic Mail", *StandardView*, Vol.4, No.4, December 1996, pp. 183-191

Jakobs, K., Procter, R. and Williams, R. (2001), "The Making of Standards: Looking Inside the Work Groups", *IEEE Communications Magazine*, April 2001, pp.2-7

Fabish, G. (2003), "An Ambitious Goal – eEurope for All", *International Journal of IT Standards & Standardization Research*, Vol.1, No.1, January – June 2003, pp.57-61, Idea Group Publishing

Cargill, C. (1995), A Five-Segment Model for Standardization, in Kahin and Abbate (eds.), *Standards Policy for Information Infrastructure*, MIT Press, Cambridge, MA, USA, pp.79-99

Attaran, M. (2004), Exploring the relationship between information technology and business process reengineering, *Information & Management*, 41 (2004), pp.585-596

Poon, P. and Wagner, C. (2001), Critical success factors revisited: success and failure cases of information systems for senior executives, *Decision Support Systems*, 30 (2001), pp.393-418

EXPLANATORY MODEL FOR E-COMMERCE INITIATIVES

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ABSTRACT

E-Commerce is now a worldwide phenomenon, with multiple impacts on the success and evolution of organizations in a large variety of industries, due to its unique features. These both challenge and revolutionize traditional business reasoning. Recognizing the importance of a profound and comprehensive realization of the multiple aspects that facilitate and determine e-commerce, in this paper we present an explanatory theoretical model for e-commerce initiatives, developed under a qualitative Grounded Theory approach [Strauss & Corbin, 1990]. The conducted work led to the identification and description of factors influencing organizations' adoption and exploitation of e-commerce.

KEYWORDS

e-commerce, e-business, model

1. INTRODUCTION

The technological progress of the past few decades originated an environment were organizations are forced to actively seek new options for more effectively compete in their markets. In a context of fast and permanent evolution, the Internet has an absolutely central role, as an important channel for communication and trade of goods and services. The reason for this is that frequently business initiatives and e-commerce initiatives allow the complete transformation of the way in which businesses are run, at various levels and scope.

Now used by millions of people and organizations worldwide, the Internet places within the reach of virtually any business, from gigantic multinational corporations to micro-businesses, the simplified access to

new markets, the seizing of new customers, the establishment of relations with new suppliers, the undersigning of new alliances and partnerships, and the exploitation of new products and services, all without physical, geographical or time barriers, which are commonly imposed on "conventional" business practice.

Although information technologies, and particularly the Internet, are effectively recognized are powerful tools, essential for the survival and evolution of any organization, just by adopting them there is no warranty of positive results or competitive advantages. There is no direct relationship between their adoption and return on investment; the latter depends on how the available technologies are used [Li, 1995; Strassmann, 1997].

E-commerce initiatives (EC) pose no exception to this reality. In spite of the attention devoted to EC in the past few years, the results from investments haven't exactly matched expectations; in some cases, they actually proved most disappointing. For the most part, the recurrent problems in EC initiatives are due to the fact that many organizations, overly eager to replicate profits reported in the media, are drawn into a wave of enthusiasm, without systematically considering the advantages and disadvantages regarding the various possible scenarios for action.

E-commerce is not a solution for each and every organization. If the EC process is ill driven, it can even create more problems than the available business benefits. Like in many other practices, when badly used, it can be a financial and strategic disaster, thus it is not an option to take lightly. Several risks are associated with EC, and the lack of their understanding may easily compromise any potential benefits.

The decision process of an e-commerce initiative is quite complex. There are several fundamental aspects, which an organization must consider before defining a route. Whatever the options of the organization, they must be considered carefully and wisely. They must also employ a broad knowledge of the various underlying implications.

This paper presents an explanation for the reality of EC initiatives, by forwarding a model that identifies a set of factors involved in the process of embracing, implementing and using e-commerce. The model we propose is the result of a Grounded Theory study, during which we closely analyzed six recent e-commerce initiatives.

2. CURRENT PERSPECTIVE ON E-COMMERCE

There are countless definition of e-commerce, which furthermore have varied in time [ITS, 1996; Scherckenbach, 1997; Price Waterhouse, 1998; Ernest & Young, 1999]. The most commonly-accepted definition views e-commerce as the buying or selling or goods/services by use of electronic data networks, such as the Internet; transactions can be between companies, between companies and consumers, or between the public sector and the private sector [EU, 2004]. EC is a component of e-business, which in turn is defined by IBM as "a safe, flexible, and integrated proposal for distribution of distinct business values, through a combination of systems and processes that run the main business operations, using the simplicity and reach made possible by Internet technologies" [Amor, 2000].

The period between the years 1995 and 2000 was one of the most euphoric periods in the history of world commerce. It was also a time when the fundamental concepts of EC were developed and explored. Thousands of .com companies were launched, backed by over 125 billion US dollars of venture capital – one of the greatest expansions of venture capital in world history [PriceWaterhouseCoopers, 2002].

For these companies, EC represented an extraordinary opportunity to gain many times the normal return on investment, much more than the capital costs. The international crash of stock exchanges, which began on March 2000, and the subsequent economical slowdown, raised several questions regarding the long term benefits of ICT and of the Internet. It also temporarily reduced the level of available investment capital (venture or otherwise) for infrastructure, and effectively represented a turning point in the views on EC.

The disillusion that occurred in 2000 and 2001, due to the failure of many .com companies, seems to have given way in the following years to a more positive perspective on the impact of the Internet on business performance [UNCTAD, 2003]. However, this renewed trust in the ability of technology to improve business operations presents itself in several different fashions, unlike the single, overly optimistic vision of revolutionary change, which was prevalent at the end of the 1990s.

Currently, EC keeps growing at a furious pace, regarding the number clients and revenue figures. And in spite of the many EC visions developed in the period between 1995 and 2000 that haven't been fulfilled, sales

keep growing yearly. Not just that, but consumers learned to use the Web as a powerful source of information on products that they eventually purchase through other channels, such as traditional companies.

3. EXPLANATORY MODEL FOR E-COMMERCE INITIATIVES

The turbulence, the constant change in the business envelope, and the specificity of each particular organization, render unviable the formulation of universal prescriptions for EC initiatives. Thus, the EC strategy must be defined according to each company's situation. Nevertheless, all cases go more or less through the same problems and critical issues [UERN, 2002]. According to Ludescher and Usrey [Ludescher & Usrey, 2000], "should there be a model identifying the critical elements in EC initiatives, it would help businesses extract the maximum number of advantages from those initiatives".

Aiming to contribute to the better understanding of the several factors that are relevant to the success of embracing, developing and using EC, in this paper we put forward an explanatory theoretical model of e-commerce initiatives. This model, presented in figure 1, aims to identify the direct and indirect influences, which sets of input factors, process factors, and output factors exert on EC initiatives.
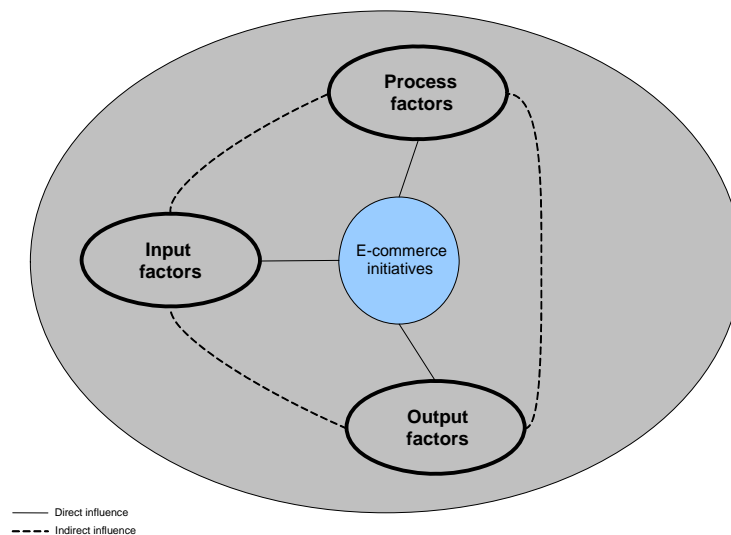
Figure 1. Explanatory Model of e-commerce initiatives.

Input factors are the set of elements that are relevant and exert their influence regarding the input of EC initiatives. Process factors are elements that are relevant in the process of developing the business and the technological solutions, in the EC context. Output factors are elements resulting from the process of EC development and exploitation, under the perspective of its impact throughout the several organizational levels and the business encompassing environment.

The model presented here is, basically, a practical way to articulate those various aspects of reality, both theoretical and experience-based, which are accepted and recognized as relevant to the study and practice of EC. The analysis of the six cases studied included several personal interviews and an exhaustive review of literature, both current and academically established, regarding the fields of information systems and technology, e-commerce, and management. Those interviews were subsequently codified and processed, leading to different model versions. We have deemed this work complete after achieving an acceptable corroboration level for each factor. In the model, the sets of factors detailed in Table 1 are identified.

Table 1. Input factors, process factors, and output factors in e-commerce initiatives.

Input Factors	• Business model • Kinds of products/services • Business vision • Business facilitators and inhibitors • Business objectives • Business strategies • Internal organizational short-term trends • External organizational short-term trends • EC motivations • Strengths, weaknesses, opportunities, threats, and obstacles regarding EC • EC solutions • Logistics • Target audience • Partnerships • Investment and financing
Process Factors	• Management commitment • Adequate business structure for EC initiatives • Structure • Approach and method • Lifecycle of the solution • Project management • Critical success factors • Exploitation of the EC solution • Features of the EC solution • Technological solution • Process facilitators and inhibitors
Output Factors	• Strategic impacts • Tactical impacts • Operational impacts • Impacts on the encompassing environment • Crosswise impacts on the internal environment

The various mentioned factors are those which strongly determine and drive EC, according to the observed practice. Obviously, in face of a specific case, the relative importance of these factors must be considered; it could happen that other factors reveal themselves more relevant, under specific circumstances. Therefore, our standing is that the Explanatory Model of EC Initiatives must be seen as a set of reference factors for EC, not as a strict model.

The identification of each factor accounted for its various relevant aspects that were of foremost importance in the studied cases (typically, any given factor is broader in reach than its description; the studied cases highlighted the central points).

4. CONCLUSION

EC challenged and still challenges much of traditional business reasoning. The unique dimensions of EC technologies (ubiquity; global reach; universal standards; richness; interactivity; customization, and information density), suggest new, varied potentials for running the business [Varian, 2000].

Aiming to contribute to improve the success levels of EC investments, we have proposed an explanatory model for e-commerce initiatives in organizations. The model we presented takes it that there are three kinds of factors (input, process, and output) exerting direct influence over EC initiatives and we must also emphasize the internal indirect influence among themselves. The specific influences of each factor on the EC activity, as well as the influences among each other, have not been expressed in this model. The high number and complexity of such influences renders their exhaustive identification exceedingly hard (or likely, even impossible).

The great diversity of options and the multiple cases of success and failure tell us that success would be achievable by an adequate combination of these various factors.

There is no "right" way or universal motive to commit to a EC initiative. Even if there was, it would likely change in the course of time, due to business demands, politics, or technology itself. Organizations must commit to EC initiatives according to the set of their circumstantial factors, *i.e.*, in line with the aspects which determine and allow the success of the company's decision.

Basically, the model set forth is a practical way to articulate details of theoretical and experimental reality – details that are commonly accepted and seen as relevant to the study and practice of e-commerce. This model is expected to provide organizations with an instrument allowing them to, for instance: support and promote the laying out of action plans and strategies for e-commerce initiatives; identify risks and organizational implications of the various types of e-commerce initiatives; and attain better return on investment.

REFERENCES

Amor, D., The e-business (r)evolution, Hewlett-Packard Professional Books (2000).

Bauer, C. and Scharl, A., "Quantitative Evaluation of Web Site Content and Structure", Internet Research: ElectronicNetworking Applications and Policy, 10 (1) 31-43 (2000).

Crosby, P., Quality Is Free: The Art of Making Quality Certain, McGraw-Hill, New York (1994).

Ernest and Young, "eCommerce in New Zealand – First Annual Study Results", Wellington, United Nations Center for Facilitation of Procedures and Practices for Acquisition, Commerce and Transport (1999).

EU, European Union, http://www.ukonlineforbusiness.gov.uk/cms/template/popup-content2.jsp?id=310439 (accessed on January 5th, 2004).

http://www.pwcmoneytree.com/moneytree/nav.jsp?page=historical (accessed on March 15th, 2003).

Institute for Telecommunication Sciences, Federal Standard 1037C: Glossary of Telecommunications Terms, Boulder, National Telecommunications and Information Administration (1996).

KPMG, Electronic Commerce Research Report, London, UK (1997).

Li, F., The Geography of Business Information, Wiley (1995).

Ludescher, G. and M. Usrey, "Towards an ECMM (E-Commerce Maturity Model)", Proceedings of the First International Research Conference on Organizational Excellence in the Third Millennium, Estes Park, Colorado State University (2000).

McKay, J., "E-Business Maturity: the SOG-e Model", Proceedings of the 11th Australian Conference on Information Systems, QUT (2000).

Paulk, M., Weber, C., Curtis, B. and M. Chrissis, The Capability Maturity Model: Guidelines for Improving the Software Process, Addison-Wesley (1995).

Price WaterHouse Coopers, "MoneyTree Survey 2002",

Price Waterhouse, Technology Forecast 1998, Price Waterhouse, California, (1998).

Rogers, D., "The Challenge of Fifth Generation R&D", Research Technology Management, July-August, pp. 33-41 (1996).

Scheckenbach, R., Semantische Geschaeftsprozessintegration, Gabler Verlag, Deutscher Universitaets – Verlag, Wiesbaden (1997).

Strassmann, P., The Squandered Computer – Evaluating the Business Alignment of Information Technologies, Information Economics Press (1997).

Strauss, A., and J. Corbin, Basics of qualitative research, Thousand Oaks, CA: Sage (1990)

UERN, Microsite project – Estudo Norte.Com, study developed for the União das Associações Empresariais da Região Norte, cofinanced by the Programa Operacional da Região Norte (ON, operational programme for the Northern region), Measure 1.4 (December, 2002) http://www.uern.pt/microsite (accessed on January 10th, 2004).

UNCTAD, E-Commerce And Development Report 2003, United Nations Conference on Trade and Development, (2003).

Varian, R., "When Commerce Moves On, Competition Can Work in Strange Ways." New York Times (August, 2000).

Willcocks, L., "Formulating and Achieving Business Internet Strategy", Electronic Commerce: Strategies to Improve (1999).

EBRANDS: THE CASE OF BOSTON COFFEE CAKE

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ABSTRACT

The growing importance of ecommerce made the study of brands in the internet particularly relevant both for researchers and marketers. This paper is the outcome of a research project on the ebrands – i.e. brands commercialized in the internet. An exploratory approach was chosen through a multi-case analysis. One of the cases is presented here. The study indicated that, in the future with the broadband and consequent media convergence, differences between physical and virtual brands might be limited to the level of marketing mix actions and tools, taking in the account the kind of product/service and the desired positioning.

KEYWORDS

Ecommerce, branding, consumer behavior, case study.

1. INTRODUCTION

One of the main consequences of internet was the development of direct marketing. This allowed the implementation of relationship marketing strategies to a large dimension companies, usually involved with a huge public (Turban et al, 2000). This entire dynamic resulted in new challenges and opportunities to brands. Ecommerce brought a fast rhythm which pressures deeply the organizations, benefiting the consumers and, in some aspects, the society in general. This brought brands to react in order to find new forms of responding to those pressures. Additionally, it allowed improving customer satisfaction, loyalty and, consequently, increasing sales and brand value (Moon and Millison, 2000; Brito, 1998).

As Rayport and Jaworski (2002) state, physical and virtual markets are merging in one single space. This leads to the use of the most effective channels in the establishment and defense of a brand. Does this mean that in the near future, differences between physical and virtual brands are likely to disappear?

In this context, ebranding represents a new major research field in ecommerce. It is a relatively unexplored area where a number of important issues remain without answer. Indeed, it was never so easy to build a recognized brand in the short term. But, it was never so ephemeral (Carpenter, 2000).

This paper is the outcome of a research project that aimed to study the consumer response to the ebrands. The paper attempts to understand whether virtual branding demands a different approach compare to physical branding. Two research questions were raised: Does a virtual brand need a different approach than a physical brand? What is the real impact of the internet on branding?

An exploratory approach was chosen based on qualitative methods through a multi-case analysis. This methodology was adopted because ebranding is a new field of research and there isn't a common established and accepted conceptual framework (Yin, 1994).

One of the cases studied was Boston Coffee Cake, which refers to a small size coffee cake manufactory oriented to a niche market with a high price target.

In short, the main contributions of this study could be classified at three levels:

- **Virtual brands approach**

The virtual branding approach depends on the kind of brand as well as its marketing tools. In fact, a pure on-line brand must have a different communication strategy from a traditional brand. Then, it is essential to manage the communication efforts according to the type and habits of the target public.

- **On-line presence**

The study also showed that although the ecommerce may be not applicable to all brands, they should have an on-line presence. That is, the opportunity costs of being absent from the internet are likely to negatively affect the brand image.

- **The best ebranding practices**

The importance of the best ebranding practices (Carpenter, 2000) relied fundamentally on the type of brand, product/service and marketing strategy. These practices seem to constitute an effective tool in building brand visibility. However, this does not mean necessarily brand profitability. In the future, differences between physical and virtual brands might be limited to the level of marketing mix actions and tools.

2. THE STUDY

For most brands, the on-line experience did not correspond to the expectations. This reinforced the idea that an on-line brand needs a different approach. The companies were used to create brands slowly and with huge mass marketing investments. On the internet, the distances became measured in seconds. Furthermore, new on-line brands became suddenly strong competitors.

Also, certain recognized ebrands were not able to capitalize on their brand name to generate profits, and, in some cases, the business model failed. This might mean that time still play an important role in building a valuable brand. That is, the foundation of brand value is the creation of committed and closed relationships throughout the time (Aaker et al, 2004; Barnes, 2000; Diller, 2000; Fournier, 1998; Fournier & Yao, 1996; Sheth and Parvatiyar, 1995).

In this sense, it was considered that a theoretical model sustained on brand classical frameworks should guide the establishment and the defense of a brand. However, such model should also include new elements, which have proved to be fruitful for on-line brands. First, such elements should focus on the evaluation of brand on-line affinity, according to the "score card" proposed by Diorio (2003). Second, on a set of ebranding practices based on the observation of successful on-line brands, according to the "The best ebranding practices" by Carpenter (2000). Finally, it is necessary to ensure the surviving of those brands in an unpredictably and volatile environment. Although this new field does not offer solid theories, three aspects seem to play an important role on the defense of brands in the marketspace: the virtual communities, the on-line and off-line advertisement and the media convergence (Rayport & Jaworski, 2002).

2.1 The Methodology

An exploratory approach was chosen, based on qualitative methods through a case study analysis. In this study, the main question of research has an exploratory purpose. Thus, the main objective is to formulate hypotheses of study about the on-line brand management.

The analysis of the case was based on a theoretical framework. The framework for analysis offers a logic structure, which allowed analyzing a brand's strategy toward the electronic commerce and represented a descriptive tool for systematizing and organizing the information.

The study relied on a semi-structured interview conducted with the Boston Coffee Cake's manager. Additionally, three emarketing experts were interviewed in order to better understanding the case in the ecommerce context.

2.2 The Framework for Analysis

The framework for analysis (see Figure 1) was built on the basis of four conceptual constructs. First, the classical theory of branding (Aaker, 1991; Keller, 1998). To analyze a brand it is fundamental to understand not only its identity mix but also the marketing mix strategy as well as the public mix. That is brand as a triadic concept: sign, object and image (Lencastre, 1999; Mick, 1986). In fact, the way a brand is perceived by the public influences its own identity.

Second, since the consumer behavior is determinant in implementing any brand strategy, the "Electronic commerce consumer behavior model" developed by Turban et al. (2000) was considered a good contribution.

Finally, the scorecard for evaluating brand on-line affinity developed by Diorio (2002) and the best practices on ebranding proposed by Carpenter (2000) were the third and fourth elements of our framework for analysis.
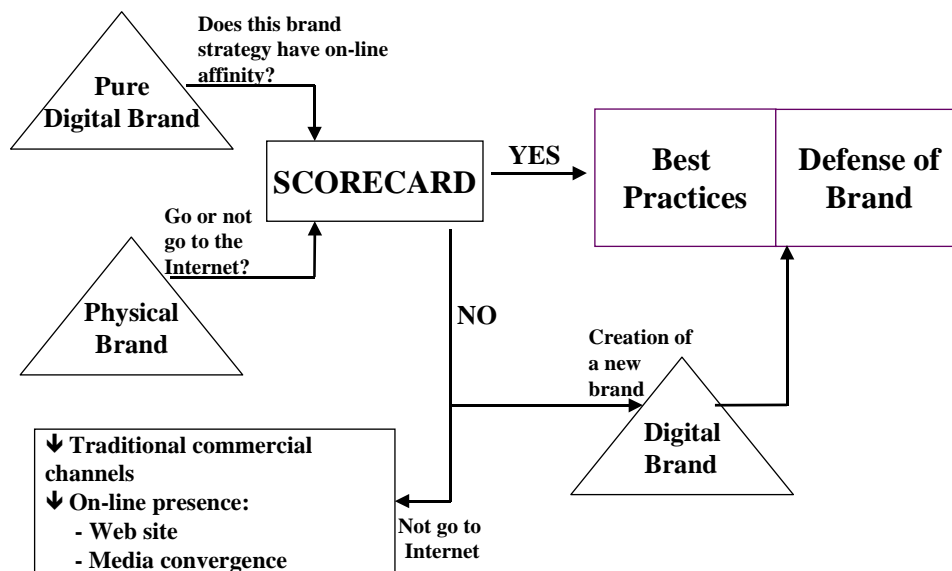
Figure 1. The framework for analysis

2.3 The Boston Coffee Cake

The Boston Coffee Cake was founded in 1993 in a small village closed to Boston. The product shows a high quality level. In 2002, the brand was judged the best coffee cake in America by the American Tasting Institute. The cakes are distributed through the traditional retail and services, and by direct marketing through paper catalogs and internet.

From 1995 on. the direct marketing was extended to the on-line catalog. At that time, Boston Coffee Cake was a recent and unknown brand with just two years of activity. Such decision was determined by the following factors: convenience to the consumer, reaching more market and reducing costs.

The ebranding strategy can be considered as one of the actions of the whole brand strategy for building awareness, along with the paper catalogs and the packages of cakes. Boston Coffee Cake does not have own stores, commercializing its products by a net of brokers in the traditional retail and services. Through the toll free and the internet, the company contacts directly with the final consumers. This allows improving the interactions with customers and delivering better service convenience.

Showing a proactive posture toward electronic commerce, Boston Coffee Cake intends to make, in a medium term, all business partners' transactions electronic. Such might result in the enlargement of the market segment of the company and is related with cost reducing.

This is a case of a low recognition physical brand, which uses the on-line channel for building awareness and achieving more market (namely in Europe where the brand started to be sold through the on-line channel). However, the Internet has not been used yet as a channel that allows learning about customers, in a systematic way. In fact, although the email and toll free service, there is not a formal and unique relationship strategy.

The scorecard provided a good grad in some aspects, such as:

- First mover advantage: it was the first coffee cake on internet;
- Customer segment affinity: direct marketing affinity by catalog marketing;
- Brand experience portability: the brand's paper catalog experience favors the on-line transferability;

However, the domain name does not offer conditions of good recognition in the global market, the internet has not been used yet as a channel that allows learning about customers in a systematic way, and there isn't the use of innovation and creativity in the ecommerce strategy of the brand.

Boston Coffee Cake is a good example of on-line transferability easiness of a traditional direct marketing strategy. However, this brand did not make hard Web investments. Inclusively, it did not rely on the usual ebranding practices. In addiction, the product and the brand imaginary does not offer important context value.

The application of the framework for analysis put in evidence that a brand must become "visible" whether by viral marketing, off-line communication or physical assets. Therefore, it is essential to manage the communication efforts according to the characteristics and habits of the target public.

Furthermore, in what concerns the best ebranding practices, the real importance they assume relies fundamentally on the type of brand, product/service and marketing strategy. Indeed, those practices revealed themselves as effective tools to build brand visibility – although such does not mean necessarily brand profitability.

Finally, the media convergence and the ecommerce represent new capabilities for the traditional marketing. In this sense, classical branding must evolve and use new approaches. Namely, it seems evident that all the brands tend to have an on-line presence.

3. CONCLUSION

The study concluded that in the near future, with the generalization of the broadband and the consequent media convergence, marketers couldn't regard to an ebrand as the opposite of a physical brand. Rather, brands have to be managed in a comprehensive way, taking into account all alternatives based not only on the kind of product/service offered but also on the desired positioning.

On the other hand, this study, representing an exploratory research on ebranding, is likely to provide suggestions for further investigation. Thus, the new ways that the traditional marketing must consider when

looking to a brand (either on-line or off-line) emerges as an important research field. As well as the challenge of making a brand profitable through the internet revealed itself as an interesting study theme.

Moreover, the validation of the framework for analysis deserves more attention. Such implies to test, in a more extended way, both the brand classical theory relevance for ecommerce, and the practical ebranding theory – i.e. the scorecard of Diorio (2002) and the best e-branding practices suggested by Carpenter (2000). In this way, it would be also interesting to test the hypotheses in a larger basis of generalization, that is, with more and contrasting cases.

REFERENCES

Aaker, D., 1991. *Managing Brand Equity – Capitalizing on the Value of a Brand Name*. The Free Press, New York.

Aaker, J. et al., 2004. When Good Brands Do Bad. *Journal of Consumer Research*, Vol. 31, pp. 1-16.

Barnes, J. G., 2000. Closeness in Customer Relationships: Examining the Payback from Getting Closer to the Customer. In T. Hennig-Thurau and U. Hansen (Eds.), *Relationship Marketing: Gaining Competitive Advantage through Customer Satisfaction and Customer Retention* (pp. 89-105). Springer, Berlin, Germany.

Brito, C., 1998. *A Insustentável Leveza do Marketing* (working paper 81). Faculty of Economics, Porto, Portugal.

Carpenter, P., 2000. *eBrands: Building an Internet Business at Breakneck Speed*. Harvard Business School Press, Boston, USA.

Diller, H., 2000. Customer Loyalty : Fata Morgana or Realistic Goal? Managing Relationships with Customers. In T. Hennig-Thurau and U. Hansen (Eds.), *Relationship Marketing: Gaining Competitive Advantage through Customer Satisfaction and Customer Retention* (pp. 29-48). Springer, Berlin, Germany.

Diorio, S., 2002. *Beyond e: 12 Ways Technology is Transforming Sales and Marketing Strategy*. McGraw-Hill, New York.

Fournier, S., 1998. Consumers and their brands: developing relationship theory in consumer research. *Journal of Consumer Research,* Vol. 24, No.4, pp. 343-373.

Fournier, S. and Yao, J. L., 1996. *Reviving Brand loyalty: A Reconceptualization Within The Framework of Consumer-Brand Relationships* (working paper). Harvard Business School.

Keller, K., 1998. *Strategic Brand Management: Building, Measuring and Managing Brand Equity*. Prentice-Hall, Upper Saddle River, USA.

Lencastre, P., 1999. A Marca: O Sinal, a Missão e a Imagem. *Revista Portuguesa de Marketing*, Vol. 8, pp. 105-119.

Mick, D.G., 1986. Consumer Research and Semiotics: Exploring the Morphology of Signs, Symbols, and Significance. *Journal of Consumer Research*, Vol.13, pp. 196-213.

Moon, M. and Millison, D., 2000. *Firebrands – Building Brand Loyalty in the Internet Age*. Pergamon, New York.

Rayport, J. and Jaworski, B., 2002. *Cases in e-Commerce*. McGraw-Hill/Irwin, New York.

Sheth, J. N. and Parvatiyar, A., 1995b. Relationship Marketing in Consumer Markets – Antecedents and Consequences. *Journal of the Academy of Marketing Science,* Vol.23, No.4, pp. 255-271.

Turban, E. et al, 2000. Electronic Commerce. Prentice-Hall, Upper Saddle River, USA.

Yin, R., 1994. *Case Study Research: Design and Methods* (2nd ed.). Sage Publications, Thousand Oaks, USA.

THE ROLE OF ARCHITECTURE IN DRM VENDOR ECONOMICS

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ABSTRACT

The advent of digital rights management (DRM) has lead to the creation of two generations of DRM technologies. First generation technologies largely focused on copy protection, and because of this, many erroneously equate copy protection and DRM. Second generation technologies; however, have begun to address a much broader scope of possibilities associated with the myriad of business opportunities that can be built around the more general idea of managing rights. Nevertheless, to date, DRM vendors have experienced very little success in the marketplace. Experts have postulated a number of reasons for the failure of this market to appear, some related to the business models, others to the technologies themselves, and still others related to the lack of standards in this area. In this paper we consider the role that the definition of a well-defined DRM architecture will have in addressing these problems. In particular, we consider how the specification of a minimal architectural framework can help to guide the development of DRM technologies, as well as help to identify the role that standards should play.

1. INTRODUCTION

The digital rights management (DRM) industry is relatively young, emerging over the past fifteen years. In its initial stages, the DRM industry modeled itself along the lines of the prevalent rights management business models in the non-digital world. Specifically, the emergence of digital technology made it possible to create perfect copies of on-line content. Later, the development of the Internet facilitated the dissemination of this content. Hence most of the early DRM technologies concentrated on copy protection. These are referred to as first generation DRM systems. Subsequently, those in the DRM industry became explicit in recognizing that DRM is in fact much more than copy protection alone. For example, research and development of rights expression languages (RELs) provided a means to express rights in machine-readable and machine-actionable form, something that now appears as a basis for DRM. In addition, companies started to use the Internet as a cost-effective means for content distribution. The growth of the Internet also made it possible to create new business models for content distribution, which gave rise to second-generation DRM systems. Second generation DRM systems shifted their focus from copy protection to rights expression. This can be seen as a shift of technologies from being content-distributor-centric to that of being user-centric. A slew of technologies emerged in the late nineties which provided solutions ranging from kernel-level rights enforcement to sophisticated facilities such as superdistribution in a single package. What we have witnessed however is the failure of most of these technologies (DRM vendor graveyard, 2005), as well as a general reluctance towards the prominent use of DRM in commercial applications. There are a number of reasons for these failures, some related to technology and others to the economics of DRM. In this paper we consider how these two are related. In particular, we consider the role that technology must play in the specification of a minimal architectural framework for DRM. Such a framework provides the scaffolding upon which multi-vendor DRM solutions can be built, which we believe is a necessity in order for viable DRM markets to emerge. Without such a framework, monolithic one-vendor solutions will continue to be the norm, and these markets will continue to progress slowly. In this paper we consider how

an agreed upon architectural framework for DRM can facilitate the growth of DRM markets. We have previously proposed a layered DRM framework for DRM technologies (Jamkhedkar & Heileman, 2004). In this paper we consider how such a framework can help to guide the development of technology along with assist in the establishment of helpful standards.

2. RATIONALE FOR A LAYERED FRAMEWORK

Consider the client-server model associated with a typical DRM system, where the user of the client machine wishes to purchase a piece of content, and the server side is responsible for delivering the content along with its associated rights. The rights are then enforced on the client machine. There are three basic processes that must be supported within this framework. At the highest level are the dealings of the client system with the server. An intermediate level is concerned with how exactly the rights are specified as well as how they should be interpreted in particular environments. At the lowest level the concern is how the rights are enforced on the client side. Figure 1 provides a detailed breakdown of the DRM layers. Note that the client/server interactions are in the upper layers, while rights enforcement technologies (RETs) are located in the middle layers. Rights expression and interpretation (REI) form the minimal requirement of any DRM system. Since they constitute the minimal requirement of DRM systems, they are placed in the core of the framework. The REI Layer would provide a common denominator over which various DRM services can be built. Every DRM system would require the REI layer service. New services can be created using the REI service. Just as TCP, HTTP and UDP, etc., are various services created out of IP, REI can provide a common ground for creation of new DRM services.

Users demand a range of services, and these services can be created independent of the underlying RETs. The functionalities of these DRM services should be determined by end-to-end arguments during DRM system design (Clarke et al, 2002). The service layers help DRM solutions adapt themselves to different business models, and are divided into two parts: the Application and Negotiations Layers. Functions that are more central to DRM, such as trust-establishment, interoperability, content tracking, access control, security and watermarking, will be implemented in the Negotiations Layer. Application specific functions such as monetary transactions, personal trust establishment, pricing models, preview facilities and content search facilities will be implemented in the Application Layer. The service layers represent the upper dome of the hourglass-shaped structure shown in Figure 2.

The REI layer is implemented over the RETs. Similar to the underlying networks that serve the purpose of actually transmitting the data, RETs attempt to enforce the specific rights associated with particular content items and users. RETs represent technologies that enable rights enforcement. Technologies such as secure containers, authorized domains, watermarking, and trusted platforms will be implemented in the RET layers. These RETs are bound to change with advances in computer science and electronics, though their role should always remain the same. Thus if the core of the framework is limited to rights expression and interpretation, then the framework will be flexible enough to change with the changing requirements of DRM environments, without invalidating useful applications that have been previously built on top of the minimal DRM services.

2.1 Technologies Independent of Services

In most of the current DRM systems, the services provided by the system are bound to the technologies used for the enforcement of rights. DRM vendors generally have their rights enforcement software running on client devices. Thus the range of services provided to the users is heavily dependent on the rights enforcement solutions available in the DRM systems. We previously proposed breaking down the DRM process into layers (Jamkhedkar & Heileman, 2004). Layered systems help to buffer services from rapidly changing technologies. Our work is inspired by the highly successful OSI framework and the TCP/IP protocol architecture. The central idea behind the proposed DRM framework is identification of the minimal
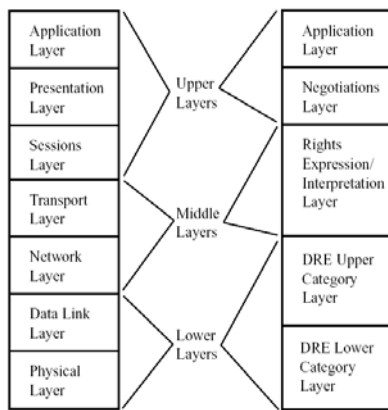
Figure 1. A breakdown of the OSI data communications layers and the proposed DRM layers into upper, middle, and lower
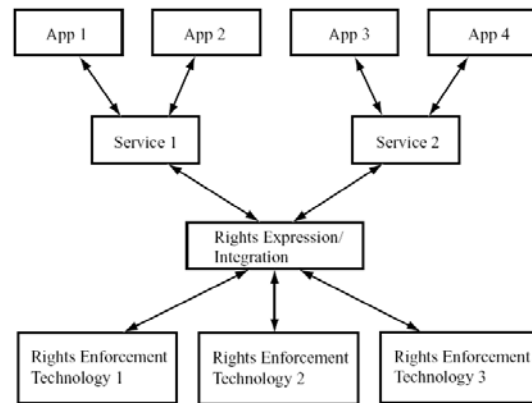
Figure 2. DRM as a layered system with an hourglass structure. In this case Rights Expression and Interpretation provides the minimal service, and this service is therefore located at the notch of the hourglass

requirement of the DRM processes using this service as a separator of RETs and DRM services. In a layered DRM framework it is easy to analyze and develop DRM systems in which services are separated from RETs. The REI layer, which provides the minimal requirement of any DRM system, will buffer the services from the RETs. Then DRM services can be developed on the minimal DRM service provided by the REI layer. One of the main hurdles to achieve this is the establishment of trust between the DRM server and the RET running on the client system. This trust establishment can be achieved through the Negotiations Layer.

2.2 Tussle Spaces

Clarke et al. (2002) emphasize the need for new design strategies to accommodate different tussles between Internet players. It is important that these tussles do not affect the stability and flexibility of the Internet. These design principles emphasize flexible frameworks which provide choice for different players to express their preferences. Also the design must be modularized along tussle boundaries so that tussles do not spill over and distort unrelated issues. With regards to tussles, DRM faces more severe challenges than those currently faced by the Internet. DRM is most importantly about business, and tussles are an integral part of business. There are three main players in any DRM scenario: the content owner, the content distributor and the user. Each of these players has their own goals. The goal of the content provider is to have a choice in selection of employing a content distributor for his work. The goals of the content distributor include market success, ability to target a large user base, high control over user activity, and keeping out new entrants. The goals of the user include service provider independence, high rights expressive power and choice of services. These goals conflict and thus there exist different kinds of tussles among these players over different issues. Next we consider some of the important tussles developing in the DRM industry.

Usage flexibility provided by DRM products is an important tussle in the DRM industry. While service providers want maximum control, users want to experience maximum freedom and flexibility. Any DRM system which does not provide this balance will fail in the market. The layered DRM framework solves this deadlock. If DRM services can be separated from the RETs, a user with a sophisticated RET can enjoy more flexibility. Thus, instead of deciding the outcome of the tussle, a correct architecture can create space wherein the involved parties can arrive at equilibrium. The content provider wants to keep the user whereas the user wants to have a choice in selecting his own content provider. This is another tussle faced by the DRM industry. In the current typical DRM setup if a user has to stop using one content provider and switch to a different one, he has to download the RET software from the new content provider. This acts as a deterrent to changing content providers. What is needed is a mechanism whereby a user has the freedom to change while incurring minimal inconvenience. Since the layered DRM framework separates the services from the RETs, a user having a single RET on his machine can change the content provider. Independence of

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services from RETs makes it possible to employ the services of different content providers over a single RET.

2.3 Standards

As noted by Clarke et al. (2002), the outcome of the tussles need not be defined by technologists. It is necessary to create a right environment where equilibrium can be reached among the players with conflicting interests. The specification of the layers themselves helps to a certain extent to identify these tussles. Now standards can be defined over the boundaries of these tussles to allow well controlled evolution of the technologies developed within the tussle space. The way the layers interact with each other define these tussle boundaries and provide focal points for the introduction of standards (Heileman & Jamkhedkar, 2005). The definition of the standards will depend upon the interests of each of parties involved in the tussle and the impact of their interests on the layered framework.

3. VENDOR ECONOMICS

One of the major tussles in any industry is the space for new entrants, which is normally blocked by the established parties already active in the industry. An interoperable DRM system can provide a solution to this situation in which different parts of the system can be developed by different vendors. Interoperability can be accomplished by standardization. Excessive standardization will stymie competition and innovative solutions. Also to survive in the complex DRM market it is essential to have a flexible architecture which will adapt to different requirements. We will look at each of these in the following subsections.

3.1 Space for New Entrants

Currently many DRM vendors provide complete DRM solutions. Interoperability of DRM is still in its initial stages. Thus DRM vendors are expected to provide services as well as their own RETs. RETs tend to be sophisticated and complicated technology solutions, and large investment is necessary to develop practical RETs. This deters new entrants who may not enough capital to invest in DRM development. Also since services are not independent of the RETs, operating system and rendering device manufacturers do not have enough incentive to incorporate DRM in their products unless they decide to provide complete DRM solutions. As a result of this we have DRM vendors who try to provide complete solutions including rights enforcement, with little support from operating system and rendering device vendors. These RETs have overlay architectures and thus are susceptible to security breaches at the kernel level. This would not have been the case if enough support is provided by the operating system and rendering device manufacturers. It is also the case that these vendors try to meet every DRM requirement. The size of their solutions, changes in DRM requirements and rapidly changing rendering devices often make these DRM solutions obsolete.

With the separation of RETs and DRM services, a user with sophisticated RET will enjoy better DRM services. A demand for such sophisticated RETs is a justifiable incentive for device manufacturers and OS vendors to include high-level RET mechanisms in their products. A layered framework will also facilitate interoperability in DRM solutions providing space for new entrants, where they can introduce parts of DRM solutions in the markets.

3.2 Space for Competition

As mentioned previously, a layered DRM framework will facilitate interoperability. The space within the layers is free of any standards. This space provides area for competition among different DRM product vendors. To establish market gains and to attract new customers, different DRM product vendors will implement innovative and attractive DRM solutions. The Application Layer is a service layer. Different DRM vendors can provide attractive pricing models for the customers. The lower layers represent the RETs, this area provides a space for competition among OS and device manufacturers to implement sophisticated

RET solutions. It is essential however to carefully identify these areas and separate them to promote interoperability.

3.3 Survival

The requirements of the DRM industry are rapidly changing, and it is necessary for DRM vendors to adapt themselves to emerging business models. Some of the current DRM business models discussed in Rosenblatt et al. (2002) include: paid downloads, subscriptions, pay-per-view, pay-per-listen, and usage metering. DRM architectures should therefore provide the ability to employ different business models without requiring major changes in previously installed technology. This is supported by a layered DRM architecture where changes in the business model will be only reflected in the Application Layer, without disturbing the other layers or invalidating the complete DRM product.

A layered architecture can also tackle frequent security breaches which often make security-sensitive solutions obsolete. A security breach in a certain functionality provided at a particular layer would not invalidate the complete solution. For example if a certain RET solution is found to have a security breach, the DRM services functioning in the upper layers can still operate with other RETs without making them useless. Thus the separation of services from RETs can help vendors to survive in the market against security attacks.

4. CONCLUSIONS

In this paper we pointed out how a layered DRM framework will facilitate the development of stable DRM solutions, which will help to manage the ongoing tussle between customers and DRM vendors. The current technological setting in the DRM industry has failed to address these problems, resulting in a large number of failures for DRM vendors. We also discussed how changing requirements in services and rapidly changing content rendering platforms are making it difficult for DRM vendors to implement stable solutions. The separation of DRM services from the RETs greatly facilitates the development of stable solutions. Finally we considered how a layered DRM framework can have a major influence on DRM vendor economics. Such a framework provides a space for competition among existing vendors, as well as a space for potential entrants into the DRM industry. A layered DRM framework can thus facilitate the transition of vendors from the second phase to the third phase of DRM markets.

REFERENCES

The DRM vendor graveyard. http://www.info-mech.com/drm_vendor_graveyard.html, Nov. 2005.

Clark, D.D., Wroclawski, J., Sollins, K.R., and Braden, R. (2002). Tussle in cyberspace: Defining tomorrow's Internet. In SIGCOMM, pages 347–356, Pittsburg, PA, USA.

Heileman, G. L. and Jamkhedkar P. A., DRM Interoperability Analysis from the Perspective of a Layered Framework. In Proceedings of the Fifth ACM Workshop on Digital Rights Management, pages 17-26, Virginia.

Jamkhedkar, P.A. and Heileman, G.L., (2004). DRM as a layered system. In Proceedings of the Fourth ACM Workshop on Digital Rights Management, pages 11–21, Washington, DC.

Kaplan, M.A. (1996). IBM cryptolopes, superdistribution and digital rights management.

http://researchweb.watson.ibm.com/people/k/kaplan/cryptolope-docs/crypap.html.

Rosenblatt, B., Trippe, B., and Mooney, S., (2002). Digital Rights Mangement: Business and Technology M&T Books, New York, NY.

A PATTERN LANGUAGE FOR THE DEVELOPMENT OF ADAPTABLE LOCATION-SPECIFIC MOBILE APPLICATIONS

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ABSTRACT

The increasing adoption of mobile devices in our daily life and the corresponding advances in communication-infrastructure lead to new kinds of applications. At the same time these developments cause even more complex mobile client-applications. In this paper we present how to use the well-known concept of design patterns as a basis for the development of reconfigurable mobile applications. In this work we will concentrate on questions concerning the Service Discovery and Resource Management.

KEYWORDS

Mobile Applications, Design Patterns, Adaptability

1. INTRODUCTION

The increasing use of mobile devices in our daily life plays, together with the ongoing improvements of handheld devices and the concurrently improving infrastructure, an important role. Applications running on mobile platforms often require concurrent interaction with other users of mobile devices and with static or context-specific services. Although this development is very beneficial in the eye of the end-users it brings in new problems for the developers to manage the increasing complexity of mobile applications.

One main criterion of mobile applications is their dynamic behavior. Because of this it is extremely important to consider the dynamic reconfiguration aspects during the design phase of mobile applications.

2. DESIGN PATTERNS

Design patterns are simple and concise solutions for common programming problems. The architect Christopher Alexander (Alexander et al. 1977, Alexander 1979) is generally seen as the mental father of the design pattern movement. In the area of software engineering design patterns became popular by the work of Gamma et al. (1995). Their structure follows certain rules and is based on the following elements:

- **Pattern name**: The name of a pattern is usually short, yet descriptive and acts as an addition to the design vocabulary.
- **Problem**: Patterns should include a short description of the problem they intend to solve.
- **Solution**: The solution to the problem is described in a generally applicable way. The elements of the solution are described along with their relationships and responsibilities.
- **Consequences**: While the main consequence of using the pattern is the solution to the problem, there often exist side effects. In order to make it easier to understand the trade-off involved in using the pattern, it is important that the potential drawbacks are explained.

Of course, this is not the only possible structure for describing a pattern, in fact Gamma et al. also provide an extended schema and other authors offer alternative descriptions as well (e.g. Fowler 1997).

A design pattern documents a comprehensive solution for common tasks during program design that evolved through experience into a useable solution for many situations. The engineering task during object-oriented software design is to find a suitable design pattern for a given programming task or many design patterns which together solve the problem.

The documentation of the design patterns helps in the design process from completing requirements of the given problem to the realization in a programming language. It also acts as a foundation for discussion between the developers about the solution.

The primary use of a design pattern lies in the documentation of a solution for a given class of problems. Design patterns are generally language independent. During the design phase of object-oriented software they are an accepted tool to foster the design process.

In the following sections we concentrate on the description of design patterns, which could be used as a skeleton for an architecture of reconfigurable, context-based mobile applications. Low-level aspects, such as the realization of wireless connections or middleware specific points are out of scope, since they are already discussed in other papers. In Andrade et al. (2001) a pattern language for mobility management of wireless mobile communication systems is presented. Furthermore there is a high number of design patterns covering middleware aspects, such as the *Broker*-Pattern, the *Forwarder-Receiver*-Pattern and the *Publisher-Subscriber*-Pattern (Buschmann et al. 1996). A pattern language, which contains the building blocks of typical middleware-architectures, is described in Völter (2000). Another collection of design patterns for concurrent and network objects can be found in Schmidt et al. (2001).

3. MOTIVATION AND DEFINITIONS

Mobile applications, especially those used in a context-specific way, require a high degree of flexibility. This is the especially the case here since the current position of the device decides about the range of useable services. Therefore such applications have to include two special abilities: the ability to efficiently register, discover, use and manage services and the ability for ad-hoc configuration.

Even though you may think that the aspect of dynamic adaptability of client applications only affects the client side, this is not the case most of the time. The flexible discovery, use and management of services is not restricted to the client side but also requires a flexible infrastructure on the server side.

Before we present the suggested design patterns we have to define some terms:

- **Service**: A Service offers a certain resource which may be requested from multiple different users ad-hoc. The kind of the offered resource is not relevant and should be considered opaque. A service may be realized by multiple homogenous, parallel running service providers to solve aspects as load-balancing or fault tolerance using replication. Furthermore it is possible to realize different service-providers which offer different Quality-of-Service (QoS) criteria. A Service may also be used as a homogenous interface for a subsystem according to the *Facade*-Pattern (Gamma et al. 1995).
- **Service Provider**: A Service Provider realizes, at least a part of, a certain service. Using this term services composed of different components may be described better. According to Stal (Stal 1999) a component is a binary, functionally self-contained software building block which interacts with its environment via a well-defined interface. The component must be able to cope with the embedding in different, non-predictable application contexts.

4. PATTERNS FOR THE DEVELOPMENT OF LOCATION-SPECIFIC ADAPTABLE MOBILE APPLICATIONS

Within the following paragraphs we will describe different design patterns, which can be used within the context of location-based mobile applications. First we will concentrate on the aspects of the client applications. Later on we will describe the necessary approaches for the server-based infrastructure.

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4.1 Design Patterns for Mobile Clients

To utilize a service, a mobile client needs to have the ability to discover available services in a dynamic environment. The offered services could differ depending on the context of the user. This brings in the necessity to decouple the client from the services.

A possibility to solve the first problem would be to let every service periodically broadcast a beacon and make itself known to the clients and thus its potential users. An alternative would be to let every client announce its availability via a broadcast message and every available service sends a reply.

Both techniques are not scalable in the internet and any other unicast network, since the broadcast traffic increases with every user and service.

To solve this problem you could use for example the *Lookup*-Pattern (Kircher and Jain 2000). It involves three roles:

- **Client**, which uses a service,
- **Service**, which offers a certain functionality
- **Lookup Service**, which allows other services to register. Clients could use this service to find other services.

This approach is used in different popular technologies, such as the Common Object Request Broker Architecture (CORBA) (Object Management Group 2002). Further patterns concerning service discovery—more exactly a complete pattern language—are described in Pärssinen et al. (2004).

Another problem is the dynamic behavior of mobile clients. This means they should not be coupled directly with a service. To decouple the possibly heterogeneous mobile clients from the services the *Service Abstraction Layer*-Pattern (Vogel 2001) may be used. This design pattern adds another layer between the client-applications and the services. This may be realized using the *Facade*-Pattern (Gamma et al. 1995). The Service Abstraction Layer boosts aspects as separation of concerns, generic request handling, controlled evolution and communication transparency.

In this way it is possible to tailor services to client applications which are specific to a location or which have different abilities, such as different Quality-of-Service-Characteristics (QoS).

Through the constantly changing business processes and the ongoing advent of emerging technologies the "Separation of Concerns" (Völter 2000) principle should get special attention. This is, together with the presented patterns, an integral part for the development of platform- and language-neutral mobile applications.

Another problem, which has to be solved, is the efficient use of the resources of the mobile client device. Despite the amazing technical advancements with respect to memory or available bandwidth, these resources are scarce in mobile devices. At this point you could use patterns such as *Virtual Proxy* (Gamma et al. 1995). It creates "proxy" objects which dynamically load "expensive" objects on demand and thus save active memory. For similar reasons pattern such as the *Lazy Acquisition*-Pattern (Kircher 2001), which aims to acquire memory as late as possible, were created. It is based on the following four roles:

- **User**, who wants to use a specific resource
- **Resource**, which offers a specific functionality
- **Virtual Proxy**, which offers the same interface as the resource it represents and functions as local stand-in
- **Resource Environment**, which is responsible for the management of the resources

Furthermore the Virtual Component (Corsaro et al. 2002) helps with the aspects of high configurability and flexibility at run-time. This pattern includes six elements:

- **Component** defines the interface to use the functionality of the Component
- **Concrete Component** is the concrete implementation of the Component which offers the ability to load only the needed parts of the component
- **Component Factory** offers an interface and a method to create the component

- **Concrete Component Factory** is an concrete implementation of a Component Factory which instantiates the Components
- **Loading Strategy** decides when to load a Component and when to instantiate it
- **Unloading Strategy** decides when and if a Component and its associated resources should be freed

The interface of a Component represents a building-block of an application and is realized through a Concrete Component. For the creation of Concrete Component instances the corresponding factories are responsible, which could use different Loading/Unloading-Strategies.

4.2 Realization of Services for Mobile Clients with Design Patterns

The ability to efficiently discover, manage and use services is of essential importance for the design of mobile solutions. Hereby many problems have to be solved.

Among other things, the deallocation of no longer used services or the selection of a service provider. In this section we will show different design patterns for the implementation of an infrastructure which could be used for mobile clients.

In the case of mobile clients the use of the *Evictor*-Pattern (Henning and Vinoski 1999, Jain 2001) is the most relevant solution. This approach tries to reach the goal of an efficient use of services through monitoring. Every time a service is accessed a marker is set. Services which are not used for a long time (least recently used–LRU) or which are used only rarely (least frequently used–LFU) are candidates for deallocation. The deallocation of services may happen periodically or explicit at any time. The pattern involves the following four roles:

- **User** is using the resource
- **Resource** offers a specific functionality
- **Evictor** is the instance which is responsible for the eviction of the resources
- **Eviction Strategy** defines the criteria for the eviction of resources

The main advantage of this design pattern is transparency for the client, i.e. the mobile client does not have to care about the eviction of his used services. The eviction of no longer needed resources is also possible during technical problems, such as a loss of connection. The only disadvantage is that the client application has no chance to reject the eviction of a service. This disadvantage is easily to deal with through configuration of the eviction strategy.

Another problem is the fact, that not every service is always available. This may in turn be caused by technical problems (such as loss of connection) or a changed location. In this case the *Leasing*-Pattern (Jain and Kircher 2000) could be used. This pattern is based on a method which does not offer a service for an unlimited time, but only for a limited period. When the time is over there are different possibilities. The leasing-concept, which is used e.g. in Jini (Sun Microsystems 2003) and is also specified by Sun (Sun Microsystems 1999), was disregarded for mobile location-based patterns in the past. This concept is not only useful for Jini, as the work of Jain and Kircher (Jain and Kircher 2000) suggests who even talk about a Leasing Pattern. The authors focus on the exact details of the problem, the structure and their possible variants. In technologies which do not support the leasing concept directly, such as Common Object Request Broker Architecture (CORBA), the concept can be realized through a special service (Aleksy and Gitzel 2002).

The leasing concept involves four roles:

- **Resource**, which offers a specific functionality
- **Resource Claimant / Holder** is the component which would like to use the resource. It may only use the resource if it owns a lease.
- **Lease** is the link between the resource and the resource claimant. It offers the functionality to free a resource prematurely or to extend the leasing time if possible
- **Lessor / Grantor** is the main management part. It manages the assignment of the resources to the claimants.

Furthermore there are some more design patterns which assist in the dynamic reconfiguration of software components, e.g. the *Service Configurator* (Kircher and Jain 1997) or the *Component Configurator* (Schmidt et al. 2001). Even more related patterns may be found in Welch et al. (2001).

4.3 Putting it all Together

An overview of the interaction of the described patterns is shown in figure 1. The Design Patterns Lazy Acquisition, Virtual Proxy and Virtual Component may be used in the field of client-development for mobile applications. They especially take into account things like the conservative use of resources and foster the development of adaptable applications.

The second category of the shown Design Patterns is–directly and indirectly–concerned with the client and the service part of the application. For example the Lookup Pattern works as a link between the client part of a mobile application and the (potentially) used services. The use of the Evictor Patterns frees the mobile client indirectly from the use of elaborate and complex algorithms for the efficient utilization of resources.

Other Design Patterns, i.e. Component Configurator or Service Configurator are concerned with the configuration of services and may lead to a higher flexibility.

5. CONCLUSION

This paper shows a multitude of Design Patterns which can be used in the development of context-based mobile applications. With the help of the presented Design Patterns a complete framework for architecture of adaptable, context-based and mobile applications is easily achievable. The spectrum showed here goes from aspects like service discovery and the efficient use of resources to the efficient management of a service life-cycle. Based on the introduced Design Patterns a mobile application may be developed faster and more cost-effective. Furthermore the quality is ensured through the use of "best-practice" techniques.
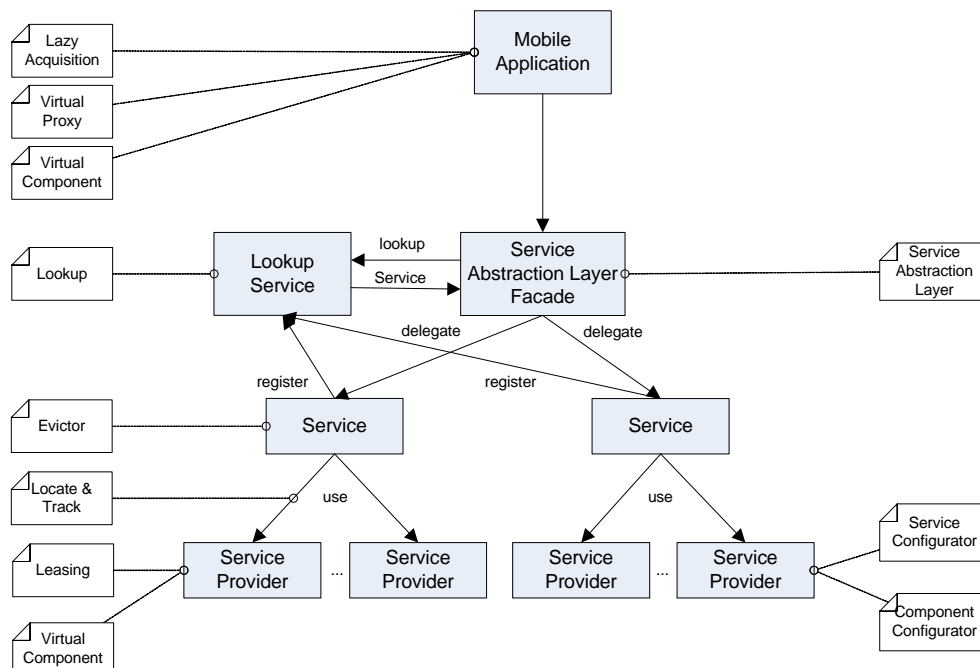
Figure 1. Pattern-oriented Development of Mobile Applications

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REFERENCES

Aleksy, M. and Gitzel, R., 2002. Design and Implementation of a Leasing Service for CORBA-based Applications. *Proceedings of the 1ˢᵗ International Symposium on Cyber Worlds: Theories and Practices (CW 2002)*, Tokyo, Japan

Alexander, C., Ishikawa, S., Silverstein, M., Jacobson, M., Fiksdahl-King, I., Angel, S., 1977. *A Pattern Language*. Oxford University Press, New York

Alexander, C, 1979. *The Timeless Way of Building*. Oxford University Press, New York

Andrade, R, Logrippo, L., Bottomley, M., Coram, T., 2001. A Pattern Language for Mobility Management. *Proceedings of 6ᵗʰ European Conference on Pattern Languages of Programs (EuroPLoP 2001)*, Irsee, Germany

Buschmann, F. Meunier, R., Rohnert, H., Sommerlad, P., Stal, M., 1996. *Pattern-Oriented Software Architecture–A System of Patterns*. John Wiley & Sons, Chichester

Cohen, B., 2000. Locate & Track. *The Jiniᵀᴹ Pattern Language Workshop, OOPSLA conference*, Minneapolis, USA

Corsaro, A., Schmidt, D.C., Klefstad, R., O'Ryan, C., 2002: Virtual Component: A Design Pattern for Memory-Constrained Embedded Applications. *Proc. 9ᵗʰ Conf. on Pattern Language of Programs (PLoP 2002)*, Monticello, USA

Fowler, M., 1997. *Analysis Patterns: Reusable Object Models*. Addison-Wesley

Gamma, E., Helm, R., Johnson, R., Vlissides, J., 1995. *Design Patterns: Elements of Reusable Object-Oriented Software*. Addison-Wesley

Henning, M. and Vinoski, S., 1999. *Advanced CORBA Programming with C++*. Addison-Wesley

Jain, P., 2001. Evictor. *Proceedings of 8ᵗʰ Patterns Languages of Programs Conference (PLoP 2001)*, Allerton Park, Monticello, Illinois, USA

Jain, P. and Kircher, M., 2000. Leasing". *Proceedings of 7ᵗʰ Patterns Languages of Programs Conference (PLoP 2000)*, Allerton Park, Monticello, Illinois, USA

Kircher, M. and Jain, P., 1997. Service Configurator: A Pattern for Dynamic Configuration of Services. *Proceedings of the 3ʳᵈ Conference on Object-Oriented Technologies and Systems, USENIX*

Kircher, M. and Jain, P., 2000. Lookup. *Proceedings of 5ᵗʰ European Conference on Pattern Languages of Programs (EuroPLoP 2000)*, Irsee, Germany

Kircher, M., 2001. Lazy Acquisition. *Proceedings of 6ᵗʰ European Conference on Pattern Languages of Programs (EuroPLoP 2001)*, Irsee, Germany

Object Management Group, 2002. *The Common Object Request Broker: Architecture and Specification Version 3.0*. OMG Technical Document Number 02-12-06

Pärssinen, J., Koponen, T., Eronen, P. 2004. Pattern Language for Service Discovery. *Proceedings of 9ᵗʰ European Conference on Pattern Languages of Programs (EuroPLoP 2004)*, Irsee, Germany

Schmidt, D. et al, 2001. *Pattern-Oriented Software Architecture–Patterns for Concurrent and Networked Objects*. John Wiley & Sons, Chichester

Stal, M., 1999. Des Knaben Wunderhorn. Kommentare des Fachbeirats Komponenten-Forum. *In OBJEKTspektrum 1/99*, pp. 18-20

Sun Microsystems Inc., 1999. *Distributed Leasing Specification*. http://wwws.sun.com/software/jini/specs/jini10specs/lease-spec.html

Sun Microsystems Inc., 2003. *Jiniᵀᴹ Architecture Specification–Version 2.0*. http://wwws.sun.com/software/jini/specs/jini2_0.pdf

Völter, M., 2000. Server-Side Components—A Pattern Language. *Proceedings of 6ᵗʰ European Conference on Pattern Languages of Programs (EuroPLoP 2001)*, Irsee, Germany

Völter, M., Kircher, M., Zdun, U. 2002. Object-Oriented Remoting–Basic Infrastructure Patterns. *Proceedings of 5ᵗʰ European Conference on Pattern Languages of Programs (EuroPLoP 2000)*, Irsee, Germany

Vogel, O., 2001. Service Abstraction Layer. *Proceedings of 6ᵗʰ European Conference on Pattern Languages of Programs (EuroPLoP 2001)*, Irsee, Germany

Welch, L. R., Marinucci, T., Masters, M. W., Werme, P. V., 2002. Dynamic Resource Management Architecture Patterns. *Proc. 9ᵗʰ Conf. on Pattern Language of Programs (PLoP 2002)*, Monticello, USA

CAPITAL RESOURCES EFFECTS DOWNSTREAM OF TECHNOLOGY CONSUMPTION

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ABSTRACT

Few theories and research in information systems and marketing focus on the way technologies are adopted and used downstream, a strong predictor of an individual's future adoption behaviours and intentions. This paper develops research, from a range of disciplines, in investigating beyond typical themes of technology application and context. It investigates how an individual's construct and past consumption behaviours can influence how they adopt, consume and experience the complex issues surrounding technology consumption, in particular M-business technologies. The proposed conceptual model gives researchers and practitioners an understanding into the factors influencing methods of providing maximum benefits and support to individuals with future technologies.

KEYWORDS

M-Business, Technology, Capital Resources, Adoption, Consumption, Consumer Behaviour.

1. INTRODUCTION

Information technology is well-regarded today as being an integral part of our lives, infused into almost all of our daily activities. Its ubiquitous existence has prompted much research interests in understanding how it can benefit, support and enhance our lives. For any technology to be truly successful, designers need to advance beyond technical challenges, aesthetically pleasing designs and great sales. The social, environmental and even political consequences associated with the new technology needs consideration and understanding. It should be widely considered valuable and convenient, regardless of the user's socioeconomic and cultural background. It should promote coherent social values rather than contribute negatively to the socioeconomic and digital divide. It should be everlasting, for the right reasons. Using a M-Business technology medium, this research addresses DeLone and McLean (1992; 2004) and Zhu and Kraemer's (2005) call to further understand how consumer's post adoption behavioural usage patterns and value considerations can promote the success of a technology (M-Business) and its resulting technologies.

2. THEORETICAL FOUNDATIONS

Adoption of technology, in particular Information Systems (IS), has been extensively researched across disciplines from marketing to IS management to communication. Each contributed with different theories but all are aimed at exploring and explaining how users perceive, adopt, and consume technology. Marketing scholars have predominantly build on Rogers' (2003) diffusion of innovation theory to understand how innovation diffuses and is incorporated into the marketplace. IS scholars concentrated using Davis' (1989) Technology Acceptance Model (TAM) to measure, explain and predict how technological systems are used in an organisational environment. From TAM, numerous developmental theories including the Consumer-context TAM (Bruner II and Kumar 2005), TAM version 2 (Venkatesh and Davis 2000) and Unified Theory of Acceptance and Use of Technology (Venkatesh et al. 2003) have surfaced further explaining technology usage. Communication scholars have utilised the Uses and Gratifications (U&G) perspective (Katz 1959) to understand the conditions and technological characteristics that promote continued usage. Psychologists have similarly incorporated U&G and extensively adapted the Theory of Reasoned Action (Fishbein and Ajzen 1975) to explain user's choices and actual usage of technology. Finally, variations of the Theory of Planned Behaviour have been developed by psychologists to account for conditions where individuals have no control over their behaviour in using technology (Taylor and Todd 1995).

These literatures to date extensively focused on understanding technology adoption, the dichotomous 'adoption versus non-adoption', and the antecedents of usage. Such research often stops short of understanding technology's effect on users downstream of adoption, which this research aims at. Few focus on investigating if and how people's technology usage and value perceptions change post adoption. This research proposes that experiences downstream of adoption are strong predictors of an individual's and their social group's future adoption intentions and behaviours. Any study that aims to investigate how consumers experience the complex subject of technology adoption and consumption is in essence investigating how to improve consumer's future and inevitable technology adoption, adding value to its wider industry and ultimately its users socially. This research will investigate how consumer's adoption and consumption behaviours and experiences influence how they adopt Mobile-Business technologies, to further promote M-Business in the community.

3. CONSUMPTION BEHAVIOUR

With today's rapid technological advancement, consumers are increasingly stressed and frustrated by its complicated usage and overwhelming learning and maintenance requirements (Lee and O'Connor 2003). For the technically unaware, information technology such as the internet and mobile phones are mere black boxes. Its sophistication nature often makes selecting, adopting, maintaining and future upgrading too difficult to comprehend for the average user. Such inhibition is further enhanced by for example consumers' push for smaller packaging and more functionality, and manufacturer's overwhelming number of models.

These are just some of the array of technological dilemmas consumers face. Each consumer reacts differently to each dilemma. Some actively overcome such fears of adopting a new technology through active learning, whilst others are forced to deal with these negative impacts using hesitation or avoidance strategies (Dhebar 1996). This research proposes that an individual's cultural, educational, social, economic, political and technological backgrounds, which determines their social and occupational network, play an integral role in determining how individuals approach and cope with the many facets of technology consumption, in particular M-Business technologies. To understand how individuals, groups, organisations and cultures adopt and consume technologies to support and enhance their lives, is to understand the basis of how and why they behave the way they do during consumption. Through this insight, we can better understand how consumers can best adopt, consume and experience technologies in the future.

4. CAPITAL RESOURCES

In an age of hybridisation, cultural, educational, social, economic, political and technological systems have publicly become recognised placeholders for personal values, identities and statuses. In order to understand

one's unique set of tastes, tendencies and behaviours, an in-depth investigation is needed of one's primary habitus, that is their family (Rojas et al. 2001). This involves investigation into one's parents, their educational background, social network, cultural tendencies, political affiliations and technological awareness. This research proposes that to understand an individual's experience with technology consumption requires the characterisation of the individual's socio-economic, cultural, technological and political constructs. In doing so, Bourdieu (1979; 1990) introduced the concepts of habitus, field and cultural and educational capitals to sociology to understand the rationale, underlying principles and motivations behind human social actioning, idea formulation and dispositions (see Table 1). Many researchers (Dubelaar and Kates 2003; Holt 1998; Inglehart 1990; Johnson 1993; Pieterse 2000; Putnam 1995; Rojas et al. 2001; Shah et al. 2001; Thompson 1994; Wacquant 1996) have further extended this framework, identifying new capital resources that individuals draw upon (see Table 1).

Table 1: Primary capital resources

Capital type	Description
Cultural	Socially rare and distinctive tastes, skills, knowledge and practices
Educational	Formal education level and knowledge
Social	Family, relationships, organisational affiliation and networks
Economic	Financial resources, occupation and demographics
Political	Political affiliation, knowledge and support
Technological	Technology knowledge, skills, awareness and ability to use

This research proposes that capital resource theory has a direct influence over consumers' adoption and consumption experiences. It suggests and thus investigates the link between a consumer's developed capital portfolio and their approach to technology consumption. By understanding this link, developers and marketers can enhance future design and integration of M-Business or any other technologies for consumers.

5. CONCEPTUAL MODEL

Several theories and research findings on technology adoption, consumption behaviour and capital resources have already been outlined. To enhance the understanding of how these theories and findings link together, a conceptual model of capital resource attainment and technology consumption was developed (see Figure 1).
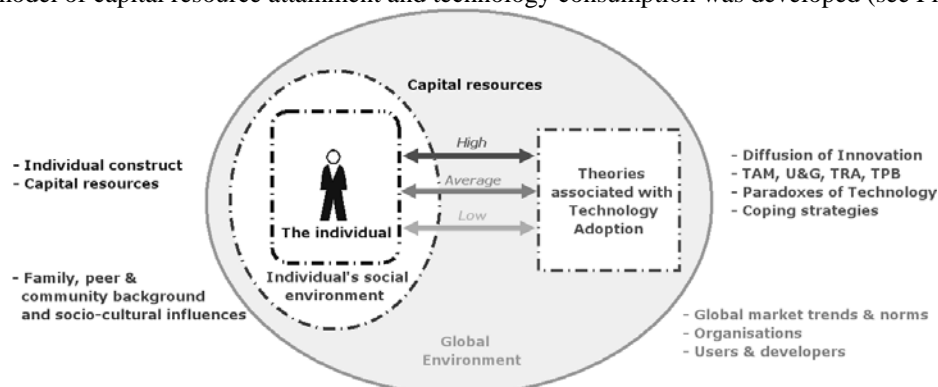
Figure 1. Conceptual Model of Technology Consumption

Four key entities are associated with technology consumption. An **individual**'s portfolio of unique cultural, educational, social, economic, political and technological properties define and divide who they are, what they do, act, interact with, life trajectories, and even the process governing their thinking. To understand their unique set of tastes and behaviours requires understanding their habitus (Bourdieu 1979) created and developed over time by their **social environment** including their family, peers, educational system, community and social group. Consumers will experience the vast array of **theories associated with technology adoption** including diffusion of innovation, TAM and paradoxes and coping strategies of technology uniquely in the macroscopic **global environment** of market trends and norms. Entities are represented with broken boundaries showing a permeable interaction between elements. For example, an individual can freely interact with and can be influenced by their social environment which itself interacts

with and is influenced by the wider global environment.

An individual and their social environment employ a unique set of technology adoption and consumption pattern, based upon the construction of their capital resource portfolio and level of capital resource attainment. The research will propose a way to quantitatively categorise individual's cultural, educational, social, economic, political and technological capital as a capital resource producer (**high**), commoner (**average**) or adopter (**low**). It will propose that individuals holding different levels of capital resources will employ different adoption and consumption strategies resulting in different consequences and considerations to future adoption. Capital producer have the knowledge, skills, experiences and beliefs that contrasts them with capital adopters on the success of consumption experience. For example, a high social capital consumer can employ their understanding of social assimilation, communication and trust, to turn complex and stressful consumption behaviours into a constructive experience, enhancing their confidence in future adoption (Dubelaar and Kates 2003). Conversely, a low social capital consumer will tend to follow technology and market forces, bowing to external pressures and expectations, further increasing stresses from consumption.

This research will explore beyond levels of capital resources to also investigate which capital resources and what extent influences which experience and why. To truly investigate the electronic marketing of M-Business is to investigate and understand the links between capital resources with consumption behaviour. Technology's value is derived differently for each individual as they experience its benefits in different situations with different costs. This research proposes that these differences are influenced by how an individual's repertoire of capital resources influences their perspective of and commitment to technology.

The conceptual model emerged from numerous interpretations of the outlined literature and represents the current effort to graphically scope and link together the various ideas this research addresses. One of the main aims of this research is to understand how the external world and personal trait entities, outlined by their capital resource portfolio, influence an individual's approach to technology adoption. Such an insight will not only allow individuals to enhance their quality of life through more effective and efficient adoption and usage of the technology's benefits, but it will also provide technology designers and manufacturers a means of recognising the underlying issues involved in technology adoption. This will allow a better understanding on how best to create and develop a technology that brings real value to both the consumer and associated organisations, and promote consumption practices that minimise unnecessary stress and anxieties placed upon consumers in future adoptions. The result of this research and the conceptual model is applicable to any technology, but this research uses the M-Business technology medium as a platform for investigation.

6. METHODOLOGY

Data collection for this research will be carried out using a series of qualitative open semi-structured long interviews with various informants that have adopted and consumed an M-Business mobile technology. The interview approach will provide an in-depth exploration into a consumer's psychological and behavioural experiences. Each informant forms a different case study, as each informant hold a different set of capital resource portfolio, providing a unique perspective on the interaction of each entity in the model.

To find the extent to how the linkages are formed between an individual and the theories of technology adoption and consumption, individual's construct of capital resource levels needs investigation. Literature have only investigated informant's cultural (Holt 1998), social (Grootaert et al. 2004; Putnam 1995), political (Booth and Richard 1998) and technological capitals (Dubelaar and Kates 2003; Rojas et al. 2001). Therefore from literature, this research will aim to adapt and develop rating scales that categorises an individual's level of capital attainment for all six primary capital resources.

7. CONCLUSION

This research innovatively brings together the research interests and literature various disciplines, to understand how consumers adopt and consume technologies downstream of adoption. It investigates how capital resources and social background influences how consumers accept, adopt and use technology, understanding the vast array of physical, psychological and behavioural experiences consumer face in the complex process of technology consumption. The outcomes of this research is a conceptual model of technology consumption that provides consumers, technology designers and manufacturers, an insightful

mutual understanding of the consumption behaviours associated with technology consumption. Such understanding will promote more technologically and socially responsible technologies. Understanding a theory is, after all, meaningless without really understanding the people from which it is derived.

REFERENCES

Booth, J.A. and Richard, P.B., 1998, "Civil Society, Political Capital and Democratization in Central America," *The Journal of Politics*, 60 (3), 780-800.

Bourdieu, P., 1979, *Distinction: A Social Critique of the Judgement of Taste*. London: Routledge & Kegan Paul.

Bourdieu, P.,1990, *The Logic of Practice (Richard Nice, Trans.)*. Stanford: Stanford University Press.

Bruner II, G.C. and Kumar, A., 2005, "Explaining consumer acceptance of handheld Internet devices," *Journal of Business Research*, 58 (5), 553-58.

Davis, F.D., 1989, "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology," *MIS Quarterly*, 13 (3), 319-40.

DeLone, W.H. and McLean, E.R., 1992, "Information Systems Success: The Quest for the Dependent Variable," *Information Systems Research*, 3 (1), 60-95.

DeLone, W.H. and McLean, E.R., 2004, "Measuring e-Commerce Success: Applying the DeLone & McLean Information Systems Success Model," *International Journal of Electronic Commerce*, 9 (1), 31–47.

Dhebar, A., 1996, "Speeding high-tech producer, meet the balking consumer," *Sloan Management Review*, 37 Winter 1996 (2), 37-49.

Dubelaar, C. and Kates, S., 2003, "Internet Adoption and the Moral Economy of the Household: Consuming Strategies after Adopting a New Product. Built on a Disruptive Technology Platform," *Working paper*.

Fishbein, M. and Ajzen, I., 1975, *Belief, attitude, intention, and behavior: an introduction to theory and research. Reading*: Addison-Wesley Publications.

Grootaert, C., Narayan, D., Jones, V.N. and Woolcock, M., 2004, "Measuring Social Capital: An Integrated Questionnaire." Washington DC: World Bank.

Holt, D.B., 1998, "Does Cultural Capital Structure American Consumption?," *Journal of Consumer Research*, 25 (June), 1-25.

Inglehart, R., 1990, *Cultural Shift in Advanced Industrial Society*. Princeton: Princeton University Press.

Johnson, R., 1993, *"Editor's Introduction," in The Field of Cultural Production: Essays on Art and Literature, Randal Johnson, Ed*. Cambridge: Polity Press.

Katz, E., 1959, "Mass communication research and the study of popular culture: An editorial note on a possible future for this journal," *Studies in Public Communication*, 2, 1-6.

Lee, Y. and O'Connor, G.C., 2003, "The Impact Of Communication Strategy On Launching New Products: The Moderating Role Of Product Innovativeness," *Journal Of Product Innovation Management*, 20 (1), 4-21.

Pieterse, J.N., 2000, "Social Capital, Migration and Cultural Difference: Beyond Ethnic Economies," *Institute of Social Studies Working Papers*, Working Paper Series No. 327 (December).

Putnam, R.D., 1995, "Bowling Alone: America's Declining Social Capital," *Journal of Democracy*, 6 (1), 65-78.

Rogers, Everett M., 2003, *Diffusion of Innovations (5th Edition ed.)*. New York: Free Press.

Rojas, V. , Roychowdhury, D., Okur, O., Straubhaar, J. and Estrada-Ortiz, Y., 2001, "Beyond Access: Cultural Capital and the Roots of the Digital Divide," *Working Paper*, University of Texas, Austin.

Shah, D.V., Kwak, N. and Holbert, L., 2001, ""Connecting" and "Disconnecting" With Civic Life: Patterns of Internet Use and the Production of Social Capital," *Political Communication*, 18, 141-62.

Taylor, S. and Todd, P.A., 1995, "Understanding information technology usage: A test of competing models," *Information Systems Research*, 6 (2), 144-76.

Thompson, C, J. (1994), "Unfulfilled Promises and Personal Confessions: A Postpositivist Inquiry into the Idealized and Experienced Meanings of Consumer Technology," *Advances in Consumer Research*, 21, 104-08.

Venkatesh, V., Morris, M.G., Davis, G.B., and Davis, F.D., 2003, "User acceptance of information technology: Toward a unified view," *MIS Quarterly*, 27 (3), 425.

Venkatesh, V. and Davis, F.D., 2000, "A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies," *Management Science*, 46 (2), 186-204.

Wacquant, L. (1996), "Reading Bourdieu's "capital"," *International Journal of Contemporary Sociology*, 33 (2), 151-70.

Zhu, K. and Kraemer, K.L. (2005), "Post-Adoption Variations in Usage and Value of E-Business by Organizations: Cross-Country Evidence from the Retail Industry," *Information Systems Research*, 16 (1), 61–84.

EXPLORING SOURCES OF COMPETITIVE ADVANTAGE:E-BUSINESS APPLICATIONS WITHIN CHINESE HOME APPLIANCE INDUSTRY

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ABSTRACT

This paper reports on the findings from case studies of two Chinese leading home appliance companies which address the main e-business applications in Chinese home appliance companies. In particular, it explores the sources of competitive advantages gained from e-business applications. Specific attention has been paid towards using the value chain framework to analyse the main sources of competitive advantage.

KEYWORDS

e-business, competitive advantage, value chain, Chinese home appliance industry

1. INTRODUCTION

This paper investigates the key sources of competitive advantages gained from e-business applications made by Chinese home appliance companies and whether the value chain theory and its related theories' can explain this phenomenon.

One of the key issues in e-business research is how established companies can gain competitive advantage by exploring e-business. Despite the interest in e-business applications by traditional firms, few empirical studies have been carried out to look at how 'clicks-and-mortar' approaches offer competitive advantages, especially from a specific industry perspective (Steinfield et al., 2002). Moreover, the Chinese government has identified e-business as a critical technology for closing the economic gap between China and the USA, Japan and European Union. According to CINIC (2005), China has 94 million Internet users, the world's second-largest online population. By comparing CINIC's reports of 2002 and 2005, although the Internet population has grown rapidly, e-business hasn't been accepted on a large scale due to the relative underdevelopment of the financial infrastructure and a lack of trust among potential customers with respect to electronic transactions. Nonetheless, some progress has been made: 1) Online payment via credit card or debit card has been better accepted; 2) Consumer acceptance of the Internet and e-commerce has improved; 3) More categories of products and services have explored the channel of e-commerce.

Hence, it is attractive to investigate how to gain competitive advantage from e-business applications in the context of Mainland China as theoretical instructions in this area are lacking, but at the same time urgently required. Therefore, the aim of this research is to address the gap both from the current literature and from practice necessary by investigating sources of competitive advantage gained from e-business adoption by established home appliance manufacturers in Mainland China. This aim can be broken down into the following questions: 1) What is the accepted definition of e-business in the Chinese home appliance industry? 2) What are the main e-business applications in the Chinese home appliance industry? 3) What are the key sources of competitive advantage gained from e-business applications by home appliance

manufacturers? 4) How effectively can the value chain model capture the key sources of competitive advantage? 5) Can any new framework/theory of transformation to value chain model arise from empirical data analysis?

Many researchers have acknowledged that strategic management is one of the most important disciplines to look at what opportunities Internet technology poses for entrepreneurship and what drives competitive advantage (e.g. Ethiraj et al., 2000; Amit and Zott, 2001). By using concepts from strategic management, this research will be concerned with competitive advantage by using the value chain framework as an analysis tool.

Research conducted by the authors over the last two years has showed that the value chain framework is useful to identify and categorize possible e-business application areas in Chinese real estate. Moreover, this categorization makes identification of key sources of competitive advantage explicit. However, this framework cannot fully explain the success of e-business applications nor the realization of intended motivations. (Tao and Hinton, 2004)

This paper provides empirical evidence of how established organisations gain competitive advantage through their e-business applications in home appliance industry. Furthermore, it offers insight into how value chain theory helps to explain this phenomenon within the Chinese economy.

Overall, this research aims to contribute to formulating a more solid theoretical basis for how Internet-based business can create sustainable competitive advantage which is one of the promising opportunities in EC research suggested by Kauffman and Walden (2001).

2. METHODOLOGY AND RESULTS

2.1 Methodology

This research adopts a case study approach, as the nature of the research questions requires a deep understanding of the situation, gathering rich data from which ideas are induced, incorporating stakeholder perspectives, and generalization theoretical abstraction. The lack of solid prior theorizing about a topic makes the inductive case study approach an appropriate choice of methodology for developing theory (Eisenhardt, 1989).The main aims are to identify and describe main e-business applications and the sources of competitive advantages gained by the case companies, as well as any common patterns between the companies. Besides case study is used mainly to test theory, as well as to provide description and generate theory.

The criteria of selecting cases follow two rules: specified population and theoretical sampling. E-business is tentatively defined here, following Zwass (1996), as the sharing of business information, maintaining of business relationships, and conducting of business transactions by means of telecommunications networks. The companies that have adopted applications from the following categories will be considered: 1) Buying and selling goods and services through Internet-related technology; 2) Conduct key business activities through Internet-related technology, here key business activities refers to activities identified by value chain concept; 3) Maintaining business relationships through Internet-related technology. By selecting companies, this research will focus on theoretically useful cases, such as those that replicate or extend theory by filling conceptual categories. The conceptual categories include the dotcom retail continuum (de Figueiredo, 2000) and two distinctive e-business technology adopter groups: Internet pioneers and Internet pragmatists. Internet pragmatists refer to firms that have adopted the Internet in order to enhance existing products and processes. These are frequently labeled 'clicks-and-mortar' operations. Previous research conducted by authors referred to above (Tao and Hinton, 2004) and this paper both focus on the category of Internet pragmatists but in different e-commerce product continuum.

Based on the above mentioned criteria, two companies were chosen in the home appliance industry. The interviews to these two companies were conducted in two stages respectively: 1) two interviews in the period from July to August 2004; 2) three interviews in the period from May to June 2005. In these two stages, similar case study protocol has been followed.

The data analysis is influenced by grounded analysis, four principles of high quality analysis given by Yin (1994): namely use all relevant evidence, consider all major rival interpretations, address the most

significant aspects of the case and use your own prior expert knowledge and value chain theoretical framework.

2.2 Results

This section reports an initial analysis of the data. Company I is a multinational corporation manufacturing a wide range of household electrical appliances. The Company has leadership position in the Chinese home appliance industry. Company II is a subsidiary of Corporation A, which is one of China's leading manufacturers of household electrical appliances. Company II manufactures on electrical accessories.

Table 1. The key features of the case companies' use of e-business (EB). [OS: organizational structure; IS: information system; SCM: supply chain management; CRM: customer relationship management; EIP: enterprise information portal; PLC: product life cycle; PDM: product development management]

Company	EB strategy	Main EB applications	Benefits of EB adoption	Impacts on OS & industry	Obstructions of EB adoption
Company I (2004)	1) Adopt B2B & B2C on the whole corporation scale; 2) Use EB to create value; 3) Become an e-shopping mall (Aim 3).	1) B2C; 2) B2B: e-procurement; CRM to dealers and key customers; 3) E-marketing; 4) B2Employee.	1) Optimize supplier's network; 2) Better SCM and shorten PLC; 3) Save cost on raw materials; 4) Meet customers' special needs and increase customer base; 5) Provide timely and accurate information.	1) Redefine OS based on the business and information flow. 2) One of national role models of EB application; 3) B2C has little influence on the industry.	1) The low volume of B2C sales; 2) Conflicts between online and offline channels; 3) The limited coverage of the corporation's sales' network in the countryside.
Changes in 2005	1) Improve SCM; 2) Improve enterprise IS; 3) Improve the growth rate of online sales; 4) Cancel Aim 3.	1) Cancel the provision of personalized made-on-order; 2) Build online customer centre.	1) EB causes polarization of companies in the industry through shortening PLC, improving company's brand name and customer services.	1) OS was often readjusted.	1) B2C sales volume improved by methods of charging delivery fee, marketing promotion and setting assessing benchmark.
Company II (2004)	1) Apply EIP; 2) Apply IT in the whole corporation; 3) EB strategy integrated into business strategy.	1) Online channel management to subsidiaries and dealers; 2) Manage dealer's inventory (Application 2); 3) B2Employee.	1) Improve working efficiency; 2) Change employees' concept on IT; 3) Contribute to company's brand name.	1) Established an independent IT department and a commercial department; 2) Competitors feel the pressure of adopting EB.	1) Cooperation from dealers: channel conflicts; 2) The employees' concepts and working habits.
Changes in 2005	1) Standardize IS and integrate systems; 2) Enforce the implementation of the systems; 3) Add new systems such as PDM.	1) Adopted EIP and e-procurement. 2) Improved in B2C; 3) Adjust Application 2.	1) Further improve on efficiency and shorten order handling time; 2) Cost saving on procurement; 3) Optimize supplier's network; 4) Realize information integration and real time information sharing.	1) Have minor impacts on OS although OS is subtly adjusted continuously.	1) To maintain the security of EIP; 2) To contribute to implement management concepts.

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Both companies are pioneers in applying information systems and business management concepts in their respective sectors. Table 1 shows the key features of the case companies' use of e-business based on the interviews in 2004 and 2005 respectively.

The key common themes identified are: 1) Improving supply chain management is currently the key concern in terms of e-business application. This includes sharing data, integration and collaboration with upstream and downstream companies. Figure 1 shows the key e-business applications in the value chain of the industry. 2) The companies have become more pragmatic in terms of e-business application. They return to the fundamentals of business. This was reflected in two areas. A) They set up more practical. i.e. they gave up the ambitious aims of becoming an e-shopping mall, managing dealers' inventory and taking personalized order. B) They have focused on integrating and optimizing enterprise information systems with the aim of building up solid foundation for e-business application. 3) They have emphasized the importance of integrating business process with e-business application which is best reflected by the function and the design of the IT department. In Company I, IT promotion department and the business process department are integrated. In Company II, IT department is defined as the management information department. 4) They emphasize the importance of implementing information systems or e-business from a whole enterprise perspective rather than from an individual subsidiary company perspective with the aim of saving resources of the whole enterprise. 5) Both enterprises lack formal evaluation system to the overall e-business application although they have evaluation indices to each small project. Moreover, they don't think it is a necessity to have a comprehensive evaluation system for the overall e-business application. 6) Both enterprises have mentioned brand as one of their main sources of competitive advantage. And e-business applications contribute to building and maintaining their brand name. 7) Finally, both enterprises have no example to follow in terms of e-business application. They have to explore e-business through learning by doing.
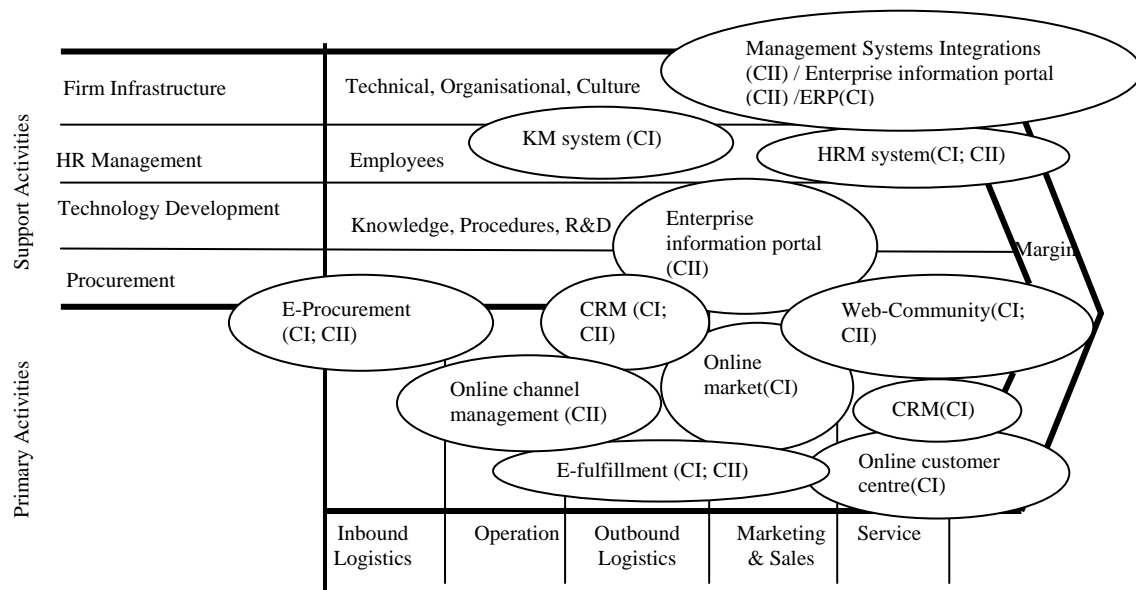
Figure 1. E-business applications in the value chain in Chinese home appliance industry. [Company I: CI; Company II: CII; enterprise which has adopted a particular e-business application is stated following the application.]

Meanwhile, differences of e-business application exist between these two companies. 1) Although e-business application has influenced organizational structure of both enterprises, the extent of influences is different. In Company I, the whole business process and organizational structure have been re-defined accompanying e-business adoption. In Company II, organizational structure has not been redefined thoroughly. Only some adjustments have been made to establish two new departments. 2) Different stages of e-business strategies have been adopted by these two companies. To Company II, the main aim of e-business application is to support business operation. Hence, the key is to let its supply chain run smoothly. So, Company II has no strong interest in B2C. While to Company I, besides the aim of supporting business operation, it also explores opportunities of using e-business to create business value. Hence, Company I

keeps on exploring B2C. 3) Different aims of e-business application are also reflected on the detailed e-business applications in each enterprise (shown in Figure 1). As it is shown on Figure 1, Company II has mainly adopted enterprise information portal, e-procurement, CRM, and online channel management to manage its value chain. These applications have improved the efficiency of the value chain. Accompanying the adoption of enterprise information portal, the information among different systems has been integrated. While Company I has further explored e-business applications facing end consumers along its value chain besides the main applications have been adopted by Company II.

3. CONCLUSION

This research has begun to explore the main e-business applications within Chinese home appliance industry and their impact on competitive advantages. As Figure 1 shows, in general, the value chain framework is useful to identify and categorize possible e-business applications in the industry. In this industry, e-business adoption is necessary for leading companies to improve operational efficiency. They firmly believe that e-business applications are contributing to their gaining competitive advantage. Meanwhile, they realize that the key to understand e-business concept is that e-business is only a method to solve problems arising in the company. Hence, they need to take a pragmatic approach and focus on the fundamentals of the business. Nonetheless, further work needs to be done on closing the gap between understanding and analyzing the reality and the actual gaining of competitive advantages from the applications. Further analysis of this data is planned to explore these issues in greater detail.

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REFERENCES

Amit R. and Zott C., 2001. Value Creation in E-Business. *Strategic Management Journal,* Vol.22, No.6/7, pp 493-520.

CINIC (China Internet Network Information Center), 2002. http://www4.cnnic.net.cn/resource/develst/cnnic200107rep-3.shtml accessed on 21 April 2004.

CINIC (China Internet Network Information Center), 2005. http://www.cnnic.net.cn/resource/develst/cnnic200107rep-3.shtml accessed on 20 April 2005.

de Figueiredo J. M., 2000. Finding Sustainable Profitability in Electronic Commerce. *Sloan Management Review,* Vol.41, No.4, pp 41-52.

Eisenhardt K. M., 1989. Building theories from case study research. *Academy of Management Review,* Vol.14, pp 532-550.

Ethiraj S. et al, 2000. *The impact of Internet and electronic technologies on firms and its implications for competitive advantage*, The Wharton School. Available from: http://knowledge.wharton.upenn.edu/PDFs/977.pdf, accessed 05 April 2003.

Kauffman R. J. and Walden E. A., 2001. Economics and electronic commerce: survey and directions for research, *International Journal of Electronic Commerce,* Vol.5, No.4, pp 5-116.

Steinfield C. et al, 2002. The dynamics of click-and mortar electronic commerce: opportunities and management strategies, *International Journal of Electronic Commerce,* Vol.7, No. 1, pp 93-119.

Tao Y. and Hinton M., 2004. Exploring sources of competitive advantage in e-business application in Mainland Chinese Real Estate Industry, *Proceedings of International Conference on Electronic Business,* Beijing, China, pp 655-660.

Yin R., 1994. *Case Study Research: Design and Methods,* (2nd Edn), Sage, Thousand Oaks.

Zwass V., 1996. Electronic commerce: structure and issues, *International Journal of Electronic Commerce,* Vol.1, No. 1, pp 3-23.

PROBLEMS PROSPECTS AND DEVELOPMENT OF e-COMMERCE – CASE STUDY OF SOUTHERN AFRICAN DEVELOPMENT COMMUNITY (SADC)

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ABSTRACT

E-commerce is revisited taking into account of existing published research work, mostly encompassing the area of definition, functions, benefits, problems, prospects and development of e-commerce. E-commerce is a part of e-business, which is using and sharing complex information through the services of internet so as to bring the Business to Consumer (B2C) as close and faster as possible. As a paper less business, it creates many ethical, moral and cultural problems in addition to mistrust. It is located that the users of internet in Africa compared to the rest of the world is negligible. Within Southern African Development Community (SADC) region, except Mauritius, Seychelles and Republic of South Africa, other countries are not extensively using the internet and hence, not much e-commerce can be traced within those countries.

1. INTRODUCTION

E-commerce is a trade based on internet. It is the use of paperless information technologies to cut costs, improve the quality of goods and services, and respond faster to trading partners' needs. A trading partner is an organisation which is outside of our own business (Jack, 1998).

E-business is the use of technology infrastructure and applications to synthesize and optimize new and existing business process (Alan, 2001).   It covers business to business (B2B), business to consumer (B2C) and consumer to consumer (C2C). Of late, e-commerce is further extended to business to employees (B2E). The success of e-commerce depends on brand name (Fritz, 2000) of the product and the employees changing their traditional attitudes for pricing conventions (Vicki, 2001).   Many e-business relationships are highly collaborative, demanding the sharing of complex information, hence knowledge based trust plays a critical role for the success of e-commerce (Douglas, 2001).

E-commerce will reduce costs more so there will be major impact on the transactions cost as it through its online distribution service will reduce cost by 98% (Fritz, 2000). All the managerial ingredients for planning, co-ordination, control and communication are readily available in e-commerce channel, and management can make human and corporate decisions quickly.

2. PROBLEMS

E-commerce creates the problems of internationalisation. As the buyer and seller are from different countries, there will be ethical, moral, cultural problems. It has lead to cut-throat competition as many publishers are determined to get a bigger slice of the e-commerce pie (Steve, 2002). Though it has given rise to a boom in B2B, Qizhi and Robert (2002) are of opinion that e-commerce is confronted with problems such as "technology platform," adoption, and implementation. Some e-vendors failed to deliver the goods and

identified privacy violations (Foster, 2000). Wat *et al*, (2005) identified the risks such as resources, requirements, vendor quality, client server security, legal, managerial, outsourcing, physical security, cultural and re-engineering. Susan (2000) indicated the security as the biggest concern.

3. PROSPECTS

Internet growth has penetrated in all activities including the commercial farming involving more than 50% of internet world (Doluschitz et al., 2000; Commonwealth of Australia, 1999). Jay (2000) was of opinion that e-commerce develops its little brothers such as Window's products. E-commerce will have prospects if there are reliable buyers and sellers in electronic marketplaces and also facilitate automated transaction (Conan, et al, 2005).

4. DEVELOPMENT

The development of e-commerce and websites go together. They are a gateway to the Internet for B2B and B2C. The evolution of the number of www servers worldwide is a useful indicator of the growth of e-business and as on June 2004 there were over 51 635 000 websites worldwide (I-Ways, 2005). United States Department of Commerce data suggests a necessary precursor to the success of electronic commerce in active engagement of Internet activities by the population at large (Gray, 2004).

5. DEVELOPMENT ACROSS THE WORLD

Internet usage is well noticed in the developed countries such as USA, UK, Australia etc but not much impact in the developing nations and more so Third World Countries (UNCTAD, 2004). Table 1 highlights the poor usage of internet in Africa compared to the world wide usage and developing countries. Only negligible percentages of 0.018, 0.016, and 0.012 registered for years 2003 to 2001 respectively. Comparative study of internet usage per 10 000 people in developed countries and Africa shows that Africa registered negligible percentages of 0.033 and 0.028 for the years 2003 and 2002 respectively. When there is a poor usage of internet in Africa one cannot expect miracles in e-commerce in Africa.

It is further advisable to study usage of internet per 10 000 in selected countries in Africa, so that one can later identify the effect of e-commerce in SADC region in Africa

Table 1. Comparative Study of the Internet Users of Africa with World wide

Particulars	2003	2002	2001
World wide Internet Users (thousands)	**675 678**	**626 579**	**495 886**
Developed countries (thousands)	396 754	388 746	339 427
Developing countries (thousands)	246 290	209 556	139 317
Others (thousands)	32 634	28 277	17 142
From African Continent	**12 123**	**9 988**	**6 119**
% of Internet users in Africa compared to world users	0.018	0.016	0.012
% of Internet users in Africa compared to developed countries	0.030	0.016	0.012
Per 10 000 people in Developed countries (Numbers)	4 495	4 474	NA
Per 10 000 people in Africa (Numbers)	148	124	NA
% users per 10 000 people: Africa compared to Dev. countries	0.033	0.028	NA

(Source: United Nations Conference on Trade and Development Report, 2004

Table 2 has revealed that a few countries such as Seychelles and Mauritius have been more effectively using the internet compared to other countries in Africa. As these countries are islands and their location influenced the development and usage of internet compared to other nations in Africa. In China, Government actively participated in e-commerce education (Juhua, et al, 2004) where as the prime ministers of Japan and

Great Britain, the leading "E-Nations" in e-commerce development, signed an agreement to work together in promoting policies in e-commerce development (Stephen, 2004). Major transformation of the Greek economy is due to Information Communications Technologies (ICTs) (Dimitrios, et al, 2003).

Table 2: Internet Users per 10 000 (in numbers) in selected countries in Africa.

Country in Africa	2003	2002	2001
Algeria	160	160	65
Botswana	349	349	297
Egypt	393	282	93
Kenya	127	160	64
Mauritius	1229	1033	883
Namibia	338	267	246
Nigeria	61	35	10
Senegal	217	104	102
Seychelles	1 452	1 452	1 099
South Africa	682	682	649
Swaziland	259	194	137
Tunisia	637	517	424
Zimbabwe	430	430	87

(Source: United Nations Conference on Trade and Development Report, 2004)

The extensive literature review revealed that there is insignificant e-Commerce research in Africa more so in SADC region, hence this research attempts to bridge the gap by taking up the development of e-Commerce in SADC region as a topic for research.

6. SADC REGION AND E-COMMERCE DEVELOPMENT

Southern African Development Community consists of Angola (ANG), Botswana (BOT), Congo (DRC), Lesotho (LES), Malawi (MAL), Mauritius (MAU), Mozambique (MOZ), Namibia (NAM), Seychelles (SEY), Republic of South Africa (RSA), Swaziland (SWA, Tanzania (TAN), Zambia (ZAM) and Zimbabwe (ZIM). Problems and developments were analysed in relation to the government commitment, public interest, national and international organisations participation, and evident active e-commerce development initiatives within the country and the same is presented in a condensed form in Table 3.

Table 3. Comparative Study of the problems and development of e-Commerce in SADC Region

	Government Commitment	Public Interest	National/International Organizations	e-Commerce development
ANG	Slow ICT development. No e-Commerce planned (Govt. to Business (G2B).	TeleCom	Trial agreement with IMF	Ebo Net 2000. LANs. Ebo Net first ISP
BOT	Govt regulates through B TA. ICT policy waiting for Pariliament approval recommended-focus on e-Health, Education, Tourism, Govt. No e-Commerce G2B.	Participation of Private Sector encouraged. Botswana Inf. Society.	Bus. Advertiser, UNNET, Botsnet provide internet connectivity.Info Bot largest ISP-GIABotswana & Mega. AfricaInternet Connectivity, joint initiative by COMESA and SADC. USAID Leland.	Users 15-20 thousands. E-Commerce firms. Maitlamo project recommended new ICT project with in their policy document.
DRC	ICT very minimal. World Economic Fourm-NEPAD E-Readiness Policy Programme, 2003. No appropriate policies.	Information Not Available (INA)	Internet connectivity joint project COMESA and SADC. No national interest working group.	Not much development
LES	Min of Trade & Industry established e-Commerce. No G2B e-commerce. No policies to enhance trust in digital	INA	International gateway at Lesotho Telecommunication Corporation. Cisco Internet for Internet Networking training	2000 users including 32 small and the Central Bank of Lesotho. & Lesotho Highlands

	economy.		women.	Development Authority.
MAL	Govt committed to invest in e-Govt & e-Commerce. Malawian Telecom Authority.	INA	International Computers Ltd, British Company.	Two net works 30 000 sub-scribers. ISPs 5000 sub-scribers.
MAR	Govt. committed. E-Govt, e-Com. E-Commerce has international status. & gets tax benefits. Off-shore e-Commerce development.	Ebene Cyber City. Inf. & Communication Technology Authority	Business Parks three agreements with India. RSA Certification Agency. SARegional Telecom African Connection I UN IT Policy	Internet access for residential & business. E-commerce, e-Marketplace and e-Hub.
MOZ	E-Commerce occupied sixth place. No e-Commerce G2B.	INA	13 International Internets. Cisco Internet Networking.	Little activity
NAM	On line contracts not accepted by law. National Accreditation body for ICT. Got committed.	ISPs and Polytechnic hosting services	White skilled person have ties with South Africa & Germany	Limited local market targeting to SMEs
SEY	Govt. committed to invest in e-Govt & Com. Have security technology.	INA	Africa connection initiative SADC's telecom. Regional harmonization.	Users can connect. Impact of e-Comm. Offshore activities.
RSA	Govt. committed ICT to play a vital role in society. Maintained privacy of e-Commerce transactions.	INA	40 Internet domain in World Cisco internet. US AID Leland Internet project. UN It Policy.	Planned to for 1.82 million. Discovery Channel Stores e-Com .
SWA	WTO commitment on telecom. No e-Commerce G2B.	INA	INA	2000 users including 32 small & medium.
TAN	Exists in e-Medicine & Commerce.	INA	INA	Acknowledged Base for Decision makers.
ZAM	Association for Progressive Communications.	INA	INA	INA
ZIM	Govt & people committed.	NA	NA	Users 4 m. people.

(From Web sites of the countries under study)

6.1 Government Commitment

It is located that government commitment towards e-commerce within the region is very low. Majority of the countries within the region have very minimal e-commerce activity or none at all. The governments are failing to provide appropriate policies for infrastructure for ICT's nor policies that enable trust in a digital economies at the same time maximizing benefits, except, for Mauritius, South Africa and Seychelles. Mauritius and Seychelles have further proven their commitment to e-commerce by planning e-commerce activities among their governments, local business, and international businesses while the rest of SADC is failing to do so. South Africa's e-commerce's activity is almost as that of the developed country, big portals, however there is no evident government related e-procurement in place. Finally, one country that is actively trying to develop and implement e-commerce and ICT friendly environment is Botswana with its new ICT policy which is currently awaiting parliament approval.

6.2 Public Interest

In the area of public interest not much literature was available except for Botswana where Botswana Information Technology Society (BITS) is actively trying to involve the private sector in e-commerce and ICT participation development at large.

6.3 National and International Organizations

In most cases it is evident that national and international organizations do participate but it is not clear where their contribution is failing to stimulate the development of e-commerce in the SADC region. One may blame the failure on poor government policies towards e-business and poor public interest, and high ICT prices within the region.

6.4 E-Commerce Development

Overall e-commerce development is still very low in the SADC region except in the previously mentioned countries of Mauritius, Seychelles, and South Africa. SADC and Africa at large represent a very low percentage of world internet users, *see table 1.*

7. CONCLUSIONS

In Africa there is a growing tendency of using IT and it was noticed that the potential gains for the economy throughout Africa are immense (Stephens, 2004). World Bank has been planning e-commerce developments by means of providing wireless Internet opportunities to developing countries (Mohsen, 2004). Even the developed country like Singapore, on line marketing (e-commerce) is still in its infancy (Lydia, et al, 2005).

At a sub-regional level, SADC and Common Market for Eastern and Southern Africa (COMESA) have both adopted a variety of measures to improve the use of ICTs, most notably:

- SADC's model telecom legislation which has been adopted by a majority of member states and is therefore a legally binding protocol.
- The formation of the Telecommunication Regulators Association of Southern Africa (TRASA) which acts as a forum for regulators in the region to exchange information and experience.
- The ComTel project to develop the terrestrial telecommunication links between neighboring states in COMESA, harmonize and upgrade the cross-border information systems in transport, customs, import/export and trade.
- SADC has announced plans for a single currency by 2016 (Southern Africa Monitor, 2005). This will boost e-commerce in this region if adopted.

8. FURTHER RESEARCH

As seen from the above study that there is not much e-commerce studies in the SADC region except for Mauritius, Seychelles, and South Africa. As identified that there are many hindrances for the development of e-commerce in general and more so in SADC region, it is felt that further research is necessary by taking each country in SADC region as a subject of study. The authors of this paper have made a maiden venture of studying Botswana as a case study. Readers interested may kindly go through the paper "Challenges Facing B2C E-commerce in Botswana" which identified factors militating against B2C in Botswana and to locate ways of improving B2C transactions in Botswana.

REFERENCES

Alan, L.H., 2001. Finally, Someone knows what he's talking about. *Hydraulics & Pneumatics*, Vol. 54, No.12, pp.4-4.

Commonwealth of Australia, 1999. *Use of Information Technology on Farms, Australia.* Canberra: Australian Bureau of Statistics.

Conan, C.A., Douglas, L.D., James, V.H. 2005. Marketplace and technology standards for B2B e-commerce: progress, challenges, and the state of the art. *Information & Management*, Vol. 42, No. 6, pp.865-875.

Dimitrios, B. 2003. Information Technology Penetration and E-commerce Developments in Greece, With a Focus on Small to Medium-sized Enterprises. *Electronic Markets,* Vol. 13, No. 4, pp.309-324.

Doluschitz, R., and Pape, J.2000. Erfolgspotentiale fureCommerce im Agrargewerbe. Working paper, Department of Farm Management, University of Hohenheim.

Douglas, A.H., 2001. Trust in the Networked Economy: Doing Business on Web Time. *Business Horizons*, Vol. 44, No. 2, pp. 38-44.

Foster, E., 2000. While some kids were left waiting for Santa, many e-tailers delivered on time. *InfWorld*, vol. 22, No.7, pp121-123.

Fritz, W., 2000. Electronic Commerce – Threat To European Electrical And Music Retailing? *European Retail Digest*. Vol, 25, pp. 65-67.

Gary, M., Grant, C.N., and Scott, J.S. 2004. United States Internet Penetration, *Applied Economics Letters,* Vol. 11, No. 9, pp.529-532.

I-Ways. 2005. Internet Use Rising Among Developing Country Firms, But E-Business Lags. Digest of Electronic Commerce Policy and Regulation, Vol. 28, pp.24-26.

Jack, S., 1998. Tapping the power of Commerce. *Association Management*, Vol. 50, No. 1, pp. 86-92.

Jay, G. 2000. Microsoft's Little Bro. *Business Week,* No. 3711, pp.44-45.

Juhua, C., Yong, H., and Wei, W. 2004. E-Commerce Education in China. *Journal of Electronic Commerce in Organizations,* Vol. 2, No. 2, pp.65-77.

Lydia, G., Daphne, L., Lingtay, K., and Har, S.W. 2005. Online Marketing: A Boon or Bane for Business in Singapore? *Asia Pacific Business Review*, Vol. 11, No. 3, pp.327-347.

Mohsen, K. 2004. The Wireless Internet Opportunity for Developing Countries. *I-Ways, Vol 27, No. 1, pp.17-20.*

Qizhi, D., and Robert, J.K, 2002. B2B E-Commerce Revisited: Leading Prespectives on the Key Issues and Research Directions. *Electronic Markets,* Vol. 12, No. 2, pp.67-83.

Southern Africa Monitor. 2005. SADC Currency by 2016. Vol. 10, No. 4

Stephen, T. 2004. UK and Japan Working Together as Leading E-Nations. *I-Ways*, Vol. 27, No. 1, pp.15-16.

Steve, S., 2002. Making Context King… or…Can Relevance Engines Make Content Pay Off? *EContent*, Vol. 25, No.5, pp. 44-45.

Susan, B. 2000. E-commerce more talk than action. *Pensions & Investments*, Vol. 28, No. 5, pp.32-36.

UNCTAD, 2004. *E-Commerce and Development Report.* United Nations, Geneva.

Vick, R., 2001. E-commerce success requires cooperation. *American Metal Market*. Vol. 109, No. 46, pp. 4-8.

Wat F.K.T., Ngai. E.W.T., and Chong, T.C.E. 2005. Potential risks to e-commerce development using exploratory factor analysis. *International Journal of Services Technology & Management,* Vol. 6, No. pp.1-1.

Zim Observer. Aug 2005. E-Commerce Struggling to take root in Zimbabwe

World Economic Forum-NEPAD E-Readiness Policy Programme, 2003

AN INVESTIGATION OF THE FACTORS AFFECTING THE ADOPTION OF B2C E-COMMERCE IN SADC COUNTRIES: CASE STUDY OF BOTSWANA

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ABSTRACT

The explosion in E-Commerce utilization has necessitated a considerable amount of attention, especially with regards to the performance of different economies in the global e-market place. Studies show that developed economies of the west have fully integrated the use of e-means in economic transactions, while developing countries, especially in the African continent have not attained a good level of integration in the global e-market. This study seeks to carry out a factor analysis of challenges to the adoption of business to consumer (B2C) e-commerce in Botswana. The study reveals that the following factors constitute challenges to the adoption of e-commerce in Botswana: Internet Marketing Factor (16.748%), Organizational Factor (14.319%), Internet Logistic and Access Factor (10.926%), Security and Legal Factor (10.278%), Customer Demographic Factor (9.673%), Internet Development Factor (6.267%), Media Reporting Factor (5.465%); with extraneous factors impacting about 26.323% . The study proposes some recommendations that could facilitate the adoption of ecommerce by organizations in Botswana.

KEYWORDS

B2C (Business-to-Consumer), E-commerce, SADC, e-market place

1. INTRODUCTION

Majority of studies conducted in electronic commerce were in developed nations (Hawk 2004), while predictions point to a significant growth in e-commerce in developing countries in the first decade of the twenty first century (McConnel 2000). Previous studies have identified the following factors to militate against the actualization of e-commerce, especially in developing countries: consumer mistrust of local internet service and products (Pavlou 2003); uneven diffusion of internet across countries and poor ICT infrastructure (Rose and Straub 2001, Garcia-Murillo 2004, Dutta and Roy 2005); unorganized electronic marketing (Rovenpor 2003); government policies
and low credit card penetration (Hawk 2004). Mahmood *et al.* (2004) indicate that trust and economic conditions explain more than 80% of variability in online shopping behavior.

The hypothesis that business and consumer mistrust of the local internet service plus low local market are negatively impacting the use of e-commerce in Botswana appears to be worthy of study. Among other things it is assumed that mistrust of the local internet services could have been triggered by poor network infrastructure, while low local market is due to generally low population of Botswana. Recent studies have established that developing nations need to concentrate on providing access to technologies and imparting ICT skills, in order to provide for successful blended learning (combination of e-learning and phase to phase lecturing) as a means of preparing the populace for the global electronic marketplace (Seleka G.G and Gianini D. 2005).

This study attempts to carry out an investigation of the factors that impact on the adoption of Business-to-consumer (B2C) e-commerce in SADC countries, with emphasis on Botswana. We further suggest ways by which e-commerce adoption can be facilitated. The results of the study would be useful to businesses, government, investors, researchers, and consumers in improving the viability and operations of the B2C E-Commerce in Botswana.

2. METHODOLOGY

The data collection instrument for this research is the questionnaire, which was administered to product/service organizations in both public and private sectors of Botswana. Various industries that have the potentials of e-commerce adoption in their businesses are included in the population of the study. The sampling frame is organized according to job positions in the organization, which form sampling strata. Two hundred questionnaires were distributed to staff of fifty establishments, which were randomly sampled, with a person sampled from each stratum within an organization. Ninety seven questionnaires were properly filled and returned for the purpose of analysis, at an average rate of two questionnaires per organization. The reliability of the data was evaluated using the Chronbach's alpha, which showed a very high reliability (α = 0.9386).

The following variables relating to ecommerce adoption were identified through literature search and utilized for the purpose of analysis: level of funding available for retail development on the internet (lfd), senior management's level of commitment to e-commerce (smc), the company's internet development strategy (ids), level of human resources available (hrs), web design skills of company personnel. (wds), the management vision of the usefulness of the internet (mvs), suitability of product range for internet retailing (spr), concerns about security aspects (csa), concerns about legal and liability aspects (cll), costs of development and computer networking technologies (cdn), limited knowledge of e-commerce models and methodologies (lke), conviction about the benefits of e-commerce (cbe), company's logistical infrastructure (cli), company's target customers' levels of access to the internet (cai), company's target customers' levels of computer literacy and internet awareness (ccl), gender of company's target customers (gcc), age of company's target customers (acc), the current size of on-line market place (csm), the maturity of internet market (mim), other retailers' on-line retail activities (ora), credit card penetration (ccp), technical reliability of the internet (tri), web developer's promotional offers (wdp), media reporting about the positive and negative aspects of the Internet (mrp).

The factor analysis by principal components is adopted for the evaluation of the factors that affect the adoption of B2C ecommerce by the sampled organizations. The primary goal is to obtain some factors each of which would load on some variables affecting internet adoption with a view to determining the impact of each variable on the adoption of ecommerce in Botswana. The following statistics were generated for the purpose of analysis: Correlation matrix, Kaiser-Mayer Olkin (KMO) and Bartlett's test, Communalities, Initial factor loadings, Rotated factor matrix, The factor score coefficient matrix, eigenvalue and percentage variance of factors.

3. RESULTS AND DISCUSSION

The factor analysis of the data was carried out using Statistical Package for Social Sciences (SPSS) Version 11.0. The Bartlett's test produces a χ^2 of 1240.225 with a significance level of 4.6254E-22, which shows that the sample taken from the total population under study is adequate. The KMO test produces a measure of 0.860, which further confirms the adequacy of the sample. The results obtained from the Bartlett's test and KMO test also indicate the suitability of the application of factor analysis.

The analysis of the correlation matrix shows that the highest correlation of 0.687 exists between "other retailers' online activities" (ora) and 'the maturity of the internet market' (mim). The least correlation of 0.102 exists between 'conviction about the benefits of e-commerce' (cbe) and "gender of target company's customers" (gcc). The implication is that "other retailers' online activities" is very likely to share the same factor with 'the maturity of the internet market'. On the other hand, 'conviction about the benefits of e-commerce' is not likely to share the same factor with "gender of target company's customers".

Table 1. Communalities

	Initial	Extraction
LFD	1.000	.658
SMC	1.000	.789
IDS	1.000	.743
HRS	1.000	.703
WDS	1.000	.744
MVS	1.000	.678
SPR	1.000	.699
CSA	1.000	.834
CLL	1.000	.756
CDN	1.000	.773
LKE	1.000	.735
CBE	1.000	.673
CLI	1.000	.706
CAI	1.000	.778
CCL	1.000	.675
GCC	1.000	.769
ACC	1.000	.695
CSM	1.000	.778
MIM	1.000	.707
ORA	1.000	.775
CCP	1.000	.704
TRI	1.000	.737
WDP	1.000	.710
MRP	1.000	.863

Extraction Method: Principal Component Analysis.

Table 2. Rotated Component Matrix (Varimax)

	Component						
	1	2	3	4	5	6	7
LFD		.681					
SMC		.645					
IDS		.713					
HRS		.631					
WDS		.488					
MVS		.676					
SPR			.600				
CSA				.864			
CLL				.789			
CDN						.735	
LKE			.416			.522	
CBE		.598					
CLI			.505				
CAI			.758				
CCL			.632				
GCC					.739		
ACC					.725		
CSM	.762						
MIM	.729						
ORA	.751						
CCP	.678						
TRI	.539						
WDP	.721						
MRP							.806

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

In factor analysis, there is a set of factors, which is generally referred to as 'common factors', each of which loads on some variables. There is another set of factors, which are extraneous to each of the variables. The proportion of the variance of a variable explained by the common factors is called the 'communality' of the variable. The communalities shown in Table 1 ranges between 0 and 1, where 0 indicates that the common factors explained none of the variance and 1 indicates that all the variance is explained by the common factors. For instance, the communality of the 'level of funding available for retail development on the internet' (lfd) is 0.651 (65.1%). This implies that 65.1% of the variance in lfd can be explained by the extracted factors. Thus, the level of funding available for retail development on the internet can therefore be attributed to the overall impact of the extracted factors, while the remaining 34.9% can be attributed to other factors, which are extraneous to funding (lfd).

The initial factor extraction is achieved by two different approaches for replication purpose, namely; the Mcriterium and Ncriterium. Mcriterium was adopted in obtaining a component matrix, consisting of seven factors. In order to obtain a meaningful factor loading, the principal component matrix is rotated by orthogonal transformation by varimax, promax, equamax and quartimax. However, the results obtained from the rotation by varimax appear to be more meaningful for interpretation, and is therefore used for the purpose of this analysis.

The rotated matrix by varimax is presented in Table 2, which shows the following seven factors with the variables that load on each factor: *Internet Marketing Factor* [the current size of on-line market place (csm), the maturity of internet market (mim), other retailers' on-line retail activities (ora), credit card penetration (ccp), technical reliability of the internet (tri), web developer's promotional offers (wdp)]; *Organizational Factor* [level of funding available for retail development on the internet (lfd), senior management's level of commitment to e-commerce (smc), the company's internet development strategy (ids), level of human resources available (hrs), web design skills of company personnel. (wds), the management vision of the usefulness of the internet (mvs), conviction about the benefits of e-commerce (cbe)]; *Internet Logistic and Access Factor* [company's logistic infrastructure (cli), company's target customers' levels of access to the internet (cai), company's target customers' levels of computer literacy and internet awareness (ccl), suitability of product range for internet retailing (spr), limited knowledge of e-commerce models and methodologies (lke)]; *Security and Legal Factor* [concerns about security aspects (csa), concerns about legal and liability aspects (cll)]; *Customer Demographic Factor* [gender of company's target customers (gcc), age of company's target customers (acc)]; *Internet Development Factor* [costs of development and computer networking technologies (cdn), limited knowledge of e-commerce models and methodologies (lke)]; *Media Reporting Factor* [media reporting about the positive and negative aspects of the internet (mrp)].

The seven factors identified are interrelated and the effect of one factor could impact on another factor. For instance, 'limited knowledge of e-commerce models' loaded on both Factor 3 and Factor 6. This is

because knowledge of e-commerce models would affect internet development and equally affect internet access.

It is noted that a factor model can be generated as a linear combination of the original variables. Factor scores produce a factor coefficient matrix, which can be used for estimating the performance of each organization in relation to B2C e-commerce. This is achieved by forming a linear equation of the weighted standard scores of the organizations on the variables. If the standard scores of the *ith* organization in the twenty four variables under consideration are $s_{i,1}$, $s_{i,2}$, $s_{i,3}$,…,$s_{i,24}$, then its performance in each of the seven factors denoted by C_j, j = 1,2,3,..., 7 is defined by:

$$C_1 = (0.015) s_{1,1} + (-0.127) s_{1,2} + (-0.090) s_{1,3} +... + (-0.041) s_{1,24}$$

$$C_2 = (0.279) s_{2,1} + (0.188) s_{2,2} + (0.312) s_{2,3} +... + (-0.068) s_{2,24}$$

$$C_3 = (0.002) s_{3,1} + (0.161) s_{3,2} + (-0.061) s_{3,3} +... + (-0.099) s_{3,24}$$

$$C_4 = (-0.170) s_{4,1} + (0.094) s_{4,2} + (-0.128) s_{4,3} +... + (-0.033) s_{4,24} \qquad (1)$$

$$C_5 = (0.003) s_{5,1} + (-0.113) s_{5,2} + (0.223) s_{5,3} +... + (-0.023) s_{5,24}$$

$$C_6 = (-0.069) s_{6,1} + (-0.220) s_{6,2} + (-0.163) s_{6,3} +... + (0.136) s_{6,24}$$

$$C_7 = (0.012) s_{7,1} + (0.174) s_{7,2} + (-0.011) s_{7,3} +... + (0.735) s_{7,24}$$

In an attempt to evaluate the percentage contributions of each factor to the overall adoption of e-commerce by the organization, the eigenvalues and percentage variance of each factor is generated. The eigenvalues represent the sums of squares of factor loadings and they are used to indicate how well each of the identified factors fits the data from the sample. It is noted that the seven factors contribute a total of 73.677% to the ability of the organization to adopt e-commerce. The remaining 26.323% is thought to be the contributions of some extraneous factors that are not identified by this study. The details of the effects of the factors are as follows: Internet Marketing Factor (16.748%), Organizational Factor (14.319%), Internet Logistic and Access Factor (10.926%), Security and Legal Factor (10.278%), Customer Demographic Factor (9.673%), Internet Development Factor (6.267%), Media Reporting Factor (5.465%). Internet marketing variables such as the current size of on-line market place, the maturity of Internet market, other retailers' on-line retail activities, credit card penetration, technical reliability of the Internet, and web developer's promotional offers impact a great deal on the ability of the organizations to adopt e-commerce especially in economies that are cash driven such as Botswana. Such economies are characterized by lack of trust in credit transactions, thus resulting in poor credit card penetration (Cloete and Courtney 2002, Garci-Murilo 2004). Organizational issues have equally been identified to affect e-commerce adoption (Doherty 2000, Zhuang and Lederer 2004); however in developing countries such as Botswana, such effects are compounded by the lack of exposure of top management on the benefits, and logistics of e-commerce. Customer characteristics and worries about the security of transactions made over the internet are key factors that affect the adoption of e-commerce, especially when the press often orchestrates the negative aspects of internet transactions. However, the state of e-awareness in Botswana is growing fast (SADC 2002, Ifinedo 2005), which implies organizational and customer characteristics would in the near future be enhancing factors in the adoption of ecommerce.

3. CONCLUSION AND RECOMMENDATIONS

The factor analysis by principal components has been applied in the evaluation of the adoption of B2C e-commerce in Botswana. A system of equations that is suitable for measuring the ability of organizations to adopt e-commerce has been derived from the factor score matrix. The study shows that Internet marketing factor and organizational factors constitute major challenges to the adoption of e-commerce in Botswana. The SADC countries have placed a lot of emphasis on e-readiness, and Botswana is a fast growing economy that is fast moving from group 2 to group 1 e-readiness status in the SADC region (SADC 2002). With less than 2% of the population utilizing credit cards (Ifinedo 2005), it becomes obvious that Botswana still remains a cash economy, which makes participation in international e-trading somewhat difficult, thus

making it difficult to fully utilize the potentials and opportunities provided by the existing levels of ICT infrastructure

IT infrastructural development has been a major point of emphasis in Botswana in recent years. However, a paradigm shift is needed in social attitudes and skills levels, vis-à-vis technology in both private and public sectors of the economy. Furthermore, government and financial institutions could evolve workable policies aimed at repositioning the financial mechanisms of the economy in order to take advantage of the globalization of credit card facilitated marketing.

REFERENCES

Clote E (2002), Small Business' Acceptance and Adoption of e-Commerce in the Western-Cape Province of South-Africa. *EJISDC*, 10(4) 1-13.

Doherty N, Ellis-Chadwick F, Hart C (2000); An Investigation of the Factors Affecting the Adoption of E-Commerce amongst UK-based Retailers.

Dutta A, and RoyR (2004); Process-Oriented Framework for Justifying Information Technology Projects in e-Business Environments. *International Journal of Electronic Commerce*, 9 (1) 49.

Garcia-Murillo M. (2004); Institutions and the adoption of electronic commerce in Mexico. *Electronic Commerce Research Journal*, 4 (3) 201-219

Ifenado P (2005); Measuring Africa's e-readiness in the global networked economy: A nine-country data. *International Journal of Education and Development using ICT*, 1(1) (http://ijedict.dec.uwi.edu)

Hawk, S., (2004). A comparison of B2C e-commerce in developing countries. Electronic Commerce Research, 4 (3) 181-199

Mahmood M.A, Bagchi K,. Ford T.C (2004); On-line Shopping Behavior: Cross-Country Empirical Research. *International Journal of Electronic Commerce*, 9 (1) 9-30.

Pavlou, P. A. (2003). Consumer Acceptance of Electronic Commerce: Integrating Trust and Risk with the Technology Acceptance Model. *International Journal of Electronic Commerce*. 7 (3) 69-103.

Rose, G., and Straub, D.W. (2001) The Effect Of Download Time On Consumer Attitude Toward the E-Service Retaile. *e-ServiceJournal*. 1 (1) 55-76.

Rovenpor, J (2003); Explaining the E-commerce shakeout: Why did so many Internet-based businesses fail? *E-Service J.* 3 (1) 53–77.

Seleka G and Gianini D. (2005); Experiences with international online discussions: Participation patterns of Botswana and American students in an Adult Education and Development course at the University of Botswana. *International Journalof Education and Development using ICT*, 1(2) 163-184

SADC (2002); SADC e-Readiness Readiness Review and Strategy: Recommendations of the SADC e-Readiness Task Force

Serva M.A; Benamati J; Fuller M.A (2005); Trustworthiness in B2C E-Commerce: An Examination of Alternative Models. *The DATABASE for Advances in Information Systems*, 36 (3) 89-108

EMARKETING AND ECOMMUNITY

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ABSTRACT

The Internet becomes one of the essential channels for businesses. Internet shopping growth rate doubles at the beginning of 2005 in United Kingdom. Traditional marketing mix is coordinated with product, price, promotion and place strategies. Businesses now need Internet oriented strategies to attract and retain customers. The new Internet marketing (eMarketing) mix is considered as eProduct, ePrice, ePlace and ePromotion strategies. On the other hand, online communities (eCommunities) are flourishing in which shoppers express freely their experience on different kinds of products. Their comments and suggestions are to be taken seriously by businesses. In this paper, we introduce the eCommunity strategy in eMarketing and study eCommunities and the related technologies.

KEYWORDS

EMarketing, Ecommerce, Ecommunity, Strategies, BLOG and RSS.

1. INTRODUCTION

Business today around the world operates in a fast moving environment. The Internet becomes the basic communication tool. It revolutionizes how businesses operate, communicate and differentiate them in the high competitive world. In United Kingdom, retailers are facing a tough time. The sales in the high street chains are the worst in 22 years. On the other hand, Internet shopping growth rate doubles at the beginning of 2005 as reported by IMRG (Interactive Media in Retailing Group) recently. Organizations have to embrace Internet along with the physical base is the only solution to survive in the present competitive market. After the fall of Dot.com boom in 1999, Ecommerce (Electronic Commerce) reemerges as a significant phenomenon again. This phenomenal growth is resulted by the widespread availability of broadband and mobile telecommunication. In addition, web technologies are very advanced so that the online shopping experience is greatly improved. Shoppers can view products in 3D dimension with zoom effect. Furthermore the popularity of Apple iPod demonstrates that customers are willing to pay online. More and more customers are attracted to buy online. In the next section, we will introduce the eMarketing strategies.

2. EMARKETING

Traditional marketing mix is coordinated with product, price, promotion and place strategies. The Internet is changing the way in which merchandise strategically produce and promote products. Organizations now need Internet-oriented strategies to attract and retain customers. In the Internet marketing, eMarketing mix is proposed as follows:

2.1 eProduct Strategies

Regardless it is online or offline, the fundamental principle of product strategy is to make sales. Up until now, B2C, eTailers have been very successful as technologies develop further and eConsumer confidence inevitably builds. It is now becoming common to buy lottery or cinema tickets online or even car and home insurance. However, in the 1990s, brands are all been divided online or offline such as Coca-Cola, UPS and Sony enjoyed a very distinct position in relation to Amazon, eBay and Yahoo! In order to success in eProduct strategy, participants must:

- Have expertise in Customer Relationship
- Have sustainable long term strategy
- Be customised rather than standardised
- Have good supply chain management
- Have innovative solution to overcome the limitations of Internet

2.2 ePrice Strategies

In terms of pricing, websites should clearly provide information on product features, after-sales supports, pricing/payment terms and conditions for prospective buyer. 'In this new model, information or content is not merely transmitted form a sender to a receiver, but instead, mediated environments are created by participants and then experienced (Hoffman and Novak, 1996). Brennan et, al. (2003) also pointed out that more and better online data should inevitably lead to more effective customer relationship management (CRM) systems. In order to success in ePrice strategy, participants must:

- Consider lower the price while saving extra from non-shop advantages
- Balance customer satisfaction while keeping maintenance costs.

2.3 ePlace Strategies

Many products selling online would still be delivered physically by traditional logistical solutions but there are an increasing number of customers that will want to 'collect their purchases at tube/rail stations, the workplace, the post office and the petrol station' (R. Brennan et, al., 2003). In order to success in ePlace strategy, participants must:

- Consider alternative logistical solutions to replace traditional posting service
- Evaluate the right distribution activities based on company's particular industrial circumstances.
- Reduce stocking costs by applying Just-In-Time philosophy.

2.4 ePromition Strategies

Most organizations have realized that domain name is the first stage towards ePromition, a good recognizable domain such as orange.co.uk, egg.co.uk have successfully positioned the brand on the online worked. A proper 'non-pop up' advertisement is becoming important to attract potential customers rather than banner ads in 1990s. Web Public Relations (WPR)- eCommunity is another approach to promote over the Internet, such as up to date news and stories, customer feedback forum in each product link. In order to success in ePlace strategy, participants must:

- Have direct website promotion
- Build up Web Public Relations (WPR) i.e. eCommunity
- Obtained a good domain name
- Having customer authorised eMail distribution network

Together with broadband technology, eCommunity(Internet Community) could be the most dynamic and challenging eMarketing sector. The combination of low-cost access to increasingly powerful computing and networking capabilities combined with a deregulated internet has facilitated the rapid development of a new social phenomena, that of the online community (Plant, 2003).

3. ECOMMUNITY AND EMARKETING

In the twenty-first century communities are no longer constrained geographically (Szmigin & Reppel 2004) rather, with the development of Internet technology eCommunity is now the most popular Internet based association. The most important characteristic of eCommunity development is bonding, because people are grouped to share their own experience on specific product/service, Amazon.co.uk for example, offered 'customer feedback forum' for each of their online products with ranking system from 1 to 5 (1= very bad, 5= excellent). Awareness and identity bonding are essentially to do with getting customers while relationship and community bonding lie in the realms of customer retention and customer service (Sterne, 2000).

3.1 The Concept of eCommunity

In terms of business, the concept of eCommunity is potentially an appropriate step forward in marketing's thinking with regard to the nature of relationships between and across suppliers and consumers (Szminin & Reppel, 2004). Since 2002, blog becomes the most common method to present individualized information over the Internet that enables other users to read and comment on.

On the other hand, the concept of customer bonding (Cross & Smith, 1995) is the route to achieving success on eCommunity through improving quantity of customer and customer loyalty. Some researchers argue that there is a term 'E-loyalty' that will be the secret weapon of the web (Reichheld & Schefter, 2000). Companies that try to understand what drives E-loyalty have a major opportunity to develop the most appropriate form of on-line community (Szmigin & Reppel, 2004).

Muniz and O'Guinn (2001) identify three core components of community as being:
- An intrinsic connection that members feel toward one another and difference from others not in the community.
- The presence of shared rituals and traditions, which perpetuate the community's history, culture and consciousness.
- A sense of moral responsibility, duty or obligation to the community as a whole and its individual members.

3.2 eCommunity Strategy

Based on the understanding of what eCommunity is about, there is a requirement to develop eMarketing strategy under eCommunity field in order to achieve success on implementation. The ultimate strategy is to satisfy customer's requirements at a profitable level. According to Armstrong and Hagel (1996) electronic communities meet four types of consumer needs. Communities of transaction facilitate the buying and selling process and deliver information related to this process; communities of interest involve a higher degree of interpersonal communication as participants interact intensively with each other on specific topics. For organisation, the development of eCommunity should focus on the interactivity and dynamic customer to customer (C2C) information exchanging availability. Bonime and Pohlmann (1997) argued that interactivity is any action that responds dynamically to user control. The importance of interaction in relation to customer bonding is that people are involved while interacting with one another.

On the other hand, the eCommunity should enable participants to 'create new stories, personalities or whole new environments and finally communities of relationship give participants the opportunity to share certain life experiences' (Szmigin & Reppel, 2004). This customer focused form of on-line community, however, has a real opportunity for long-term profit maximisation (Szmigin & Reppel, 2004). We should distinguish that eCommunity should focus on personalisation rather than common marketing customisation. Prahalad and Ramaswamy (2000) made an important distinction between customisation and personalisation which is pertinent for this concept: 'customisation assumes that the manufacturer will design a product to suit a customer's needs. Personalisation on the other hand is about the customer becoming a co-creator of the content of their experience'.

Therefore the critical success factor of eCommunity is the content of the community. To be more specifically, a successful eCommunity should involve personalized interactivity between user, community and other participants. Another potential advantage is that it brings the consumer back into the conversation. No longer do customers need to wait for the representations of the supplier; they have agency in their own right and can embark on conversations with one another, experts and the supplier (Levine et al., 2000). To achieve successful eMarketing strategy, it is important to focus on eCommunities as they hold the potential to foster not only business to consumer interaction, but also consumer to business interaction which can help strengthen the bond between customers and service providers and thus develop real 'conversations' among all the stakeholders within the community (Szmigin & Reppel, 2004).

4. A SURVEY ON ECOMMUNITIES AND THE TECHNOLOGIES

Online communities or eCommunities are flourishing in Ecommerce. Ebay, the most famous online auction, just celebrated its 10th anniversary in 2005. It has 150 million users worldwide and 10 million alone in United Kingdom. There are 3 million items for sale in the UK. eBay is very successful to maintain a huge and loyal community. Because of this, small companies are now used eBay as the window to sell local and overseas. The Inland Revenue has monitored the eBay sellers to determine which individuals are 'traders,' and therefore charge for tax. In eBay, community managers are appointed to monitor the responds to concerns of eBay users and implement the technical changes that none but the most hardcore eBay buyers are likely to notice. In addition, they are to lure new customers into the world of flogging (Williams, A., 2005). Also there are online chats, discussion board, news, and announcement and community program education. eBay has provided the community-like services to the customers. This shows that how important is the eCommunity to the success of eBay.

As the number one e-tailer since 2001, Amazon's annual sales are over $5billion in 2003. Since the customers mainly buy from the site. Amazon has adopted different approaches by providing a friendly atmosphere for the buyers. The features consists of
- Easy browsing, searching and ordering
- Reviews, recommendations, and personalization
- "Welcome back, Sarah Shopper" for the previous shopper.Recommendations of new books.
Customers are feeling comfortable to shop on Amazon web sites as it provides community-like atmosphere.

However the eCommunities outside eCommerce's sites have different pictures. Since the US presidential election in 2004, the opinion on eCommunites has become mainstream. According to blog tracking firm Technorati, there are currently 14 million blogs with 80,000 more being added every day. And 30 percent of all 50 million Internet users are blog readers. In short, a lot of people are reading and writing blogs (Nardini,2005). Blogs differ from forums or newsgroups in that only one entity can create new subjects for discussion on their blogs. While writing a personal blog can be fun, business blogging can be a powerful tool, allowing you to communicate with a significant number of consumers and achieve many of your business objectives. There are some additional advantages for businesses that blog:

- Word-of-mouse**. Message can reached hundreds if not thousands or millions of people.
- Speed. A blog can get the word--or your response--out immediately, much faster than any other form of media.
- Awareness and loyalty**. Purchasers of your product can read about it, post comments and engage in discussion. This creates a personal, open, honest, trust-building dialog.
- Feedback**. Businesses can find out immediately what people think of their company, products and ideas.
- Community halo-effect. Bloggers can cooperate and make the blogosphere a better place.

5. CONCLUSION

Blogs's popularity is continuing to grow after the events of July London Bombing and Hurricane Katrina in New Orleans. Blogs empower people to express their knowledge and opinions to anyone. This is important for marketers because consumers now control part of the conversation and can influence a brand's future based on their personal perceptions (Cohen, 2005). Marketers need to track blogs to capture the current and future trends. The way to start tracking trends on blogs is to visit a blog search engine such as Technorati or Bloglines. However the most effective way is to collect information via RSS feed whenever new information on the product or service appears on blogs.   RSS (Really Simple Syndication) is a family of XML files formats for Web syndication used by news websites and weblogs (blog). Through blogs, companies can gather market intelligence and target a niche audience to build brand. Blogs create not only more opportunities but also more challenges. Blogs can be an integral part of a marketing strategy.

REFERENCES

Armstrong, A. and J. I. Hagel (1996). "The real value of on-line communities." Harvard Business Review 74(3): p134-40.

Bonime, A. and K. C. Pohlmann (1997). Writing for new media. Chichester, John Wiley & Sons.

Brennan, R., P. Baines, et al. (2003). Contemporary strategic marketing. New York, Palgrave Macmillan.

Cohen, H.(2005). "Blog Marketing Strategies (and How to Measure Them)," May 12 at clickz.com retrieved at http://www.clickz.com/experts/crm/actionable_analysis/article.php/3504241 on 30 Oct., 2005.

Cross, R. and J. Smith (1995). Customer Bonding - pathway to lasting customer loyalty. Lincolnwood, IL, NTC Publishing Group.

Hoffman, D. L. and T. P. Novak (1996). A new marketing paradigm for electronic commerce. The Information Soceity.

Muniz, A., M. Jr, et al. (2001). "Brand community." Journal of Consumer Research 27(4): p412-32.

Nardini, J.(2005). Blogging 101 in enterprise.com at http://www.msnbc.msn.com/id/9581402/.

Peppers, D. and M. Rogers (1997). Enterprise one-to-one future. New York NY, Doubleday.

Plant, R. (2003). "Online communities." Technology in Society 26: p51-65.

Prahalad, C. K. and V. Ramaswamy (2000). "Co-opting customer competence." Harvard Business Review 78(1): p79-87.

Reichheld, F. F. and P. Schefter (2000). "E-loyalty." Harvard Business Review 78(4): p105-13.

Schleuning, C. (1997). Dialogmarketing - theoretische fundierung, Leistungsmerkmale und Gestaltungsansatze. Ettlingen, IM Fachvergag.

Sterne, J. (2000). Customer service on the Internet - building relationships 2nd ed. New York NY, Wiley Computer Publishing.

Szmigin, I. and A. E. Reppel (2004). "Internet community bonding: the case of macnews.de." European Journal of Marketing 38(5/6): p626-40.

Williams, A.,(2005). "60 second Interview on July 13," Metro, England, UK.

AN E-LEARNING ENVIRONMENT BASED ON AUTHORED INFORMATION

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ABSTRACT

This article proposes an innovative model of learning environment, based on the sharing of knowledge between people, forming a community around areas of interest to these people. Based on the level of interest of users in each other, the solution, by evaluating user content and its communication, promotes people who stand out as contributors to knowledge. Thus, the users of this environment form a web of specialists on a wide variety of subjects relevant to the user community. In this context, the tool is used to find people that have a certain kind of knowledge (*authored information*), as opposed to finding the information itself. This environment is part of the SONAR project, developed by C.E.S.A.R. (www.cesar.org.br) with the support of a government research institution (CNPq – www.cnpq.br), and will be called TruLog (www.trulog.com). A case study is proposed for the dissemination and sharing of knowledge within the e-Business area.

1. INTRODUCTION

In a world in which information and knowledge are competitive differentials, often responsible for the establishment of relationships, the need to learn is part of people's daily life. Therefore, the demand for learning environments which are in sync with daily tasks and easy to access and use is real and urgent.

The interactive information environments based on global communication webs such as the Internet constitute one of the most important sources for obtaining knowledge. However, an undifferentiated mass of information is not knowledge, just as a Web search tool which results in a large amount of information cannot be considered a learning environment. Knowledge is directly associated with the concept of intelligence, which can be seen as the result of the use, by a company or person, of its intellectual resources and its capacity to bring focus, clarity, and meaning to large quantities of information and data, turning them into relevant content. When this content is shared within a group of people or businesses, and incremented with interactivity and communication among the authors, we have a learning environment that is both powerful and able to bring true competitive advantages to all involved.

Within this context, this article proposes an innovative model of learning environment built through sharing the knowledge of the people who use it, forming a community around areas of interest to these

people. This environment proposes to merge two needs that are met separately by two important Internet solutions: Google (www.google.com), which is, above all, an information-finding tool, and Orkut (www.orkut.com), which is an environment for meeting people. Different from Orkut, in the model proposed by this article, people search for other people who possess knowledge about a given subject and, through these people, find the information they seek. Different from Google, all the information found will be associated with the user who referred it and, therefore, all the information will have authorship. Based on the level of interest of users in other users, the solution promotes people who stand out as knowledge contributors via an implicit evaluation performed automatically by the application, forming a web of specialists on a wide variety of subjects relevant to the community that makes use of the application. This environment is part of the SONAR project, developed by C.E.S.A.R (www.cesar.org.br) with the support of a government research institute called CNPq (www.cnpq.br), and will from now on be referred to as TruLog (www.trulog.com).

This article is organized into five sections. Section 2 describes the functional and non-functional requirements of the TruLog environment. The technology involved is presented in Section 3. Section 4 presents some case study proposals, one referring to the context of this conference itself. Lastly, Section 5 presents the conclusions and final considerations of this article.

2. TRULOG REQUIREMENTS

Different types of technology information and advances thereof have been applied to the development of learning environments [3][4][5]. The architectures proposed based on the LMS and SCORM (www.adlnet.org) models incorporate functional elements in common with the one-directional teaching model (teacher-student), such as the implementation of conventional components, such as classrooms and evaluation tests, in addition to the constant preoccupation in integrating other solutions that use these models. Other models associate e-learning environments with administrative management, broadcast courses, virtual conference tools, or even applications that involve concepts of knowledge management [6], based on categorizing information and ontologies [1][2]. However, e-learning environments should not be limited to using new technology to support conventional models of learning, but should be attuned to market demands and the personalized behavior of users. TruLog, taking real learning needs and the type of behavior of Internet-based environments as its premise, focuses on meeting the following requirements:

Functional
- Facilitate construction of an information base elaborated collectively by users, in order to share and disseminate successful experiences;
- Facilitate the emergence of various study and learning dynamics, through the implementation of digital environments which favor effective engagement of the participants in these activities;
- Provide synchronous and asynchronous communication environments among the users;
- Raise the quality of shared information, with evaluation of the content produced.

Non-functional
- Performance: provide efficient response time for accessing data and information;
- Scalability: support different platforms and resources, as well as large numbers of participants;
- Extendibility: allow other solutions and third party products to be easily integrated into the environment's platform;
- Flexibility: adapt to different scenarios and learning needs, on various themes and using diverse sources of information, such as files, links and original content.

Based on these requirements, three functional modules can be pointed out as essential to the TruLog environment: Content, Communication, and Evaluation. For each of these modules, functions were proposed that would maximize the ability to meet the aforementioned requirements, as shown in the use-case diagram in Figure 1.
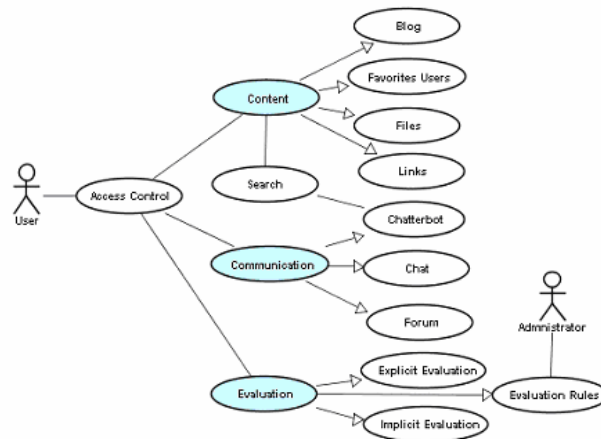
Figure 1. Use-case diagram for the TruLog e-Learning environment.

2.1 Content

To access the TruLog environment, users will need to register to receive a login and password. This function is represented in Figure 1 by the use-case *Access Control*. Once logged into the environment, users may include content through four areas: *Blog*, for the content elaborated by the users themselves; *Files*, for including files in various formats, such as documents, images, spreadsheets, etc.; *Links*, including links to other websites; and *Favorite Users*, used to indicate other TruLog users (authors), who show expertise in subjects of interest to the logged user. All the content will be associated to one or more keywords (labels), informed by the users upon inclusion or indicated by the system based on an artificial intelligence algorithm [11]. In this environment, users may also associate any content to a theme created by them. User-created themes will be organized into a list of subjects to make finding specific information easier. All the functionalities for content maintenance will be made available to users through an editing interface.

Users may perform searches in any area of content, including the chatterbot knowledge bases. Searches can be performed for keywords. The result of a search will always be a list of authors, ordered by the number of points each has in the evaluation system, from highest to lowest. The keywords searched for will be highlighted in each area of content of the selected user.

Finally, TruLog will offer an online clipping service, as part of TruLog's integration with a system developed at C.E.S.A.R., which consists of a structured search tool based on an information extraction algorithm [10]. This functionality aims to add dynamic content to each user's TruLog area.

2.2 Communication

This is a fundamental module for TruLog, since interactivity among participants is key to this environment's success. The communication module presents three main functionalities: online chat, chatterbot [9] and forums. Different from the chat, which offers an interactive environment for synchronous communication among users, the chatterbot uses artificial intelligence technology to create an individual robot which, based on a knowledge base provided by the user, allows asynchronous interaction among TruLog users and robots which represent users. This way, if a user searches for an author in a given subject and he is not, at that time, logged in to TruLog, the user can talk to this author's robot, and thus access the knowledge that the author registered in its knowledge base. Besides these two functionalities, TruLog will also provide a tool for discussion forums.

2.3 Evaluation

User evaluation will be implicit. The application will monitor access to various content areas of each user, attributing points to the user based on access frequency. Some criteria were adopted for users' implicit evaluation score: number of clicks on links added by the user (10%); number of users who added the user to their "favorites" area: (25%); quantity of access to files made available by the user (20%); user's login frequency (10%); frequency of other users' visits to the user's page (5%); number of additions to user's blog (10%); number of other users' comments to a user's blog(10%).

These criteria, their relative weights, and the rules of implicit evaluation will be informed by the Administrator through a parameter interface and may be adjusted during the use of TruLog, according to the behavior of users in the environment. Based on these evaluations, TruLog will show, on its main page, a sample of specialists, dynamically pointing out a ranking of a number of authors of greatest interest to TruLog's public.

3. TECHNOLOGY INVOLVED

In order to meet the non-functional requirements of performance, extendibility, scalability, and flexibility mentioned in Section 2, TruLog's architecture will follow coding conventions for the Java™ programming language, as defined by Sun™ (http://java.sun.com/docs/codeconv). The application will use the MVC (Model-View-Controller) architectural project pattern (http://java.sun.com/blueprints/patterns/catalog.html). To this end, the application will use Struts, an open-source framework for the development of web applications [ref]. For searches of the content generated, the search engine Lucene (www.javaworld.com) was chosen. Lucene integrates directly with Web applications, and can be used as the core of any search functionality, and works with any kind of text data (HTML, Word, Excel, PDF, and XML).

All the system's business rules will be derived from the requisites and use-case documents, via modeling patterns geared towards responsibilities. This branching will use GRASP, whose main patterns are *Information Expert, Creator, Low Coupling, High Cohesion* and *Controller* [7].

Manipulated-data persistence will be handled by *PostgreSQL* as SGBD. Since PostgreSQL is a relational SGBD, the system will use *Hibernate*, a tool for relational object mapping, which will be responsible for converting the relational data from PostgreSQL to a Java™ language object, and vice-versa. Besides these technologies, we also used *Quartz*, an open-source API for scheduling and managing background processes, and *Program D*, the implementation of the A.L.I.C.E bot engine for the chatterbot.

TruLog's architecture is totally based on open patterns and the use of components, allowing new components to be integrated into its architecture in the future.

4. PROPOSALS OF TRULOG CASE STUDIES

The TruLog environment is still in development, with completion planned for January 2006. Initially, the proposal is to make it available to the general Internet public, with support from content-based communities which want to be partners, and from communication advisors to promote and publicize the tool. However, it is important to point out that TruLog may be applied to different contexts and communities without the need for any type of change in the application. Following this line of thought, we can apply a version of TruLog to any other previously formed communities. For example, this environment can be used by the authors and those interested in this conference, e-Commerce 2005, focusing on the suggested themes (for example, Barriers to e-Business, Business-oriented e-Commerce, Cases in e-Commerce, Consumer-oriented e-Commerce, etc.) and guiding TruLog users in the creation of associations of these themes to their content. As a result, a community could be built around this conference, which would not end after the conference proper, remaining active through the participation of the authors, interactions, and information generated before, during, and after the event. In addition, the web of e-business specialists that would result from this community could be open to the public of other conferences in the area, promoting a much wider range of e-business knowledge and opening up opportunities for a more complete mapping of studies, research, and cases in the area.

5. CONCLUSION

TruLog is an application that is being developed by the SONAR project, initiated in September 2004, with the goal of providing a prototype to the Porto Digital public in January 2006. The SONAR project is part of a group of projects in the area of Innovation at C.E.S.A.R, with part of its technical team subsidized by a program of incentive to technological and industrial capacitation, from a government institution called CNPq. The initial idea of the project was to integrate solutions previously developed by CESAR, such as Clipping Online and a version of Chatterbot, within an environment which would support collaborative learning and that could easily be incorporated into the daily activities of its users. From the analysis of collaborative environments and user communities generated by solutions such as Google and Orkut, the consultants to the SONAR project had the idea to build an environment that, besides the answers to the questions, "where can I find information on a certain subject" and "where can I meet people?", could answer the question, "where can I find people who know about a given subject?" To implement this idea, the TruLog team has tried to preserve the focus of integrating solutions already developed by CESAR within a flexible, scalable and high performance architecture, based on open-source technology.

TruLog can be used in different contexts and applications, either in the context of public applications on the Internet, or in that of private applications on an intranet or extranet. However, at the conclusion of the SONAR project, a study will be made to implement this type of e-learning environment in business contexts. In parallel, the business model of this technology must be defined, in order to financially support the solution and its maintenance and evolution. That, however, is a new project.

ACKNOWLEDGEMENTS

REFERENCES

[1]   Abel M. et al, 2002. e-Learning and Organizational Memory. *ICAI Conference*, pp. 418-423.

[2]   Abel M. et al, 2004. Using Two Ontologies to Index e-Learning Resources. *IEEE/WIC/ACM International Conference on Web Intelligence (WI'04)*, pp. 549-552.

[3]   Bouras C. et al, 2001. Architectures Supporting e-Learning through Collaborative Virtual Environments: The Case of INVITE. *ICALT Conference*, pp. 13-16.

[4]   Cristea, V., 2001. A Collaborative Environment for High Performance Computing. *IWCC Conference*, pp. 47-59.

[5]   Koohang A., 2004. Create learning objects in collaborative e-learning settings. *Issues in Information Systems*, volume V, no. 2, pp. 582-590.

[6]   Lambe P., 2001. Knowledge Management Revisited: Part 2 – Building the People Infrastructure for Your E-Business. *Business Times magazine*, Singapore.

[7]   Larman, C.; Applying UML and Patterns; 3. ed.

[8]   Lopes C. V., 2005. Survey of Technologies for Web Application Development. *ACM Journal*, Vol. 2, No. 3.

[9]   Neves A., 2001. A Chatterbot for Virtual Learning Environment. *TELEMATICA-2001*, Saint Petesburgh.

[10]   Santos S. C., A Framework for Web-Commerce Search Brokers. *International Conference on Internet Computing (1)*, Las Vegas, pp. 261-267.

[11]   Teixeira I. et al, 2002. ActiveCP: A Method for Speeding up User Preferences Acquisition in Collaborative Filtering Systems. *SBIA Conference*, pp. 237-247.

ELECTRONIC WORD-OF-MOUTH: MOTIVES FOR READING CUSTOMER OPINIONS ONLINE: RESEARCH PLAN FOR THE UK MARKET

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ABSTRACT

Through Web-based consumer opinion platforms, the Internet enables customers to obtain electronic word of mouth from other consumers. Customer opinions are available to a vast number of other customers online, and therefore can be expected to have a significant impact on the success of goods and services. This paper describes a qualitative research plan to identify customer motives for reading other customers' online articulations from Web-based consumer opinion platforms. The research is conducted in three stages: narrative case method, online interview method and participant validity checks. This research constitutes the first phase of a larger research study that investigates motivation for reading and writing customer opinions online.

KEYWORDS

Electronic Word-Of-Mouth, Virtual Opinion Platforms, Virtual Community, Customer Online Articulation, Electronic Marketing.

1. INTRODUCTION

Customer comments articulated via the Internet are available to a vast number of other customers. This paper describes a qualitative research plan to identify customer motives for reading other customers' online articulations from Web-based consumer opinion platforms. This research constitutes the first phase of a larger research study that investigates motivation for reading and writing customer opinions online.

Virtual opinion platforms (consumer portals) have emerged as special Internet offerings that allow consumers to tap articulations (i.e., opinions, comments, etc.) of other consumers on a great number of goods, services, and companies. The illustrated study intends to investigate two main research issues:

a) What are consumers' motives for reading articulations on opinion platforms; what are the factors that have the most influence?

b) To investigate how much consideration consumers give such articulations when making buying or communication decisions.

A previous study by Hennig-Thurau and Walsh (2003) addresses some parts of these questions, and it will be discussed in detail in the literature review. However, it has some limitations:

1. *Hennig-Thurau and Walsh (2003) study began with a comprehensive literature review that led to the identification of eight motives for reading customer articulations.*

The researchers believe that additional qualitative research should be conducted to explore the motives for customer-to-customer interactions more fully and would act as a check on the validity of the motives Hennig-Thurau and Walsh (2003) identified.

2. *Hennig-Thurau and Walsh (2003) investigated German online communities only.*

An investigation of the study's findings in the United Kingdom is important as cultural differences between UK and German consumers may restrict the validity of their study findings in a UK context.

3. *The empirical results allow conclusions at a general level, but make it difficult to reach conclusions about specific consumption activities.*

To identify such differences, the researchers hope to differentiate between articulations on different goods and services (e.g. high involvement such as cars and computers and low involvement such as stationery etc.) and different phases of the consumption process (e.g. pre-purchase and post-purchase).

2. LITERATURE REVIEW

2.1 Electronic Word-Of-Mouth

Unlike traditional Word-of-Mouth (WOM), virtual WOM is more permanent and can be 'overheard' by many if it remains on the Internet for a period of time. This has implications for firms if there are negative articulations against their products, but it also gives customers the opportunity to respond to each other (and to changes in the products) over time.

Virtual opinion platforms are found in the United States, South America, Europe, and China. As of November 2003, the two largest German opinion platforms, ciao.com and dooyoo.de, had fast-growing archives of more than 6 million articulation that consumers can view at any time at no charge. (Hennig-Thurau and Walsh, 2003).

It has been maintained (Stauss 1997, 2000) that the wide dissemination of virtual opinion platforms and their high level of acceptance by consumers suggests that customer articulations on opinion platforms have an influence on consumer buying and communication behaviour and, consequently, on the market success of products.

Hennig-Thurau and Walsh (2003) maintain that virtual opinion platforms differ in minor ways but have similar basic functions. They enable consumers to read the opinions and experiences of other consumers relating to a wide range of product and service categories and to write their own reviews.

2.2 Motives for Reading Customer Articulations on Opinion Platforms

Motives are the "general drivers that direct a consumer's behaviour toward attaining his or her needs" (Assael, 1998). They significantly determine consumer behaviour and therefore are useful in explaining why consumers read other consumers articulations on opinion platforms. The research by Hennig-Thurau and Walsh (2003) used a deductive approach to examine motivations that would help explain why users read customer articulations on the Internet, especially on Web-based opinion platforms. These motives were:

2.2.1 Risk Reduction

With regard to buying decisions: (Schiffman and Kanuk, 1987), this motive results directly from risk-related theoretical considerations, where opinion leaders have favourable attitude toward risk, and striking relationships with innovativeness (Gatignon and Robertson 1985). It is also notable that risk preference as a characteristic of opinion leaders is significantly correlated with individual participation, and negatively correlated with stubbornness (Chan and Misra 1990).

2.2.2 Reduction of Search Time

Spears (2001) maintained that various factors correlated with time pressure have been identified, such as economic growth, the invasion of organizations and automation of everyday life and lifestyles (Gross, 1987).

2.2.3 Learning How a Product Is To Be Consumed

Granitz and Ward (1996) study shows that over 20 percent of the total words in on-line articulations were devoted to product recommendation and another 20 percent of the 204 customer articulations in a news groups were dedicated to discussions of how to use a product.

2.2.4 Learning What Products Are New In The Marketplace

It is a product-involvement motivation. Curiosity and novelty seeking explain why consumers need to learn what products are new in the marketplace (Schiffman and Kanuk, 1987).

2.2.5 Determine Their Social Position

Schiffman and Kanuk (1987) maintain that the social function of consumption is the source of other motivations. Thus, consumers might read product-related information on opinion platforms in order to evaluate the product and its associated social prestige.

2.2.6 Dissonance Reduction

Dissonance reduction is a motive that can be derived from the theory of cognitive dissonance (Sweeney et al. 2000). Dissonance can be reduced by neutral or unbiased information that confirms the consumer's assessment of a consumption situation or the soundness of the consumer's choice.

2.2.7 Remuneration

As many opinion platforms reward consumers, directly or indirectly, for reading contributions, the motivational character of monetary incentives has been demonstrated in numerous psychological studies (Deci et al. 1999), and therefore it may represent a motive for reading other consumers' online articulations.

2.2.8 Belonging to a Virtual Community

A motive that can be derived by applying social-psychological Internet related community research to readers of contributions who become members of a virtual user community. Granitz & Ward (1996) (p.161) explained that consumers might be turning to the Internet to interact with others who share their "consuming passions" in discussion groups such as those available in www.google.com (e.g. recreational groups; rec. and any topic groups; alt.) and www.usenet.com as well.

3. RESEARCH QUESTIONS

The researchers will investigate two research questions in this first phase of research:
RQ1)   What are consumers' motives for reading articulations on online opinion platforms?
RQ2)   Which motives for reading articulations on online opinion platforms have the most influence on consumers when making buying and communication decisions?

4. DATA COLLECTION METHODS

Exploratory qualitative research will be used to investigate and test the first two research questions. This will include investigation of the validity of the eight motives identified by Hennig-Thurau and Walsh (2003) and to investigate whether any further motives can be identified. Qualitative data will be collected by working online with individuals through e-mail and by 'chatting' one-to-one using real-time software. It is preferable that the respondents use IRC (Internet Relay Chat) software to take part in qualitative stage in this research. This allows the researchers to chat in real time with a group of people or one-to-one (Mann and Stewart, 2000) and makes it ideal for narrative case method and online interviews to be carried out. In cases where the participants prefer not to use IRC and refuse to be guided to download a package, the researchers will use e-mail as an alternative strategy. As a participation incentive, respondents will be granted ten pounds each. Access to respondents is already granted by top opinion portal website (Ciao.co.uk).

4.1 First Stage: Narrative Case Method

A multiple case study approach, which can be used widely to gain an in-depth understanding of one or more consumers, neo tribes or organisations (Newholm, 2005), will be adopted as the first phase of research

methods. a minimum of fifteen individual case studies will be considered. Data collection and analysis will have sequential stages to build a cumulative understanding of each consumer. At the first stage, participants will be sent an e-mail asking them to write narratives about their experience of reading customer articulations online. Personal narrative stories provide case histories from which to draw inferences about human behaviour (Hannabuss, 2000), and to develop, advance and/or disband theoretical perspectives of the phenomena being examined (Clandinin and Connelly, 1994). In this research, participants' narratives will be analysed and then categorised into themes. This will provide the basis for selection of questions for the semi-structured online interviews at the second stage.

4.2 Second Stage: Online Interview Method

Since research questions in this study are relevant to online behaviour, online interviewing can more closely target the population of interest; computer users in the UK who read customer opinions online. Consumer segments with access to the Internet are those that are difficult to engage through other data collection techniques, so online data collection should increase accessibility to Internet users (Tse, 1999; White, 2000).

This second stage of research will complement the previous narrative method; therefore, the initial respondents will enrol again in the online interview stage. The researchers have conducted an online pilot study on a convenience sample (Daymon and Holloway, 2002). The question schedule for the semi-structured online interview was developed from the literature (Hennig-Thurau and Walsh, 2003). After reviewing participants' stories, the core questions for each individual interview will be selected from this schedule. Demographic data will also be collected; age, gender, income and education.

4.3 Third Stage: Participant Validity Check

In the third stage, the meanings derived from a respondent's material will be summarised in a synopsis of approximately 400 words. A copy will be sent to the respondent and then will be invited to comment (Newholm, 2005). The narratives and interviews will be stored on a qualitative analytical database. Using this database software, the researchers aim to identify motivational factors and behavioural dimensions.

5. LIMITATIONS AND FURTHER RESEARCH

Further research in this area will have to consider the limitations of the present study. First, the findings of this research are difficult to generalise due to its qualitative nature. Second, the current study focuses solely on motives of reading customer opinion online, an examination of writing motives will be conducted in secondary phase of the research. Other limitations of the current research are; the reliance on one opinion portal, the necessity of using a small sample of participants, the need to contact respondents through a third party and the non-physical nature of online communication.

6. CONCLUSION

This research will use a qualitative narrative approach to build deeper understanding of consumer motivation to read in online opinion portals. The results of the study should have important managerial implications for opinion portal providers and commercial product providers in the UK. For companies offering goods and services, the structure of the Internet makes it possible for a company to follow customer interaction in a detailed way that is clearly not possible with traditional word-of-mouth. For opinion portal providers, the motives of customer online interaction are powerful predictors of the behavioural reaction in online communities. Therefore, platform providers should investigate their community's motive structure thoroughly in order to manage the essential elements in the interaction. Provisional results of this qualitative research will be presented at the conference.

REFERENCES

Assael, H., 1998. *Consumer Behaviour and Marketing Action*. 6th ed. Cincinnati: Thomson.

Chan, K.K., and Misra, S., 1990. Characteristics of the opinion leader: A new dimension. *Journal of Advertising*, 19, 6, 53-60.

Clandinin, D. Jean and Connelly, F. Michael, 1994. Personal Experience Methods, in: Denzin, Norman and Lincoln, Yvonna, eds, *Handbook of Qualitative Research* (Sage, London), pp. 413-427.

Daymon, Christine and Holloway, Immy, 2002. *Qualitative Research Methods in Public Relations and Marketing Communication,* Published by Routledge, London.

Deci, E.L. et al., 1999. A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation. *Psychological bulletin*, 125, 6, 627-668.

Gatignon, Hubert and Thomas S. Robertson, 1985. A Propositional Inventory for New Diffusion Research. *Journal of Consumer Research*, 11(March), 849-867.

Granitz, N.A., and Ward, J.C., 1996. Virtual community: A socio-cognitive analysis. *Advances in Consumer Research*, 23, 161-166.

Gross, Barbara L., 1987. Time Scarcity: Interdisciplinary Perspectives and Implications for Consumer Behaviour. *Research in Consumer Behaviour*, 2, 1-54.

Hannabuss, Stuart, 2000. Telling Tales at Work: Narrative Insight into Managers' Actions. *Library Review*, 49(5), 218-229.

Hennig-Thurau, T. and Walsh, G., 2003. Electronic Word-of-Mouth: Motives for and Consequences of Reading Customer Articulations on the Internet, *International Journal of Electronic Commerce*, winter 2003-4, Vol.8, No.2, pp.51-74.

Mann, Chris and Stewart, Fiona, 2000. *Internet Communication and Qualitative Research: A Handbook for Researching Online*. Sage Publication, London.

Newholm, T., 2005. Case studying ethical consumers' projects and strategies' in Harrison et al. *The Ethical Consumer,* Sage Publications, London. P107-123.

Schiffman, L.G., and Kanuk, L.L., 1987. *Consumer Behaviour*. 3d ed. Englewood Cliffs, NJ: Prentice Hall.

Spears, N., 2001. Time pressure and information in sales promotion strategy: Conceptual framework and content analysis. *Journal of Advertising*, 30, 1: 67-76.

Stauss, B., 1997. Global word of mouth. Service bashing on the Internet is a thorny issue. *Marketing Management*, 6, 3, 28-30.

Stauss, B., 2000. Using new media for customer interaction: A challenge for relationship marketing. In T. Hennig-Thurau and U. Hansen (eds.), *Relationship Marketing*. Berlin: Springer, 2000, pp. 233-253.

Sweeney, J.C. et al., 2000. Measuring cognitive dissonance: A multidimensional scale. *Psychology & Marketing*, 17, 5, 369-386.

Tse, A.C.B., 1999. Conducting electronic focus group discussions among Chinese respondents. *Journal of the Market Research Society*, 41, 4, pp. 407-15.

White, E., 2000. Market research on the internet has its drawbacks. *The Wall Street Journal*, 2 March, B3.

THE RISE OF MP3: EXPLORATORY STUDY AND RESERCH AGENDA

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ABSTRACT

The Internet/World Wide Web (Web) is an important way for the sharing and selling of products and services, including music, in crescent virtual communities. The MP3 standard is the world's most popular file format and allows many on-line individuals to access to music which they would otherwise be denied. Although electronic commerce (e-commerce) has received considerable research attention, the literature reveals that the relationship between the music industry and the consumers trough the Internet has not yet been sufficiently studied. This research contributes to a better understanding of the use of MP3 files as legal products and also as digital piracy. This paper considers the nowadays and the future use of MP3 and attempts to provide a research agenda.

KEYWORDS

E-Communities, E-Commerce, Music Distribution, MP3, Music, Consumer Behaviour, Internet Piracy

1. INTRODUCTION

Although the consequences of marketing to the Internet are not clear yet (Peterson et al, 1997), there is a consensus concerning the attractive and different environment for marketing activities which Internet represents (e.g. Ruiz & Soriano, 2002). More than 420 million people had Internet access in 27 countries in 2003 (Nielsen, 2003). Several studies have indicated that since 2000, the proportion of Internet users who shopped on-line increased globally by 50%. Forecasts of electronic shopping sales have ranged from $5 billion to $300 billion annually (Shim et al, 2002).

The most shopped products in the Internet are books, films (dvd) and music (cd). Music industry reveals big incomes from Internet shopping. Although in the past bandwidth restrictions have obstructed a massive distribution of music in digital form over the Internet, those times are now gone away. The improvement of digital technologies over the last decade, have been threatening the music industry. And as the «old» restrictions disappeared, consumers become more able to search, download and play high-quality music in accessible digital form directly from the Net. This is undoubtly accelerating the development of the Internet as an infortainment hub, whereby it is becoming the main conduit for both information and entertainment (e.g., Lam & Tan, 2001).

The record labels which made and sold CDs in the 1980s could not keep up with all the money flowing in. Once you signed up an artist and cut the master disk, the marginal cost of production was negligible. In the 1990s an acceleration of new independent record labels not only crowded the marketplace with niche products but also attracted artists with better terms because their break-even point was lower. Over the past few years, new and irreverent upstarts in the Internet began to rewrite the industry rules with an entirely new business model (Harari, 1999).

Music is one of the most important media trade in open networks, and the Internet users are more and more attracted to popular P2P[1] technologies to exchange music files (Serrão & Marques, 2004). Piracy has become an integral part of digital online culture. It has made the MP3 the world's most popular music file format and allows many individuals to have a broad online access to music which they would otherwise be denied (e.g., Lam & Moscicki, 2004). Hackers are interested in attack computers for many purposes but now they also want to get MP3 files (Schultz, 2002), and the hackers are not the only Internet users who search the Net to obtain MP3 files… its emerging an Internet subculture of audio piracy (Cooper & Harrison, 2001). But isn't it a very thin line, which we sometimes hardly can distinguish, between piracy and the free use of Internet (and the consequent easy access to free MP3)?

This paper presents an exploratory study that considers the different web sites to obtain MP3 files from the Internet.

2. THEORETICAL FRAMEWORK

2.1 Internet Shopping

The Digital Economy emergence, sustained in a new concept of enterprise organization, has in the Web and in the Internet its foundation and main operational sustainability (Domingues & Cordeiro Gomes, 2003). Some literature indicates that the collapse of some empires based on the Digital Economy may be the end of economical models sustained in the virtual organizations and the consequent return to the classical models and the old economy (e.g., Porter, 2001). But the Internet is still growing at a high speed and firms are investing millions into online presences to gain competitive advantage (Gervey & Lin, 2000). Almost every company has its own web site these days. The problem is that they often end there: many companies create a web site just to be present on the Web (De Wulf et al, 2002). And more… nearly 90% of web sites are developed without asking customers what they want (Korgoankar & Wolin, 1999). All companies want to be visible in the Internet and so it is not surprising that even the direct selling organizations which mainly rely on personal relationship to obtain sales are including the Internet as part of their marketing strategy, either to communicate with the salespersons or to promote the products and the business to the consumer (Alturas, 2003). Quelch and Klein (1996) analyzing the posture of the on-line companies, ended that the form how the Internet is explored by the companies depends a lot of its activity history. They suggest the existence of two different operation models: the first developed by multinational companies, that use the Internet initially as one more communication and information vehicle, and that only in a more advanced phase explore their potentialities in terms of commercial transactions; and the second adopted by start-ups (companies that appear addressed to the use of the Internet potentialities). These follow a posture based since the beginning in on-line transactions.

The Internet – and the MP3 standard in particular – is changing the music industry (e.g., Lam & Tan, 2001), and the threat posed by MP3 has provided all record labels with motivation to engage in learning and capability development in order to mitigate potential damage from this disruptive technology. In response, the stablishment of a web site is the record labels first step. The capabilities and features of these web sites can play a large part in captivating the customer retention and loyalty and given that e-distribution of digital content has a vast potential to increase efficiencies in distribution there is also inevitable price pressure in result (Easley et al, 2003). In 2001 a survey was conducted to determine how the availability of digital music files has changed the music consumption habits of collegial students. Findings revealed that nearly two-thirds of the subjects owned MP3 files at the time of the survey and that although having restricted incomes and easy access to free MP3s they expressed a willingness to pay for legal downloads from commercial sites (Gallaway & Kinnear, 2001).

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[1] peer-to-peer

2.2 The MP3 Standard

From project to the new "spiritual medium", the MP3 format generated around itself a new industry and an emerging paradigm change. The beginnings of the technology remounts to 1992 but it is the massification of the Internet, in the middle of the 90's, that gives rise to its visibility. However, it was not before the final of the past century that MP3 leaves the computer magazines - to turn to a global scale subject. Nowadays, the popularity of this format is fully accomplished. MP3 (or even other better compression method) it will substitute the music CD in a way such as cruel as the CD substituted the vinyl. We think it is just a matter of time. «How soon is now?», as Morrissey (The Smiths) would sing.

In 1992 the Moving Picture Experts Group approved the MPEG-1 norm, as the flag for the storage and digital access of images in movement with audio. MPEG Audio Layer III (or MP3) is the correspondent for the storage of audio clips with similar quality to the one of a musical CD.

In the next year (1993), at a time that Internet was used by over 20 million people, the first MP3 was created in an academical server of California. The responsible authors of the Internet Music Underground Archive aimed to turn a repository of independent artists' music, and planned to distribute all of these work freely at an international level.

During the next years we assisted to the creation of the MP3 Audio Consortium, and a "mailing list" was founded. It was created to discuss the specificities and potentialities of that digital format. The declaration of intentions refers that "none of us has a patent interest in copying music in an illegal way; we are squeezed simply by the special characteristics of the new half."

It has appeared in scene the first software able to reproduce MP3, the AMP MP3 Playback, created by Tomislav Uzelac, of Advanced Multimedia Projects. One of the today's most popular reproducers of MP3 is Winamp, which was programmed by Justin Frankel and Dmitry Boldyrev. It began by being a simple "freeware" (of free distribution) but early it turned to be a "shareware" (subject to an optional payment in case of being frequently used) to finance the bandwidth used for about 30 thousand downloads every day.

MPEG algorithms compress the data to form small bits which can be easily transmitted and then decompressed accurately and quickly to allow high-fidelity reconstruction. MPEG standards aim for a compression ratio of about 52:1, requiring the reduction of, for example, 7.7 MB to less than 150 KB. Approved in 1998 and 1999 respectively, MPEG-4 and MP4 are intended for very narrow bandwidths, speech and video synthesis, fractal geometry, computer visualization and artificial intelligence to accurately reconstruct images for minimal data (Lais, 2002).

Recently two new metadata standards appeared: MPEG-21 and PDF/A. Other standards of interest to the publisher and library communities are NISO Z39.87, which uses metadata to describe images; MPEG-21, an extension of earlier versions of the MPEG standard that uses XML to describe content elements; and PDF/A (PDF/Achievable), a version of Adobe's widely used PDF that should remain stable over time and therefore can be used for digital preservation purposes (Hawkins, 2004).

The ability to share files via Peer to Peer (P2P) systems has given the public means of acquisition that challenge the monopoly of major recording and distribution companies (Lam & Moscicki, 2004). Most of P2P search applications are dedicated to file sharing services. In these applications the contents usually consist of multimedia data (e.g. MP3 audio, MPEG video) and search is done using meta-information about them (e.g. song title, author, movie title) (Attardi et al, 2004). P2P refers to a technology that enables two or more peers to collaborate spontaneously in a network of equals (peers) by using appropriate information and communication systems without the necessity of central coordination (Schoder & Fischbach, 2003).

3. RESEARCH

3.1 Research Question and Methodological Considerations

We derive our basic research question: Can we found in the Internet a large choice of web sites which permit music consumers to download all the MP3 files that they want?

The exploratory research we propose was built after the literature research, and we decided not to derive any hypotheses because this is a preliminary step in a broader empirical research. At the time we will present

this paper, we will continue to this research, carrying on other studies which aim to apprehend many other questions such as the frequency they download and listen to MP3.

In order to find the major sites where music consumers can share and download MP3 files we use some well known search engines in the World Wide Web: google (http://www.google.com), altavista (http://www.altavista.com/), and yahoo (http://www.yhaoo.com/).

3.2 Findings

3.2.1 Paid Music Download

As we watch the incredible expansion on the exchange of free digital music files amongst thousands (or millions) of Internet users, the music industry, though its initial hesitation, hugged the protected digital download once and for all. Some musical groups have done the same «by their own hands», with the promise of high quality MP3. Despite the volume of businesses of this new reality is still residual, there is already «some voices» who predict that the veteran CD won't wait a lot to give, finally, showing us its last signs of life. In the last two years it was attended the proliferation of paid services, with the Apple iTunes, to lead a market that – in the words of the specialists - is in frank expansion. Therefore let us know the main platforms which we can use to accede to the music that, until recent times, we could only found in some selected music stores. I've found 14 web sites: **Napster** (*www.napster.com*); **Music Match** (*www.musicmatch.com*); **eMusic** (*www.emusic.com*); **WalMart** (*www.musicdownloads.walmart.com*); **Sony Connect** (*www.connect.com*); **Bleep** (*www.bleep.com*); **iTunes** (*www.apple.com/itunes*); **Streamwaves** (*www.streamwaves.com*); **Real Rhapsody** (*www.musicstore.real.com*); **MSN Music** (*www.music.msn.com*); **All Of mp3** (*www. allofmp3.com*); **mp3 Search** (*www.mp3search.ru*); **Sapo** (*http://musica.sapo.pt*); **Wippit** (*www.wippit.com*).

3.2.2 Free Music Download

Here we are, as so many other times in our history in the well-known game of the cat and the mouse. When a judicial order contained, definitively, the first apparel of Napster, the explosion of the "peer-to-peer" stopped being a forecast. They were profiled immediately alternatives to the "imprisoned father" and entirely free services like Audiogalaxy could reign during some time. Also by the pressure of the industry, this left legacy in the actual eDonkey, BitTorrent, LimeWire… and many other. It also left a lot of work for the tribunals. They've become the illegal options… at the short distance of a simple click that only a few can still resist. I've found 7 web sites: **eDonkey** (*www.edonkey.com*); **Shareaza** (*www.shareaza.com*); **Soulseek** (*www.slsknet.org*); **BitTorrent** (*www.bitconjurer.org/BitTorrent/*); **Kazaa Lite** (*www.filesharingplace.com/ downloads/kazaa_lite_k++.php*); **Emulate** (*www.emule-project.net*); **LimeWire** (*www.limewire.com*).

4. A POSSIBLE DISCUSSION

This research paper represents a first step towards the study of the importance of the MP3, the way it has been spreaded amongst Internet users and the responses from the music industry to this so-called problem. We are in the early stage of the research and we have focused our study on a particular group of web sites used by the music consumers. This choice inevitably limits the possibility to generalize any results beyond the target group. Although I've found 14 web sites were we can get paid music download and 7 web sites where we can get free music download.

Our findings indicate that there is a large range of choices paid and free to download MP3 files, and the music industry seems to have no means to end with all of those web sites which provide free MP3 files to the music consumers. Are we all becoming «pirates» or this is a natural way to use the incredible variety of resources that we can find in this huge e-community(ies)?

These empirical evidences could be relevant for e-commerce music firms who seek better marketing strategies including the Internet, and also to understand and predict post consumption behaviours and to the music industry that are still not dealing with Internet piracy. To sum up, we need to expand the scope of this research in order to test the reliability and external validity of the present results.

In future studies, in our empirical research, we aim to find some answers to many of the questions involving these virtual communities, such as what are the net consumers musical motivations and the frequency they download - for some price or for free - and listen to MP3.

We are living on the edge of incredible discoveries. In fact, an emerging (almost) new power is rising. As billions of bits come and go… we try to find our own way and to keep our balance. We really just seem to be in the dawn of the greatest revolution in the world of digital music (and multimedia in general). Are we ready for the next step?

REFERENCES

Alturas, Bráulio, 2003. Direct selling: From door to door to e-commerce. *Proceedings of the IADIS International Conference WWW/Internet 2003*. Lisboa, Portugal.

Attardi, G.; Esuli, A.; Hancu, L. and Simi, M,, 2004. Participatory Search. *In Proceedings of the IADIS International Conference WWW/Internet 2004*. Madrid, Spain, pp 643-650.

Cooper, Jon and Harrison, Daniel M., 2001. The Social Organization of Audio Piracy on the Internet, *In Media, Culture & Society*, Vol.23, Nº 1 (January), pp 71.

De Wulf, Kristof et al., 2002. Towards an integrative measure of E-commerce effectiveness. *Proceedings of 31st EMAC Conference*. Braga, Portugal.

Domingues, Luísa and Cordeiro Gomes, José C., 2003. A New Integrated Business Model. *Proceedings of the IADIS International Conference e-Society 2003*. Lisboa, Portugal.

Easley, Robert F.; Michel, John G. and Devaraj, Sarv, 2003. The MP3 Open Standard and the Music Industry's response to Internet Piracy, *In Comunications of the ACM*, Vol.46, Nº 11 (November), pp 91-96.

Gallaway, Terrel and Kinnear, Douglas, 2001. Unchained melody: a price discrimination-based policy proposal for addressing the MP3 revolution, *In Journal of Economic Issues*, Vol.35, Nº 2 (June), pp 279.

Gervey, Ben and Lin, Judy, 2000. Obstacles on the Internet. *In Advertising Age*, Vol. 71, Nº 16 (April), pp 12-17.

Harari, Oren, 1999. You say You Want a Revolution?, *In Management Review*, Vol.88, Nº10 (November), pp 30-33.

Hawkins, Donald T., 2004. Metadata Practices on the Cutting Edge. In *Information Today*, Vol. 21, Nº 7 (July/August), pp 28.

Korgoankar, Pradeep K. and Wolin, L. D., 1999. A multivariate analysis of web usage. *In Journal of Advertising Research*, March- April, pp 53-68.

Lais, Sami, 2002. MPEG standards. In *Computerworld*, Vol. 36, Nº 41 October, pp 36.

Lam, Calvin K. M. and Tan, Bernard C. Y., 2001. The Internet is Changing the Music Industry, *In Comunications of the ACM*, Vol.44, Nº 8 (August), pp 62-68.

Lam, Vi and Moscicki, Jerome, 2004. Rethinking Digital Piracy. *In Proceedings of the IADIS International Conference WWW/Internet 2004*. Madrid, Spain, pp 1003-1008.

Nielsen, 2003. Net Ratings 2003. http://www.nielsen-netratings.com/.

Peterson, Robert A.; Balasubramanian, S. and Bronnenberg, B. J., 1997. Exploring the Implications of the Internet for Consumer Marketing. *In Journal of the Academy of Marketing Science*, Vol. 25, Nº. 4 (Fall), pp 329-346.

Porter, Michael E., 2001. Strategy and the Internet. In *Harvard Business Review*, Vol. 79, Nº 3 (March), pp 63-78.

Quelch, J. and Klein, L., 1996. The Internet and international marketing. *In Sloan Management Review*, 38, pp 60-75.

Ruiz, Salvador and Soriano, Pedro J., 2002. Home shopping through Internet. Experience, attitudes and purchase intention. *Proceedings of 31st EMAC Conference*. Braga, Portugal.

Schoder, Detlef and Fischbach, Kai, 2003. Peer-to-peer prospects, *In Comunications of the ACM*, Vol.46, Nº 2 (February), pp 27.

Schultz, Eugene, 2002. Hackers target California, *In Computers & Security*, Vol.21, Nº 8, pp 681.

Serrão, Carlos and Marques, Joaquim, 2004. Comércio Electrónico de Música Digital – Abordagem ao Modelo de Super Distribuição. *In Proceedings of the IADIS Ibero-American Conference WWW/Internet 2004*. Madrid, Spain, pp 219-226.

Shim, J. P.; Shin, Yong B. and Nottingham, Linda, 2002. Retailer Web Site Influence on Customer Shopping: An Exploratory Study on Key Factors of Customer Satisfaction. *In Journal of the Association for Information Systems*, Vol 3, pp 53-76.

A STRATEGY FOR SEMANTIC DOCUMENT CLASSIFICATION IN AN ONTOLOGY-DRIVEN KNOWLEDGE MANAGEMENT SYSTEM

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ABSTRACT

In the last years, there have been a growing interest in ontologies as an artifact for human knowledge representation and a critical component in Knowledge Management, Semantic Web, Business-to-Business applications, and many others application areas. We have found that it is not possible to easily represent certain types of knowledge (skills or procedures) or to transform certain types of knowledge representation (knowledge contained in diagrams) into an appropriate ontological format. To overcome this problem, our proposal is to connect knowledge sources to the domain ontology associated with an Organizational Memory without forcing any transformation in the structure of the source itself. This connection will allow the semantic classification of knowledge sources so that when a user performs a query it is possible to recover the documents that have a higher probability of containing the answer.

KEYWORDS

Knowledge Management, Domain Ontology, Semantic Classification.

1. INTRODUCTION

In the last decade, Knowledge Management has become one of the most critical factors for success in organizations. Shorter products life-cycle, globalization and strategic alliances between companies demand a deeper and more systematic organizational knowledge management. Knowledge Management solutions based on Information Technologies are focused, in general, on Organizational Memories [Ale et al., 2004] that comprise heterogeneous knowledge sources (structured, semi-structured, and informal) to facilitate access, distribution, and reuse of knowledge. Nowadays, the problem is not the lack of information or knowledge, but the impossibility of manual tracking and analysis of innumerable knowledge sources.

Ontologies have been proposed as the answer to modelling and structuring problems related to Knowledge Management. They provide a formal conceptualisation of a particular domain that can be shared within and between organizations. They are also a mean of providing the kind of formal semantics needed in sophisticated Knowledge Management systems and they constitute the conceptual backbone of a Knowledge Management infrastructure. There have been a growing interest in ontologies as an artifact for human knowledge representation and a critical component in Knowledge Management, Semantic Web, Business-to-Business applications, and many others application areas. Several research communities assume that ontologies are the appropriate modelling structure for knowledge representation. Nevertheless, little discussion has been made in relation to the range of knowledge that an ontology can represent successfully [Brewster et al., 2004].

Clearly, it is not possible to easily represent certain types of knowledge (for example, skills or

procedures) or to transform certain types of knowledge representation (for example, knowledge contained in diagrams) into an appropriate ontological format. It seems unlikely that a document containing, for example, a set of steps describing a certain task could be somehow transformed to become instances of a group of ontological concepts. To overcome this problem, our proposal is to connect knowledge sources to the domain ontology associated with the Organizational Memory without forcing any transformation in the structure of the source itself. This connection will allow the semantic classification of knowledge sources so that when a user performs a query it is possible to recover the documents that have a higher probability of containing the answer. In the next section, we offer an introductory vision of domain ontologies and the problems associated with them. Next, we present our strategy for semantic document classification along with an example. Finally, we discuss conclusions and future work.

2. DOMAIN ONTOLOGIES

Over the last decade, the word "ontology" has become a fashionable term in Knowledge Engineering community. Several definitions of ontology can be found and it can be seen that these definitions have changed and evolved over time [Corcho et al., 2003; Gómez-Pérez et al., 2004]. One of the first definitions is the one given by Neches [Neches et al., 1991] who defined an ontology as the basic terms and relationships comprised in a vocabulary of certain area along with the rules to combine those terms and relationships to define extensions of the vocabulary. A few years later, Gruber [Gruber 1993] defined an ontology as a explicit specification of a conceptualization. This definition became the most popular in the ontological community literature and was slightly modified by Borst [Borst 1997] who established that ontologies are formal specifications of a shared conceptualization. One of the most recent definitions [Fensel 2000] states that an ontology provides the elementary knowledge and the needed infrastructure to integrate knowledge bases independently of a particular implementation. Artificial Intelligence literature also contains several ontology definitions, many of which contradict one another [Noy et al. 2001]. In our case, we will define an ontology as an explicit and formal description of concepts in a particular domain, properties of each concept describing various features and attributes of the concept and restrictions for those properties.

The remaining question is how well ontologies can represent all organizational knowledge. Alan Newell [Newell, 1982] characterizes knowledge as a behavioural phenomenon. This vision of knowledge goes beyond the notion of "specification of a conceptualisation" of a concept enumeration and its relationships. From Newel perspective, knowledge does more than giving an enumeration of what exists in the world; it directly links objectives to actions. According to this, it is obvious that knowledge has an important procedural component. It is exactly at this point where a strict application of ontological representation shows its limitation. An important part of organizational knowledge sources are documents containing a type of knowledge that cannot be efficiently represented with an ontology. This valuable knowledge, in the form of procedures, skills, diagrams, etc., would be lost if we only try to find ontological concept instances in it.

To sum up, most intelligent systems are designed primarily to respond to questions from large corpus of knowledge. In these cases, ontologies provide most of the muscle necessary to construct complete systems. Nevertheless, in order to construct systems that solve real world tasks, conceptualisation is not enough. We must link our ontology to all kinds of knowledge in our organization.

3. SEMANTIC DOCUMENT CLASSIFICATION STRATEGY

As we said before, our goal is to link from a semantic point of view relevant organizational documents with a domain ontology that is the core of an Organizational Memory. In order to obtain this, it is necessary to explore the diverse ontology learning and population approaches since they will be the basis for concepts and relationship identification. These extracted concepts and relationships will be the input to our semantic document classification strategy.

There are several research works regarding concept learning from texts. The main exploited paradigms are contextual similarity [Reinberger et al., 2004] and the use of patterns that give some evidence of the presence of ontological concepts and relationships [Navigli et al., 2004; Cimiano et al., 2004; Ogata et al., 2004]. In relation to automatic annotation, there are some supervised machine learning approaches to

automate information extraction [Sabou, 2004]. However, in our opinion, these techniques rely on assumptions that are not completely compatible with our application scenario given the heterogeneity of knowledge sources associated with Organizational Memories. Consequently, we believe that it is necessary to count on a new strategy for semantic document classification that takes into account the inherent heterogeneity of knowledge sources. In order to reach our goal we have developed a strategy that comprises several steps: (a) documents pre-processing to obtain a more standardized form of plain text, (b) application of different techniques to identify the presence of ontological concepts in the text, and (c) ontological relationships identification and semantic classification of the document.

Due to the inherent complexity associated with semantics, the complete automation of knowledge acquisition still remains in a distant future [Staab 2004]. It is for that reason that our proposal presents a semi-automatic approach in which an ontology expert is part of the process. To illustrate our strategy, we present an example using a Travel ontology that contains concepts from the tourism area (available at http://protege.stanford.edu/plugins/owl/owl-library/index.html) and an extract of a web page of the same domain (available at http://www.baliforyou.com/bali/bali_beaches.htm).

3.1 Text Pre-processing

The pre-processing module allows natural language text preparation. In this sense, we intend to obtain a plain text in which special characters, abbreviations and/or acronyms have been eliminated to prepare the text for subsequent steps. This substitution is based on a list of the most common special characters, abbreviations and acronyms that could be customized for a given domain. Common examples of this substitution in the Travel domain are "Room Only" for "R.O.", "Bed and Breakfast" for "B&B", etc.

3.2 Tokenization and Lexical-Morphological Analysis for Concepts Identification

This phase is divided into two main steps: on the one hand, the tokenization of the text and, on the other hand, the lexical-morphological analysis of each token. The tokenization consists of dividing the text into single lexical tokens. This is an important task that involves activities such as sentence boundary detection, simple white space identification, proper name recognition, among others. After tokenization, a lexical-morphological analysis has to be done using a POS (Part-of-Speech) tool. In our case, we use the POS tagger provided by GATE (General Architecture for Text Engineering, available at http://gate.ac.uk/) which specifies if a term is a verb, an adjective, an adverb, or a noun. The GATE platform has been widely used as a basis for Information Extraction processes and content annotation management (see http://gate.ac.uk/business.html). It provides the fundamental text analysis technologies on which we have constructed our strategy. Since GATE´s POS tagger uses different tags from the ones used by WordNet (a tool used in subsequent steps available at http://wordnet.princeton.edu/index.shtml), it was necessary to define mapping rules between GATE and WordNet tags, for example:

GATE TAG [NN(noun singular), NNP(proper noun singular),
NNPS(proper noun plural), NP(proper noun), NPS(proper noun
singular)] ➔ *WORDNET TAG [<noun>]*

In order to identify ontological concepts within the tagged text we will focus on nouns. At this stage, using the synonyms set and hyperonymic structure provided by WordNet, we semantically expand every noun and perform a search in the ontological database. By doing this, we do not only identify exact ontological concepts occurrences but also derivations of the same word or even a synonym. In Figure 1, we present an example where the concept "beach" has been found with WordNet assistance. Following the same methodology we found other ontological concepts in the original text: Destination, Accommodation, Hotel, Surfing and Beach.
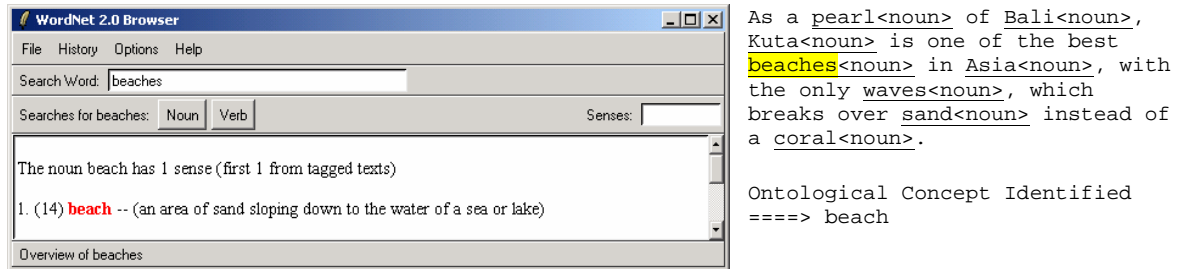
Figure 1. Noun expansion for concept identification

3.3 Relationship Identification and Semantic Classification

In this step, as is shown in Figure 2, we navigate through the domain ontology using the taxonomic structure in order to find relationships among previously identified concepts. By doing this, we aim to contextualize those concepts that, in another way, could not be related with other concept among the ones that were previously identified. In the example shown in Figure 2, we retrieve two more concepts that do not belong to the original text – Activity and Sports – but provide a context for the "Surfing" concept.

Once we have all the relevant concepts according to the domain ontology we search in the ontology database once more to retrieve other kind of relationships. As a result, we finally obtain the subset of the domain ontology that better models the document semantic content. After all relevant ontological concepts and relationships are identified we link the document to the domain ontology by adding the document identifier as an instance of each related concept, as is shown in Figure 2:
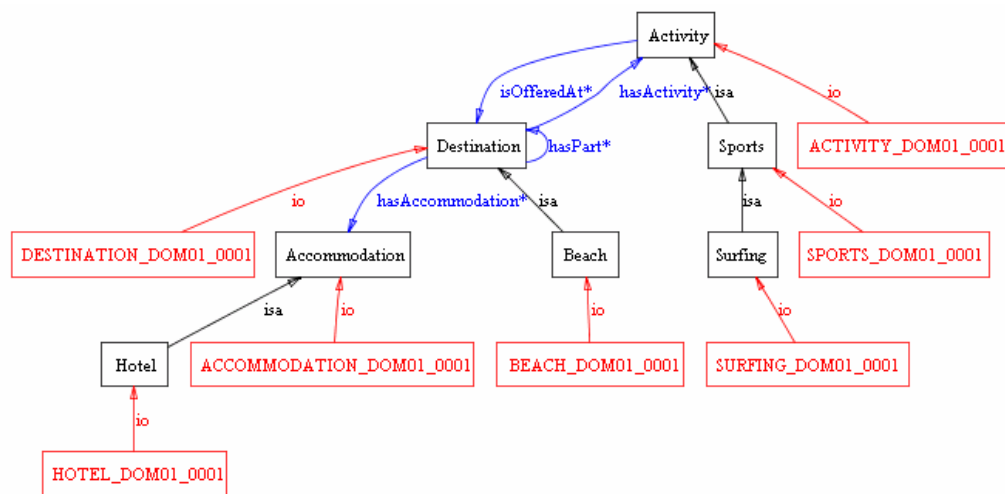
Figure 2. Document linkage

Each instance identifier will be composed by the name of the instantiated concept, a domain identifier (due to the existence of various knowledge domains inside the organization, each one with its own domain ontology) and a unique document identifier. These identifiers will allow a subsequent ontology-based semantic retrieval of organizational documents. The advantage of this classification strategy based on domain ontologies becomes evident if we compare it with an approach based on keywords frequency.

If we consider as representative those words with higher frequency, once we have eliminated stop-words, we obtain, as key concepts, "Kuta" (appears 8 times), "Accommodation" (appears 3 times), and "Tourist", "Offers", "Various", "Found", "Restaurants", "Bars", "Shops", "North"(appear 2 times).

As it is shown, several key concepts that appear as relevant in the domain model constituted by the domain ontology are lost due to their low frequency. In addition, with this kind of statistical analysis it is not possible to establish relationships among identified keywords.

4. CONCLUSIONS AND FUTURE WORK

Information Retrieval based on keywords as index terms is simple but relies on the idea that the semantics of the documents and the user query can be effectively expressed through sets of index words. At least, this is an optimistic simplification of the problem because a lot of the semantics in a document or user request is lost when we replace its text with a set of words. For this reason, it is not uncommon that documents retrieved on a keyword basis are frequently irrelevant. On the other hand, although ontology modeling is extremely valuable in the Knowledge Management field, the inherent limitations presented by domain ontologies to represent certain types of knowledge cause a large part of organizational knowledge sources to be unable to be incorporated into an Organizational Memory. It is for this reason that we have proposed an indexing strategy for knowledge sources (documents), independently of their content, that allows the linkage of these sources to the domain ontology incorporated in the Organizational Memory. This strategy may be also applied to various domains and could be useful on the Web where it would be possible to structure an arbitrary set of web pages according to a particular view of the world given by the domain ontology chosen.

In previous sections we have abstracted from the relationship between ontology evolution and the semantic indexing strategy. However, in any realistic application scenario, new documents that have to be classified will generate the need for new concepts and relationships. Terms evolve in their meaning, or take on new meanings as organizational knowledge evolves. It is clear that we will have to find solutions to problems regarding with the addition, change or elimination of ontological concepts. We see the document indexing strategy and the ontology evolution as a cyclic feedback process that has to be taken into account in any Knowledge Management initiative.

REFERENCES

Ale M. et al, 2004. Agent-Supported Ontology-Based Knowledge Management System. *Proceedings of ASIS 2004 and JAIIO 2004 (33º Jornadas Argentinas de Informática e Investigación Operativa)*, Argentina.

Borst W., 1997. *Construction of Engineering Ontologies*, PhD Thesis, University of Tweenty, Enschede, NL – Centre for Telematica and Information Technology.

Brewster C. et al, 2004. Knowledge Representation with Ontologies: The Present and Future. *IEEE Intelligent Systems.* Volume 19, Issue 1, Page(s):72 – 81.

Cimiano P. et al, 2004. Learning Taxonomic Relations from Heterogeneous Evidence. *Proceedings of 16^h European Conference on Artificial Intelligence*. Valencia, Spain.

Corcho O. et al, 2003. Methodologies, tools and languages for building ontologies. Where is the meeting point?. *Data & Knowledge Management*. Volume 46, Issue 1, Pages 41-64.

Fensel D., 2000. *Ontologies: Silver Bullet for Knowledge Management and Electronic Commerce*; Springer-Verlag; Berlin.

Gómez-Pérez A. et al, 2004. *Ontological Engineering: with examples from the areas of Knowledge Management, e-Commerce and the Semantic Web*. Ed. Springer-Verlag London Limited.

Gruber T., 1993. A translation approach to portable ontology specification. *Knowledge Acquisition*. Volume 5, Issue 2; Page(s) 199-220.

Navigli R. et al, 2004. Automatic Ontology Learning: Supporting a Per-Concept Evaluation by Domain Experts. *Proceedings of 16^h European Conference on Artificial Intelligence*. Valencia, Spain.

Neches R. et al, 1991. Enabling technology for knowledge sharing. *AI Magazine*. Volume 12, Issue 3, Page(s) 36-56.

Newell A., 1892. The Knowledge Level. *Artificial Intelligence.* Volume 18, Issue 1; Page(s) 87-127.

Noy N. et al, 2001. *Ontology Development 101: A Guide to Creating Your First Ontology*; Stanford University; 2001; http://protege.stanford.edu/publications/ontology_development/ontology101.pdf

Ogata N. et al, 2004. Ontology Express: Statistical and Non-Monotonic Learning of Domain Ontologies from Text. *Proceedings of 16^h European Conference on Artificial Intelligence*; Valencia, Spain.

Reinberger M. et al, 2004. Discovering Knowledge in Texts for the Learning of DOGMA-inspired Ontologies. *Proceedings of 16^h European Conference on Artificial Intelligence*. Valencia, Spain.

Sabou M., 2004. Extracting Ontologies from Software Documentation: A Semi-Automatic Method and its Evaluation. *Proceedings of 16^h European Conference on Artificial Intelligence*. Valencia, Spain.

Staab S. et al, 2004. *Handbook on Ontologies*. Ed. Springer-Verlag Berlín Heidelberg.

E-COMMERCE COMPANIES AND KNOWLEDGE MANAGEMENT IMPLEMENTATION

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ABSTRACT

Knowledge management is an approach that some e-commerce companies use to deal with knowledge. Unfortunately, it is very difficult to find a full description of a methodology of KM implementation that would support specific conditions in various branches, including e-commerce. The main reason is that similar methodologies are usually part of companie's know how secret or intellectual property. This causes that individual organizations develop their own methodology. The Faculty of Informatics and Management of the University of Hradec Kralove (FIM UHK), Czech Republic, belongs among them. Although the methodology called KM-Beat-It is still in the phase of development, the main goal of this paper is a brief description of this methodology, delineation of its single parts, and depiction of its potential benefits for e-commerce companies.

1. INTRODUCTION

Today, knowledge economy and knowledge society are concepts that are possible to meet in many strategic documents (e.g. (Strategy, 2004), (Strategy, 2003)). The main reason is that knowledge is becoming a strategic resource for the 21st century. It is necessary to realize that knowledge is a vital part of a business life of all companies regardless of the industry sector or the incorporated business model. That is, why knowledge management (KM) and its related activities are implemented and utilised in an extended way also among e-commerce companies. Nevertheless, the question is how to implement KM into such a type of organization in a proper way. The utilisation of the existing methodologies of KM implementation could be an answer. However, their usage is usually connected with several problems (e.g. low level of complexity, lack of information, technological orientation, etc.). To overcome these obstacles, FIM UHK develops a new methodology of KM implementation called KM-Beat-It (Bureš, 2005a).

2. DESIGN OF KM-BEAT-IT

The analysis of existing methodologies has been performed before the design of a new methodology. In this analysis several criteria were followed (e.g. generality, openness, logical sequence of single steps, sphere of business, etc.). The analysis was focused only on the selected methodologies. There were different reasons that led to this decision (e.g. many methodologies offer a lack of information that is insufficient for a detailed analysis). Examples of identified strengths and weaknesses of the existing methodologies are in table 1.

Table 1. Identified weaknesses and strengths of existing methodologies of KM implementation

Weaknesses	Strengths
Orientation on particular areas of organizational activities (e.g. new product development)	Independence on branch of industry (telecommunication, automotive industry, etc.)
Strong focus on technological solutions	Balance of single KM perspectives
Creation of a realization team when the process of implementation is already in progress	Attention paid to organizational culture
Creation of knowledge strategy before analysis of initial state	Possibility to adjust methodology according to organization's needs
Dependence on pilot project and consequent interest of other departments based on acquired results	Perception of economical aspects of KM implementation (e.g. utilisation of existing investments)
Endeavour to work directly with knowledge instead of knowledge resources or assets	Attention paid to human factors
Reiteration of only the final phases of methodology (i.e. preliminary phases are conducted only once)	Emphasis of need of continuous KM

KM-Beat-It and its four phases have been built on the basis of acquired results from the previous analysis. The full description (Bureš, 2005b) of every phase comprises of the main goal, purpose and content, basic prerequisites of initiation, criteria of completion, key documents, critical success factors, and activities and relationships of these activities. It is obvious from this description that every phase consists of several activities. Since KM-Beat-It works with this level of resolution, there is also a brief specification of a single activity including the main goal and the description of the activity, inputs, outputs and examples of utilisable methods, techniques and tools.

Of course, it would be possible to increase the level of resolution and to divide every activity into several steps that must be performed and consequently divide these steps into further activities, etc. Nevertheless, it is obvious that the purpose of the new methodology is not to describe the implementation process in all details and in all possible variants. The main purpose is to stress all the significant aspects and principles and focus on the process of the implementation from the beginning to the end. Methodology does not have to be detailed but complete. Every methodology has its own life cycle (Řepa, 1999), where the development of any methodology has to precede its implementation (i.e. to buy or build it). A developed methodology must be adjusted further according to the needs and conditions of a concrete organization. Therefore, the aim was to develop an initial version of the methodology of KM implementation that can be offered to interested individuals or organizations. That is, why basic principles and structure of KM-Beat-It allow e-commerce companies to further adjust, improve and utilise it.

2.1 Phases and Activities of KM-Beat-It Methodology

Since there is a limited space for this contribution, only the brief outline of the basic phases and their activities in KM-Beat-It methodology follows:

Assembly of a realization team – the main objective of this phase is to acquire the support of the top management and/or owners of the organization and the assembly of a realization team that will deal with and will be responsible for the whole process of KM implementation. In this phase, it is necessary to conduct the following activities:
1) creation of an interest about KM by top management and/or owners of the organization,
2) weighing up of real the possibilities and capabilities to start up the process of KM implementation,
3) decision about implementation of KM,
4) nomination of team members from the top management, employees and external experts,
5) explanation of the presence of single team members and definition of their team role,
6) definition of time of employment for each member.

Analysis of initial state – the main objective of this phase is to create an integrated view on the current state in the organization from KM perspective and specification of its strengths and weaknesses. The phase of analysis of the initial state comprises of the following basic activities:
1) creation of a survey of knowledge resources,
2) description of knowledge comprised in identified knowledge resources,
3) definition of knowledge processes,

4) analysis of current state of knowledge processes in an organization,
5) description of organizational processes,
6) finding out the current state of organizational culture,
7) linkage of acquired results,
8) analysis of strengths and weaknesses of the current state in organization.

Creation of a knowledge strategy – the main objective of this phase is to create a knowledge strategy that will support the business strategy and identify particular knowledge activities, which will support the achievement of business and KM goals. It is necessary to conduct these activities:

1) definition of a required state,
2) comparison of the current and required state and identification of main gaps,
3) creation of the list of KM activities,
4) selection of activities,
5) elaboration of plans and projects,
6) creation of knowledge strategy,
7) identification of KM metrics and their relations to the system of organization's metrics.

Realization of KM activities – the main objective of this phase is to conduct different activities, projects or plans leading to KM. It is obvious that these activities will differ in their amount, forms, time and resource requirements, orientation, or particular objectives that should be achieved in every organization. The order of their realization will depend on the priorities assigned in the previous phase. As examples of such activities, there can be named creation of the motivational program, establishment of a knowledge manager, implementation of intranet knowledge portal, changes in position and content of human resources management, the start of communities of practices, the implementation of an expert or knowledge system, adjustments in work place descriptions, identification of social and individual barriers of knowledge sharing, training of employees, etc. The main mutual goal should be quantitative and qualitative changes in the current state of knowledge resources and implementation or support of knowledge processes.

2.2 Continuous KM

Utilisation of KM-Beat-It methodology is only the first step. Obviously, it is necessary to go back to the beginning of the methodology after realization of all phases and perform more steps (cycles), i.e. conduct all the phases again. Otherwise, all the used resources were consumed for no purpose. The aim of the first cycle is to "make things to move". Only other performed cycles lead to desirable changes. In this way, continuous KM is secured in the organization. Therefore, continuous KM is presented by its never-ending introduction. Naturally, with relation to the extent of the implementation of KM, the existence of particular phases, along with their content will change in the subsequent cycles.

2.3 Benefits of KM-Beat-It for e-commerce Companies

The KM-Beat-It methodology brings new benefits, advantages or positive characteristics – e.g. concordance with KM frameworks ((Apostolou, 1999) or (Wiig, 1997)) or deployment of both approaches to KM realization ("top-down" and "bottom-up"). There is only a brief description of those that can be directly related to e-commerce companies.

An important feature of KM-Beat-It is its complexity, i.e. attention paid to all KM perspectives (Beckman, 1999). KM has been connected with implementation of some technological solutions or information systems recently (Hauschild, 2001). This approach is understandably wrong. Unfortunately, e-commerce companies have natural tendencies to support this approach because of their technological foundations and their business model. Complexity embodied in KM-Beat-It helps to avoid such a serious mistake. On the other hand, the phase of analysis of the initial state gives the e-commerce companies sufficient space for emphasising their assets that are characteristic to this particular type of business. Another advantage is linked with the applicability of KM-Beat-It in small and medium enterprises (SME) that usually do not take the effort to implement KM nowadays. The lists of organisations, where KM was successfully introduced, usually include large enterprises. SME are mostly the exceptions. Although e-commerce companies can have big turnovers, the nature of their business ranks them among SME frequently. If they want to implement KM, the KM-Beat-It methodology can be utilised. E-commerce companies can also appreciate the possibility to use existing methods, techniques and tools that are the most appropriate and

often employed in e-commerce. The reason is that KM-Beat-It is not based on specialised tools that are neither common nowadays nor suitable for specific area of e-commerce. This fact is caused by the generality of the methodology, i.e. KM-Beat-It does not originate in the context of any organization or branch of industry. KM-Beat-It is also an open methodology, i.e. it is able to incorporate new findings and knowledge in implemented area, including e-commerce. Probably, the most important advantage for e-commerce companies is the discretion in the realization phase, where the users are not pushed to any activities that could be useless. It means, that e-commerce companies can, for example, utilise their existing technological infrastructure and do not have to invest into the information and communication technologies that are unnecessary.

3. CONCLUSION

E-commerce companies, as well as other organisations with different business models, can struggle to implement KM into their environments. Unfortunately, there are some problems related to the utilisation of existing methodologies of KM implementation. These problems led to the creation of the new methodology called KM-Beat-It. Its creation was based among others on the analysis of existing methodologies of KM implementation and consequent identification of their strengths and weaknesses. KM-Beat-It comprises of four basic phases. These phases are an assembly of a realization team, the analysis of the initial state, the creation of a knowledge strategy and the realization of KM activities. Every phase has its own goals, purpose and content, key documents that are either an input or output of a particular phase, basic prerequisites of initiation, criteria of completion, and activities that should be performed in the recommended order. Implementation of KM-Beat-It assumes its iterative utilisation. Realization of KM is not about execution of some one-shot actions, but about the continual endeavour, that is dedicated to the application of main principles, ideas and procedures in an organization. Generally, there are also benefits and advantages related to KM-Beat-It utilisation. E-commerce companies can be interested in the first place in the complexity of KM-Beat-It methodology, applicability to SME, generality or discretion in the realization phase. The work on the KM-Beat-It methodology is still in progress. Therefore, the goals in the near future are to finish the process of creation of the methodology and to verify the methodology and its identified benefits in a particular organisation.

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REFERENCES

Strategy of government of Czech Republic related to EU, 2004. Ministry of Environment of the Czech Republic web pages, [on-line] http://www.env.cz.

Strategy of Human Resources Development for Czech Republic, 2003. Resolution of Czech government num. 210/2003, pp.5, Prague, Czech Republic, [on-line] http://wtd.vlada.cz.

Bureš, V., 2005a. Methodology of Knowledge Management Implementation. *Proceedings of 3rd International Conference on Multimedia and Information & Communication Technologies in Education.* Cáceres, Spain, pp.963-968.

Bureš, V., 2005b. *Methodologies of Knowledge Management Implementation.* Ph.D. thesis, University of Hradec Kralove, Czech Republic (in Czech).

Hauschild, S. at al, 2001. Creating a Knowledge Culture. *The McKinsey Quarterly,* Number 1, pp.74-81, on-line: http://www.ilabsgroup.com/rcenter/km.pdf

Řepa, V., 1999. *Analysis and Design of Information Systems.* Ekopress, Prague, Czech Republic (in Czech).

Apostolou, D. and Mentzas, G., 1999. Managing Corporate Knowledge: A Comparative Analysis of Experiences in Consulting Firms, *Knowledge and Process Management 6*, pp.129-138, [on-line] http://imu.iccs.ntua.gr.

Wiig, K. at al., 1997. Supporting Knowledge Management: A Selection of Methods and Techniques, *Expert Systems with Applications 13*, pp.15-27.

Beckman, T.J., 1999. *The Current State of Knowledge Management.* In Liebowitz, J., 1999. *Knowledge Management Handbook*, CRC Press, Boca Raton.

PROJECT MANAGEMENT LEARNING - A MODEL TO MANAGEMENT THE KNOWLEDGE IN PROJECTMANAGEMENT ALIGNED WITH PMBOK®

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ABSTRACT

Nowadays the evolution of the organizations is more and more taken by implementation of projects. The implementation of projects is the only way for the continuous improvement and the differentiation in a market more and more global. We come across ourselves with successive failures of projects that do not fulfil its objectives, one of the main causes is the lack of share best practices adopted in past projects. The model that presents learn in each project, as well, supports the project manager in the decision making and the search of the best solutions for the resolution of the project problems.

KEYWORDS

Knowledge, Project Management, Earned Value Management

1. INTRODUCTION

In the days that elapse, the organizations find in the knowledge that they possess its greater active, the capacity of using it in the decision making marks the success in the route that each one understands to take. The markets globalization and the presence of new technologies bring to organizations a challenge with which they had been never come across - the increasing competition in a unique market compels to a fast and supported change, marked by the innovation and differentiation facing concurrencies.

Independently of the route that each organization decides to take, the implementation of projects, nowadays, constitutes one of the main sources of knowledge of the organizations. In the truth, they are unique and innovative efforts, projects are the vehicle of the implementation and management of the organizational change. It's through the implementation of projects that any organization implements and materializes its strategies.

All the learning that one project provides to an organization must serve of base to its process of continuous improvement. It's in this essential way that this knowledge is organized, systemized and registered for future use in the support to the business activity of organization.

An organization cannot be dependent of the tacit knowledge that its collaborators possess, because, at any time, they can leave the organization and lead this acquired knowledge obtained in the experiences lived in the organization. Also the entrance of new resources for an organization must consider a fast knowledge

share in a way that the collaborator can be quickly informed about the reality, environment and maturity of the organization.

One of the main used techniques in the project management to make the monitoring and control of the project objectives is the Earned Value Management (EVM) technique. This technique supplies to the project manager a set of performance indicators of project that concerns to its execution. The project manager must not only have concern to the immediate , or short term, as also how to track and identify the cause of shunting lines to allow that future projects will be informed of the same situations and causes, providing them such knowledge.

In this article we will introduce the knowledge and project concepts to create a common understanding about this two fields and then we will analyze the model proposal, how it works and how it can help us to improve our projects performance.

2. PROJECT MANAGEMENT LEARNING MODEL

2.1 Knowledge and Knowledge Management

The word "knowledge", is something present in the day by day common language of all. But, in the truth, what means knowledge? In an empiricist form, we can affirm that knowledge, is the fact or the condition to know, gotten through an experience or by an association.

We can see knowledge, as a state of proper conscience, on the most varied properties, sensations, behaviours, states of the reality. All this know, inhabits, or has potential to be kept in the mind of the people, or then be stored in an organization, in its processes, products, services, systems or documents. In a general form, we can relate to the knowledge as being the know-how, or the understanding that one determined entity possess and uses to take decisions and to reach its objectives.

2.2 Projects and Project Management

Such as presented previously, the management of projects is the vehicle to implement in systematic way the organization strategy through projects. Projects are a temporary effort to create a unique product or service [PMBoK, 2004].

The management of projects applied throughout each project must not only have a reactive position when the problems are identified. But also must be intent, through the description of best practices and risks of the past, so that before the problems happening, the same ones are already been avoid. We cannot omit one of the main missions of the project manager: influence the factors that create change on projects. Trying to maximize those that provoke positive changes and trying to minimize those that provoke negative changes or harm the project.

2.3 The Need of a Knowledge Management in Projects

Being the projects unique events in the organization, that facilitate change and lead to objectives strategically proposed, it's important that the past errors do not happen in new projects.

Any individual, as well as any organization learns from two distinct forms, or it emancipates, or it learns with the errors that goes committing, being the last way more painful. If an organization, in the past, implemented practices that they had effectiveness and they produced positive effects, is there any reason to not implement them again? If an organization already implemented practices which haven't been successful, it has any reason to use the same practices?

The past knowledge is important for the continuous improvement and is each time more obligator that organizations can evolve with less pain, capitalizing everything that has lived and learned. It's also important to relate that an organization cannot be dependent on tacit knowledge of their collaborators and on the entrance of new resources for the organization; it's more and more important a fast familiarization with the organization reality.

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2.4 Objectives for the Proposal Model

The model of knowledge management presented has as a main objective: the convergence of individual knowledge acquired in each project into organizational knowledge on practise of managing projects. It intends that the model can be autonomous retrieve of new knowledge and on its recycling.

a) Integration of Knowledge Management with Project Management

The model integrates two types of activities that have different natures on the organization. If in one way, knowledge management is an activity in continuous that has by objectives: to identify, to store, to share, to spread and to create knowledge. In the other way, the project management is an activity auto-contained in each project, therefore projects are unique initiatives, never before carried through the organization, which has by objectives: cost, time, scope and quality.
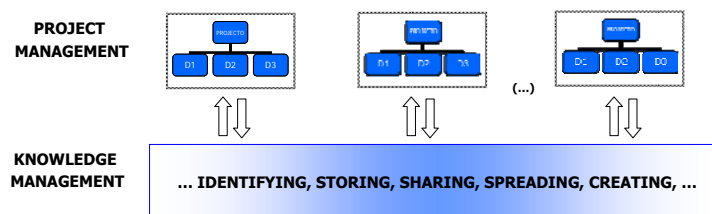
Figure 1: Integrating the project management activity with the knowledge management activity

The proposal model (PML) will act as a central model for the knowledge management generated by projects. It suggests that PML is centered in a Department of Planning and Control or in a PMO (Project Management Office).

Whenever one project initiates, the PML will serve in a first phase to support knowledge to the project management, in a way that the project manager can take the best decisions with basis on the best practices (lessons learned) already adopted. The PML will be connected to project since its start until its closing, being in permanent monitoring, supporting decisions and registering everything that has been learned throughout the project life cycle.

b) The EVM Technique as Source for Knowledge Discover

The EVM technique (earned value management) is a technique of project control focused in the analysis of productivity (performance in cost) and speed (performance in duration) of the project execution [Rodrigues, 2001].

This technique was introduced in 1962 by NASA and quickly adopted for the Department of Defence of the United States. It's one of the control techniques recommended by PMI (Project Management Institute), which is highly proven in innumerable cases of success, as for example in the construction of Euro 2004 Stadiums. We can characterize metric of the EVM in the following form [Rodrigues, 2001] (1) *CPI: Cost Performance Indicator;* (2) *SPI: Schedule Performance Indicator*

In concerns to these two last indicators, we can locate them and interpret them in the following form [Rodrigues, 2001]:

Graphical Indicators of EVM

CPI (Cost Performance Indicator)			
Interval		Light	Description
Lower Limit	Upper Limit		
1.26	+00	🟢	Save Money
1.00	1.25	🟢	On Budget
0.71	0.99	🟡	Cost Overrun
-00	0.70	🔴	High Cost Overrun

SPI (Schedule Performance Indicator)			
Interval		Light	Description
Lower Limit	Upper Limit		
1.26	+00	🟢	Save Time
1.00	1.25	🟢	On Schedule
0.71	0.99	🟡	Delay
-00	0.70	🔴	High Delay

Figure 2: Legend of the indicators of EVM technique

PML monitors in continuous CPI and SPI indicators of the project, being that, in case that CPI reaches superior indices at 1.25, it means that we are very productive or saving a lot of money, which lead us to conclude that there are effectively reasons to identify the best practice that we're adopting. If we have a SPI index superior at 1.25, this means that we're very ahead or being very quickly. Here it has also potential to register the reason of this fact, so that later this can be adopted again.

PML further registers the best practices adopted in each project and promotes its future using, it has as main fundament the knowledge convergence of project management: based on characterization of the project environment and acting with accordance with the best practices adopted until that time and really contributed for an improvement of project performance (productivity and/or speed).

PML that monitoring in continuous the indicators of CPI and SPI, is aware when these reaches inferior values at 0.7 to suggest a solution to implement and recover the project. Following presents, all the mechanics and process of PML in the discovery and use of knowledge in the project management.

1. *Start the process of capture of knowledge (**Start**)*
2. *Monitoring the evolution of solution adopted (**During**)*
3. *Validate if the solution was effective or not (**End**)*
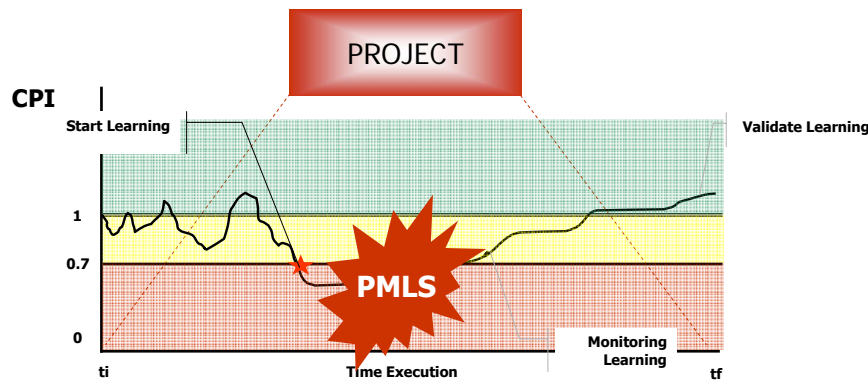
Figure 3. EVM as technique to discover knowledge

c) PML Implementation and Validation

To implement PML model you need to collect information about the projects that your organization implement in the past, and via expert judgement collect from project managers the best practices that they considered effectiveness to improve that projects performance, you will need also to collect what were the circumstances (project environment) when that best practices was applied.

After you register the historical information, you need to create a database per solution and with a parametric model based on mathematical regression you will try to find the correlation between environment, solution and the project final performance. Regression will give you many statistical indicators as coefficient of determination (R^2) to validate your model.
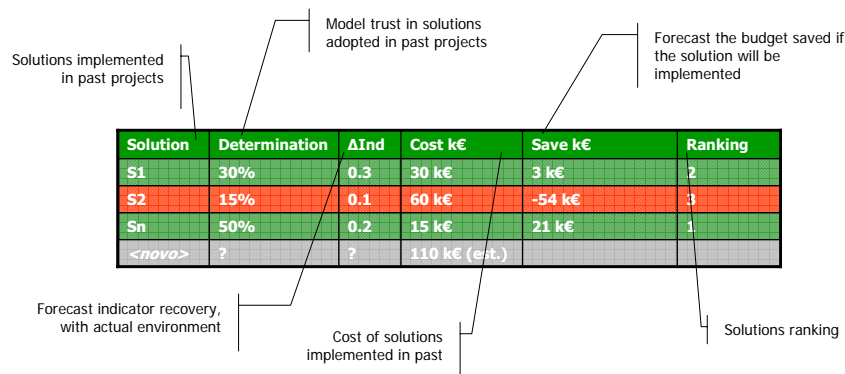
Figure 5: Proposal of solutions to implement in a project

When your project performance is below the expected you can search the best solution (decision) that was applied in the past and with the circumstances of your project, the PML will suggest you the best one with how it can improve your project and how it represents.

3. CONCLUSION

According to PMI (Project Management Institute), the management of each project crosses 5 distinct phases: initiation, planning, execution, control and closing. The PML model can be used to increase the performance of each project in our organization to perform in a better way and to provide and quantitative analysis of how much we know what we do.

REFERENCES

Abel, M. 2000. Cognição: compreendendo a perícia. Bancos de dados intelegentes. Instituto de Informática – UFRGS, 2000

Allee, V. 2000. 12 Principles of Knowledge Management. American Society for Training and Development. Virginia - USA, 2000

Davenport and Prusak, 1998. *Working Knowledge: How Organizations Manage What They Know*. Cambridge, MA: Harvard Business School Press

Gartner Glossary, 1997. *Glossary of Information Tecnology Acronyms and Terms*.

Klasson, 1999. *Managing Knowledge for Advantage: Content and Collaboration Technologies*. The Cambridge Information Network Journal, vol. 1, no. 1

Morris, W. 2002 Managing Project Management Knowledge for Organizational Effectiveness – University College London

PMBoK® 2004. *A Guide to the Project Management Body of Knowledge*. Project Management Institute. Newton Square, Pennsylvania (USA)

Rodrigues, 2001. *Complete Project Management*. PMO Consulting. Portugal

CONSTRUCTION OF A SYSTEM THAT IMPROVES MOTIVATION IN DISTANCE LEARNING
-- TWO TYPES OF ASSOCIATION TESTS REVEAL MOTIVATION AND CHANGE OF PUPILS --

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ABSTRACT

Pair association research clarifies the motivation of pupils for school, showing that they go to school because of <friends>. We tried to strengthen motivation by distance learning with two items of equipment: a big screen besides pupils named 'friends screen', and cellular phone. These improve the motivation of pupils to learn more and to increase contact with each other. Association maps before and after the lesson show that this system of distance learning is successful in changing conceptual relations in the direction of the aims of the lesson.

KEYWORDS

motivation, association map, distance learning.

1. INTRODUCTION – MOTIVATION FOR SCHOOL

This article investigates the following 2 points in providing productive eLearning for pupils: what kinds of factors enhance motivation for learning, and how a system that improves motivation by distance learning can be used.

The feelings of pupils about school is investigated[1] in order to clarify motivation for school in Sasebo City of Nagasaki prefecture in Japan.

The results of 2 pair association tests for 4th grade pupils at elementary school and 9th grade pupils at Junior high school is clear (Fig.1 & Fig 2): what pupils like about school is <friends> and what pupils feel good is <friends>[2]. This tendency is common in every grade from 4th to 9th grade. Categories <playing> and <break > (recess in school), which pupils like and describe as good, are also opportunities to spend time with friends. If pupils are asked why they go to school, they answer clearly because of <friends>.

Pupils don't like <learning>, though they think <learning> is good. Loss of learning motivation is not only a problem of eLearning, but also a problem of learning in school. Japanese schools have also a problem of loss of pupils' motivation, which should be solved by more interesting learning. Schools expect eLearning is an effective method to improve learners' motivation.

Schools can benefit from the powerful motivation factor of <friends>. However in an eLearning process for personalization <friends> are cut out, and perhaps motivation is also reduced. Therefore one way to support motivation for learning by eLearning is to recover the motivating factor <friends>.
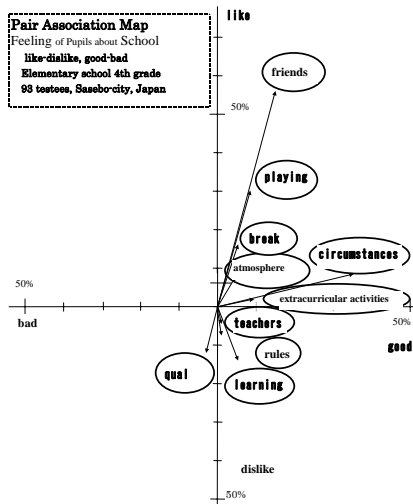
Figure 1
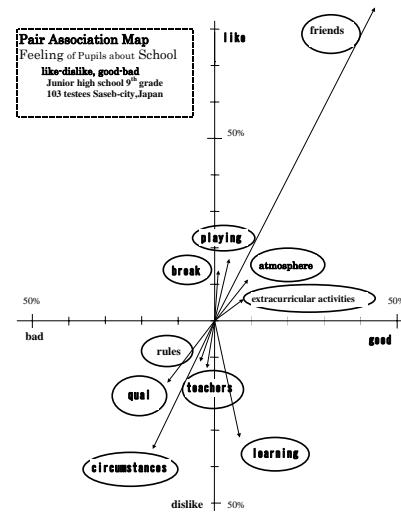
Figure 2

2. LEARNING TOGETHER SITUATION IN DISTANCE LEARNING

In learning we can distinguish a 'TV attitude' and a 'friend attitude': a person on TV is in principle distanced, unknown and there for everybody, but friends in school are near by, they know each other, and communication is personal. 'TV attitude' is passive and isolated, similar to the attitude when hearing and seeing a teacher in the front of the class. The communication in the classroom is in principle public and valuable. What friendly talk brings is not always valuable, but information with friends brings evaluation of what is taught in public. In a 'friend attitude' one can be active and positive, because there is already a base of common communication and it is easy to express oneself.

If a system of eLearning is organized only for learning, i.e. for valuable information, isolation and distance can produce in a person a 'TV attitude'. If friends are beside him or her, and personal communication is available, it will be effective for motivated learning. To integrate the factor of <friends> to learning in public, we have developed the following equipment by distance learning in a class. Because this learning experiment has been developed in schools, this case is regarded as a synchronous and group type of learning..

2.1 Friends on a screen and via a cellular phone

In our distance learning experiment in 2002, we combined 3 distanced classrooms of 6th grade pupils and used cellular phones for personal communication. A teacher located in a third classroom (Omura in Nagasaki prefecture) led discussions with another two (Keinan, on a Island in Kagoshima prefecture, and Tutu on a Island in Nagasaki prefecture). Keinan and Tutu are located at an equal distance from the main teacher, and Omura played the role of audience during the discussion. There was no difference between the two discussing classes, such as a main classroom and satellite classroom. The two classes developed learning with the lead of the main teacher. In this paper I will explain about these two distanced classes (distanced from each other and distanced from the teacher), Keinan and Tutu.

A classroom has not only a front screen to see a teacher and learning objects, but also a big screen besides pupils, so that they can feel as if friends in the remote place are beside them (Fig.3). The location and size of the screen was intended to show pictures of pupils in another place, possibly as big as real friends in the classroom. I named this side screen of pupils, 'friends screen' (screen 2 in Fig. 3). Pupils are sitting in the classroom as in Figure 3, on the right side, and the screen is located on the left side. Pupils and 'friends screen' of another distanced classroom are located on the left and right. The two classrooms combined to create one virtual classroom environment.
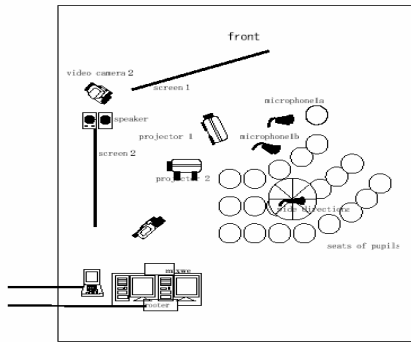
Figure 3. Construction of a classroom

Two types of microphone were used in each classroom: one recorded the atmosphere of the whole class from the ceiling, and the other type was used for discussion between classrooms, and for replying to the teacher. These microphones were used between classrooms, in other words for public use.

Cellular phones were also provided for small group talk, which was used for more personal and private communication. In this virtual classroom public discussion was conducted according to a plan of the teacher, but also pupils talked with each other in a 'friend attitude' by means of the 'friends screen' and cellular phones.

2.2 Increase in motivation

To avoid an anonymous situation, exercises of group encounter were conducted. Through photos of each other and name cards, all the members could be identified and a relaxed atmosphere was created with each other before the lesson.

The 'friends screen' and cellular phones for more personal talk created a friendly atmosphere, though the equipment was not always suitable for eye contact with each other. Pupils thought of useful ideas to make contact with each other to conquer the difficulties: raise a hand on screen or tell the color of their jackets. Together with the pupils' ideas these two pieces of equipment increased chances for personal participation with distanced friends and provided opportunities to communicate meta information about the given theme in learning. With the information for confirmation of a theme, or small questions about proceedings, pupils could be positive and active in the classroom.

Using a five rank evaluation system from 1-5, where 1 is very bad to 5 is very good, total judgment of pupils for this lesson were good. The score for the feeling of reality, in other words feelings of one-to-one communication was not so high (3.2)[3], but the increase in motivation in pupils for more communication was significant. They felt happy (4.2) about the learning, had high motivation to meet each other (4.3), and they wanted to do distance learning once more (4.0). The tele-group activity using cellular phones and the 'friends screen' could not create the feeling of being face to face, however friendly personal contact increased motivation for more learning with each other.

Naturally it is difficult to judge clearly what kinds of factors were effective for motivation, because the unusual situation of distance learning alone could be a first step towards high motivation, and the relaxed relationship brought about by a group encounter could also have played an important factor for higher motivation.

Two ways of communication screen and two ways of sound connections in this virtual classroom made it possible to permit both public and personal communication, in other words combining a 'TV attitude' and a 'friend attitude'. In this virtual classroom not only information from teachers but also meta information between friends was available. Information between friends seems to support a motivation for learning or to qualify the meaning of learning.

3   PERSONALIZATION TO A STORY IN ONE'S LIFE

Motivation is personal and depends on personal matters. The atmosphere of learning also influences motivation. For atmosphere we have organized a relaxed and friendly feeling through group encounters, in

which we used a museum in Keinan, which is suitable for the learning theme, instead of a classroom. For a relaxed feeling we had pupils bring their own chairs from their classroom to the museum.

We heard of a newcomer on the day of distance learning, so a member of staff drove to his former school to take a photo of the newcomer. The distance learning was the first lesson for him in a new school, and his photo and name were already there. When he found his face on the screen, the pupil was not an outsider on that day, and he could talk by learning in public.

The combination of one's personal life story with the public process of learning makes one's motivation to attend learning higher. Faces on a 'friends screen' and individual voices via cellular phone are a method to combine individual life stories and public learning in the classroom. Friendly personal stories are connected with each other and with learning. Knowledge itself has no connection to one's personal story, if one has no interest. For knowledge to be meaningful, one needs connecting points with one's life story.

4   CHANGE OF CONCEPTUAL CONSTRUCTION AMONG PUPILS

The theme of this distance learning was 'home town' using the specialty of each hometown as learning material. The learning material was red rice, which is ancient rice in Japan. Red rice is cultivated traditionally in only 3 towns in Japan, two of them are Keinan and Tutu. Keinan has a red rice museum. The purpose of this learning was to discover how people maintain tradition.

A free association test was conducted per one word 30 seconds before the learning and then after the learning as a means of evaluation. Written response words by pupils were calculated in a form of association map, which can provide a metaphor for the inside of a brain about the concept of people in a group. Here I show the case of pupils of Keinan elementary school. The Stimulus word is "home town (furusato)"[4].

4.1 Consciousness of pupils have concentrated into persons
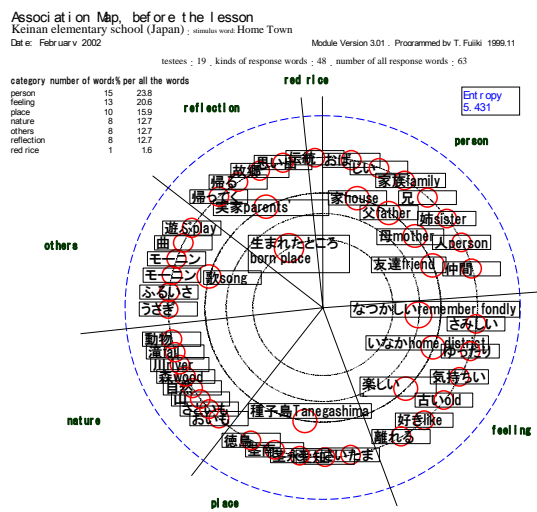
Figure 4
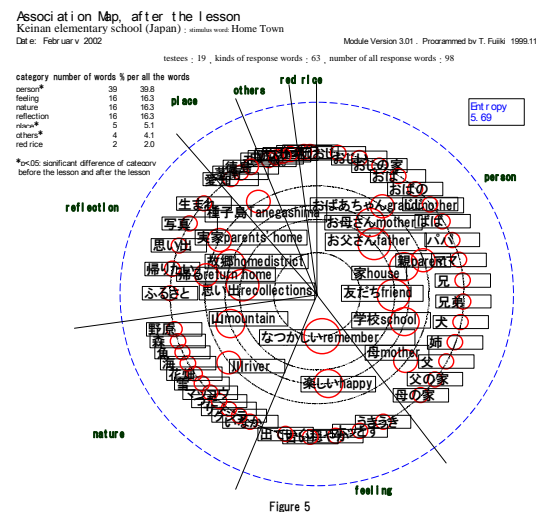
Figure 5

'Remember fondly' ones home town came top of the response words in both test. This response word has increased at the end of learning 15.8% per testee (from 26.3% to 42.1%). 'recollections' also increased by 15.8% at the end. 'Father' 'friends' and 'home district' also increased by 10.5%. Positive feelings, reflections for hometown and attention to people in one's hometown are tendencies in the level of response words of this learning. At the end of learning came many response words from pupils, so the number of response words increased from 63 to 98. Entropy is also increased. It may be inferred that pupils thought many things about "home town" during the distance learning.

A Categorized association map (Fig. 5 &Fig. 6)[5] shows the significant increase of the category <person> and decrease   in <place> and <others> (p<0.5%). The category <person> increased by 16.0% per total response words. It was the purpose of learning to focus on the activities of people to maintain the traditions of the home town, so the association map shows the successful end of the learning.

One of the decreased factors is the name of the island, where Keinan is located, and other names of places. The other is singers or phrases of songs, whose title includes hometown. Pupils have concentrated on learning, so they did not remember the songs at the end of learning.
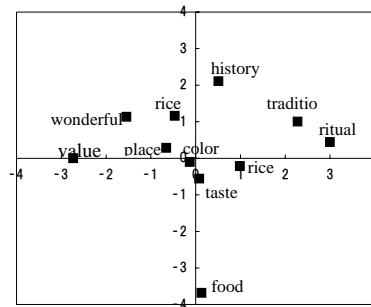
Figure 6: Keinan, before the lesson   Figure 7: Keinan, after the lesson
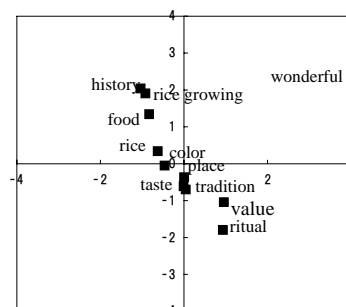
4.2 Values of red rice linked up with traditions

Analysis using the quantification method type 3 of the results of an association test of "red rice" (Fig. 6 & Fig. 7(cumulative percentage:45.7%)) shows the category <value> comes near to <tradition>. Category <value> includes a historical meaning of red rice in Japan, scarcity of red rice and meanings for the people of the home town. Name of <place> of red rice, <taste> of red rice, and <tradition> are linked with <value> of red rice in pupils' awareness after the lesson. This change in cognition is a result of the highly motivated lesson.

5. CONCLUSION

A Pair association test clarified the motivation for school in pupils: <friends> is what pupils like and feel is good. We tried to make learning motivation higher in distance learning by means of using the factor <friends> in two pieces of equipment: a big screen near pupils named 'friends screen' and cellular phones. These trials were successful in increasing motivation in the pupils. To increase motivation for learning it is also important to avoid an anonymous situation and to combine students' personal life stories with the content of the lesson. Association maps before and after the lesson show that the distance learning was successful in changing conceptual relations of pupils in accordance with the aims of the lesson.

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CLASSIFICATION AND SOFTWARE ARCHITECTURES OF E-BUSINESS REVENUE MODELS

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ABSTRACT

Revenue models are an integral part of business models. While a lot of research on business models and revenue models of the e-Business already exists, there is a shortfall of a concept to derive appropriate software architectures for the underlying software system directly from these models. In this paper we derive appropriate software architectures for revenue models of the e-Business. Therefore, relevant revenue models are classified in a first step, using a 'classification cycle' which enables you to conclude technical decisions for the design of a software architecture. The derived architecture serves as a software reference architecture for the domain of this revenue model which can be used in a lot of different business models. In case a software system for this model has to be developed, the underlying software architecture presented in this paper can be used as a sample solution to refer to.

1. INTRODUCTION

To realize a business model in the e-Business, there is a special focus on the software architecture of its underlying software system, because, like the 'e' suggests already, the processes are supposed to be performed mostly electronically. Thus, the business model and its underlying software architecture are tightly connected. Since the revenue model is a very important element of the business model, the software architecture also has to be designed according to the requirements which have to be performed to generate revenues. Therefore, the revenue model has to be characterized in a way which enables a company to derive technical decisions for the design of this software architecture.

The purpose of this article is to develop a software reference architecture to support the application of one revenue model within its encompassing business model. Thus, the reference architecture can also be considered as a domain-specific software architecture for the domain of this revenue model. Within this article it will be focused on the subscription revenue model. It can be applied to different business models like Internet-Service-Provider, online magazines or even e-shops which offer an ongoing claim of their products using a subscription.

2. RELATED WORK

Zerdick et al. (1999) and Skiera and Lambrecht (2000) investigate revenue models for the e-Business isolated from business models. Other authors use a different approach by defining revenue models as a part of the encompassing business model (Timmers, 1998, 1999; Buchholz 2001; Wirtz ,2001; Doubosson-Torbay, Osterwalder and Pigneur ,2001).

However, we could not identify any research that analyzes the dependency of business models and its related software architecture in depth. Only a few authors deal with this relation at all. One approach in this area is delivered by Bartelt and Lamersdorf (2000). However, they identify only some examples which cannot be used in general.

Due to this shortfall we chose an approach to derive a software reference architecture on the basis of a characterization of a revenue model. A software reference architecture can be interpreted as 'a collection of computational components together with a description of the interactions between these components - the connectors' (Gerlan and Shaw, 1993). More generally than an architecture, according to Bass, Clements and Kazman (1997) a reference model is 'a standard decomposition of a known problem into parts that cooperatively solve the problem'. Then, a (software) reference architecture is 'a reference model mapped onto software components […] and the data flow between these components'.

3. CLASSIFICATION OF THE SUBSCRIPTION REVENUE MODEL

Subscription of services is taken as the relevant e-Business revenue model for this article. A typical example for a business model which offers services to subscribe is an Internet Service Provider who offers web-access to its customers. For the classification of the revenue model, the 'classification cycle' is used.
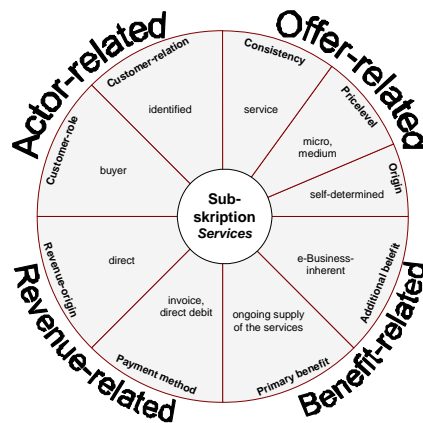
Figure 1. Classification cycle of the revenue model subscription of services

The classification cycle in figure 1 shows the characteristics of the subscription of services revenue model. Related to the elements of the definition of a business model the classification criteria to characterize a revenue model are grouped into four sections: actor-related, offer-related, benefit-related and revenue-related criteria. The close dependencies between the revenue model and its business model are considered with this approach.

Using this classification cycle, some important technical decisions for the design of the software reference architecture can be derived as we will show briefly.

4. FROM A CLASSIFICATION OF THE REVENUE MODEL TO ITS SOFTWARE REFERENCE ARCHITECTURE

Based on this characterization of the subscription of services revenue model by using the classification cycle, technical decisions for a software reference architecture are derived within this section. While there can not be given an algorithm for the process of derivation, the proposed classification cycle serves as a guidance for this process. Examples are:

- The company offers services (criteria consistency). The primary benefit for the customer is the ongoing supply of these services. Therefore, he subscribes to this service by concluding a contract. The company has to create, change and maintain its services by itself (criteria offer origin). It has to offer a variety of

different tariffs for its customers to meet a wide range of different whishes depending on the personal behavior of each customer. Therefore, contract and tariffs belong to one component but will be realized in separate classes. A selected tariff is then aligned to a contract.

- Depending on the tariff different reference values - volume or time - have to be charged and therefore have to be logged. Since the customer relationship is identified, each customer session has to be investigated separately regarding the activities of the user. Therefore, an appropriate usage account has to be realized in a separate component. This component performs the central processes to charge the customer in accordance to the use of the subscription revenue model.

- Obviously, customer profiles have to be supported as well. The origin of the revenue is direct (revenue origin). This means that end-customer transfers the revenues. They act as identified buyer who pay their bills by using invoices or direct debits. In addition, there is no need for any anonymity assumed to be an additional benefit. Thus, the customer disposes of a customer profile.

These examples show that the derivation of an appropriate software reference architecture for a revenue model is still a creative task, but this task is supported by using the classification criteria of the classification cycle. These criteria serve as a guidance during the design phase and help you to find and to shape appropriate components. These considerations influenced the creation of the software reference architecture which will be presented now.

5. A SOFTWARE REFERENCE ARCHITECTURE FOR THE SUBSCRIPTION REVENUE MODEL

According to the views defined by Gruhn and Thiel (2000), the software architectures are described on a software-technical level. UML class diagrams (OMG, 2005) are used to model the architecture. Since it is a goal of the represented reference architecture to identify relevant components which realize necessary functionality to implement the revenue model, these components are identified within the software-technical architecture by encompassing their belonging classes. The following figure 2 shows the class diagram of the reference architecture. The grey boxes encompass the classes to their related components.
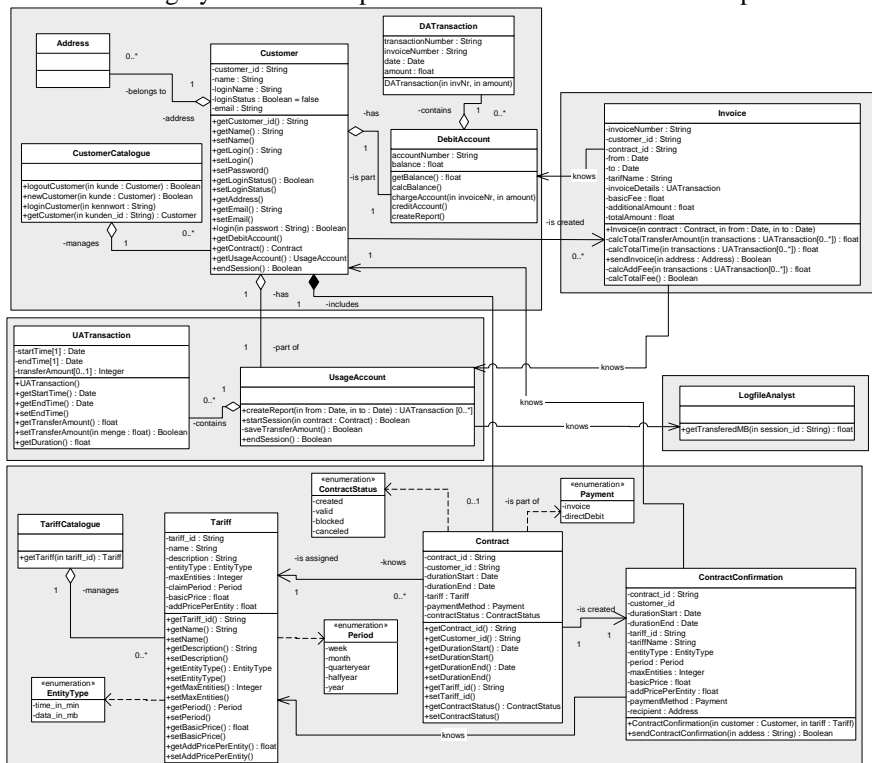
Figure 2. Class diagram of the software reference architecture

As it can be seen, five components were defined. They are discussed briefly.

The *CustomerProfile* component deals with the personal data as well as the debit account of each user. It contains five classes which should be largely self-explaining. A user can have multiple addresses that lead to the creation of an own class. The *DebitAccount* contains header information like the current balance. The transactions are stored as instances of *DATransactions*. Therefore, the constructor of this class is activated by the *DebitAccount*, handing over the relevant information which it received earlier by the invoking component, e.g. the *Invoice*. In addition, a *CustomerCatalogue* is necessary to create new instances of *Customer* or to deliver a reference of a customer object to an invoking class.

The *ContractAndTariff* component contains the separated classes *Contract* and *Tariff* as required, while an instance of *Tariff* is assigned to an instance of *Contract*. A class *TarifCatalogue* is similar to a *CustomerCatalogue* and delivers a reference to a *Tariff* object. A further class of this component is the *ContractConfirmation* which will be generated by the time the customer places the contract. It contains contract-relevant data and will be sent to the customer. An advantage of the chosen design of this component is its ability to mange tariffs separately from contracts. As it is necessary for a company to create new and change existing tariffs flexible according to business needs, the separation of both classes supports this.

The *UsageAccount* component is the central component related to the core process of this revenue model. With the input of the *LogfileAnalyst* component this component reports the activities within a session and stores them persistently into a separate data record.

The *Invoice* component uses these data to generate the invoices. For the calculation, the tariff chosen by the customer has to be compared with the used entities during this expired period. The tariff is received from the *ContractAndTariff* component, the used entities from the *UsageAccount* component. If the amount of consumed units is not higher than the maximum amount according to the tariff, only the agreed subscription fee has to be charged to the *DebitAccount* of the customer. In case the used entities exceeded this maximum, an additional price has to be calculated by the invoicing and charged to the account. At the end, a physical invoice has to be sent to the customer.

6. VALIDATION

A German Lottery company was rebuilding its internet platform recently. One of the offered games on the platform can be played in a subscription mode, so that the customer automatically takes part on the draws according to his configured parameters like draw days, predictions, and bet amounts. The design of the platforms software architecture was derived from the reference architecture presented in the previous section. Because of the divergent specification of bets, some components had to be adapted slightly. Here it became clear that the proposed reference architecture could be used as a template or sample solution for this precise real-life use case.

7. CONCLUSIONS AND FURTHER WORK

This paper focused on the creation of a software reference architecture for a revenue model of the e-Business based on a business model related characterization of this revenue model. Therefore, we introduced a classification cycle including relevant classification criteria. The parameters of these criteria, selected in accordance with a specific revenue model, enabled us to derive requirements and conclusions for the design of an appropriate software architecture. Because we focused on the domain of the subscription of services revenue model, the software architecture can be considered as a reference architecture. The benefit of this software reference architecture was proven already during its application within a practical software development project.

At this point, wee see the need of further research work in order to extend the usage of the classification cycle to further revenue models and to derive more appropriate software reference architectures. It is our aim to get a comprehensive set of reference architectures which can be used to a large variety of business models within the e-Business.

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REFERENCES

Bass, L., Clements P.C., and Kazman, R., 1997, Software Architecture in Practice, Addison Wesley

Bartelt, A., and Lamersdorf, W., 2000, Business Models of Electronic Commerce: Modeling and Classification (German: Geschäftsmodelle des Electronic Commerce: Modellbildung und Klassifikation), in: Verbundtagung Wirtschaftsinformatik 2000, pp. 17-29, Shaker

Buchholz, W., 2001, Netsourcing Business Models - Business Models for purchasing platforms (German: Netsourcing Business Models - Geschäftsmodelle für Einkaufsplattformen), in: Dangelmaier, W., Pape, U., and Rüther, M., ed., Die Supply Chain im Zeitalter von E-Business und Global Sourcing, pp. 37-52

Dubosson-Torbay, M., Osterwalter, A., and Pigneur, Y., 2001, eBusiness model desing, classification and mesurement, (October 5, 2004) http://citeseer.ist.psu.edu/dubosson.torbay01ebusiness.html

Garlan, D., Shaw, M., 1993, An Introduction to Software Architecture, in: Advances in Software Engineering and Knowledge Engineering, pp. 1-39, World Scientic Publishing Company

Gruhn, V., and Thiel, A., 2000, Componentmodels - DCOM, JavaBeans, EnterpriseJavaBeans, CORBA (German: Komponentenmodelle - DCOM, JavaBeans, EnterpriseJavaBeans, CORBA), Addison-Wesley

Object Management Group: OMG Unified Modeling Language Specification, March 2005, Version 2.0.

Reif, W., 2001, What is E-Commerce? (German: Was ist E-Commerce?), University of Augsburg, (May 5, 2003) http://www.uni-augsburg.de/lehrstuehle/info1/lehre/ss01/e-ommerce/folien/Definition.pdf

Skiera, B., and Lambrecht, A., 2000, Revenue Models for the Internet (German: Erlösmodelle im Internet), (December 13, 2003) http://www.ecommerce.wiwi.uni-frankfurt.de/skiera/publications/Erloesmodell.pdf

Timmers, P., 1998, Business Models for Electronic Markets, in: Gadient, Y., Schmidt, B., Selz, D., ed., EM - Electronic Commerce in Europe. EM - Electronic Markets, Vol.8. No. 2, 07/98, (May 10, 2005) http://www.electronicmarkets.org/modules/pub/view.php/ electronicmarkets-183

Timmers, P., 1999, Electronic Commerce - Strategies and Models for Business-to-Business Trading, John Wiley & Sons Ltd. England

Wirtz, B.W., 2001, Electronic Business, Gabler

Zerdick, A., et al., 1999, The Internet Economy - Strategies for Digital Business (German: Die Internet-Ökonomie - Strategien für die digitale Wirtschaft), Springer

EARLY ASSESSMENT OF WLAN/ BWA EXPLOITATION OPPORTUNITIES IN ASIA PACIFIC

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ABSTRACT

A number of researchers from vendors, operators to service providers attempt to assess the exploitation opportunities of wireless local area network (WLAN)/ broadband wireless access (BWA) in Asia Pacific region. A clear definition allows players in the industry to focus on the most crucial part of their businesses and prevent them from repeating the costly mistakes of the recent past by entering and subsequently exiting, non-core businesses and markets. This study seeks to address the current state of WLAN/ BWA in Asia Pacific region including market size, user segments, market forecast and so forth. The paper also summarises the key market drivers and barriers of WLAN/ BWA deployment in Asia Pacific region. This helps to map the possible future scenarios on the use of wireless solutions in Asia Pacific region.

KEYWORDS

Exploitation opportunities, drivers, barriers, WLAN, BWA

1. INTRODUCTION

The world today is moving forward at a soaring rate. Within this change wireless technology is rapidly evolving, and is playing an increasing role in the lives of people throughout the world. The people of today demand hassle free and compact products, which can be used anytime and anywhere with the best connections. Wireless is the possible solution to meeting the needs of the society. A clear definition allows players in the industry to focus on the most crucial part of their businesses and prevent them from repeating the costly mistakes of the recent past by entering and subsequently exiting, non-core businesses and markets.

1.1 Wi-Fi

Mid-2004, Wi-Fi market based on IEEE 802.11 family of standards is still relatively fragmented (IDATE, 2004). Despite onset of consolidation which has seen a number of players strengthen their position, the US market which is the most mature in the world is still very fractured (IDATE, 2004). Initially lagging behind US, Europe has now caught up, having witnessed a substantial increase in the number of Wi-Fi hotspots within a year (IDATE, 2004). As for Asia Pacific market, access point figures are increasing continuously but this rise does not make it the most dynamic region in terms of number of users and revenue (IDATE, 2004). Asia Pacific had 27,171 public Wi-Fi hotspots towards the end of Q2 2005, up 35 percent from 20,119 at the end of Q2 2004 (Bell & Roberts, 2005). Coverage at the end of Q2 2005 was up 6 percent compared with end of Q1, but that is lower than the 7 percent coverage increase seen in Q1 2005 and 10 percent gain in the last quarter of 2004 (Bell & Roberts, 2005). With the declining growth rates, it can be suggested that Asia Pacific public Wi-Fi market is maturing. Another indication of the maturing market is that Asia Pacific has seen its share of worldwide hotspot market decrease from 39 percent in Q2 2004 to 32 percent in Q2 2005 (Bell &

Roberts, 2005). Over the same period Western Europe's share of the global market increased another 2 percent to 42 percent, and North America's climbed from 21 to 26 percent (Bell & Roberts, 2005).
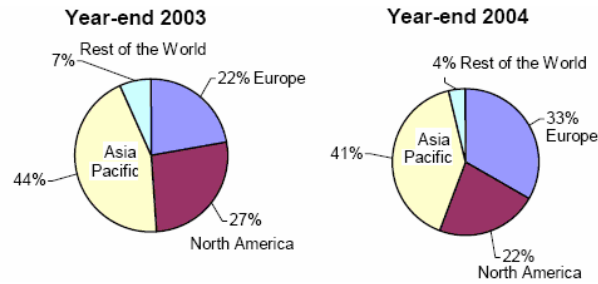
Figure 1. Breakdown of the percentage of hotspots around the world (IDATE, 2004)

1.1.1 WLAN vs. Cellular Networks

One big distinction between cellular networks and WLAN is the future market development. Although competition in cellular networks arena is restricted to finite number of spectrum licenses, public WLAN is not subject to this limitation (Siemens, 2003). This implies that the only way to reach substantial coverage is to join forces with site owners. In Asia Pacific, Green Packet is offering WLANs and cellular networks inter-working solutions (Green Packet, 2005). Also, Tropos (2004) reported that its Wi-Fi mesh solutions can provide 5 times performance improvement over typical 3G solutions that cost over 4 times more to deploy.

Table 1. Comparisons – 3G vs. Wi-Fi (Ikemefuna, 2003)

	3G	Wi-Fi
Standard	W-CDMA[1], CDMA2000	IEEE 802.11 family
Maximum Speed	2 Mbps	54 Mbps (over 100 Mbps for upcoming 802.11n)
Operations	Cellular phone companies	Individuals, Wireless Internet Services Provider
License	Yes	No
Coverage Area	Several km	About 100m (in best channel condition)
Advantages	Range, mobility	Speed, cheap
Disadvantages	Relatively slow, expensive	Short range, poor QoS[2]

1.2 WiMAX

The wildly successful 802.11x technology has been used in BWA applications along with a host of proprietary based solutions for years (WiMAX Forum, 2005). However, it was apparent that the overall design and feature set available was not well suited for outdoor BWA applications and QoS dependent services (WiMAX Forum, 2005). Though WiMAX (IEEE 802.16) faces a number of challenges in Asia Pacific market, its subscriber base is predicted to increase from over 80,000 in 2005 to over 3.8 million by 2009 (In-Stat, 2005). Service providers in Asia Pacific demonstrate strong interests in this technology and the spectrum is becoming available. Weak existing infrastructure encourages the deployment of WiMAX.

It is argued that WiMAX and other emerging high-speed wireless technologies will capture more than 40 percent of the wireless broadband business over the next few years, leaving 3G with less than 60 percent of the market in 2009 (Walko, 2004). This is due to its higher performance and flexibility compared to the alternatives (Walko, 2004). 3G will be important for its mobility, but WiMAX will directly compete with digital subscriber line (DSL) at its initial deployment, even though standards for mobility supports for WiMAX (IEEE 802.16e) is still under development (Walko, 2004). It has been suggested that the return on investment (ROI) for these new wireless broadband technologies is significantly better than for 3G.

Maravedis (Fellah, 2005) predicts that close to 1 million subscribers worldwide had some form of fixed BWA services and total service revenues in 2004 to be US$1.4 billion. In developing countries, representing most of worldwide population, the potential for BWA growth is most prominent (Fellah, 2005). In rural areas, governments are pushing the growth of broadband wireless through continuing frequency allocation

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[1] CDMA – Code Division Multiple Access
[2] QoS – Quality of Service

and subsidies to make rural business case more attractive in order to trim down digital divide (Fellah, 2005). Under 'Mobile Taiwan' project, Taiwanese Government has allocated US$237 million for the development of WiMAX BWA projects, signing a joint-collaboration deal with Intel (Total Telecom Magazine, 2005).

1.2.1 WiMAX vs. Cellular Networks

The tables show that WiMAX overcomes several limitations of Wi-Fi. In addition, WiMAX has several advantages over 3G as listed in Table 2. However, deployment of WiMAX seeks to complement the existence of 3G instead of replacing it (Lucent Technologies, 2004). For a Web page to be viewed on a cellular phone, the signal must be sent in Wireless Application Protocol (WAP) and the page should be written, not in Hyper Text Markup Language (HTML) used for most Web pages, but in Wireless Markup Language (WML) (Vaughan-Nichols, 2003). In brief, viewing Web pages with 2.5G and 3G is inherently trickier.

Table 2. Comparisons – 3G vs. WiMAX (Ikemefuna, 2003)

	3G	WiMAX
Standard	W-CDMA, CDMA2000	IEEE 802.16
Maximum Speed	2 Mbps	10 to 100 Mbps
Operations	Cellular phone companies	Individuals, WISP
License	Yes	Yes/ No
Coverage Area	1-3 miles	30 miles
Advantages	Range, mobility	Speed, long range, mobility (802.16e)
Disadvantages	Relatively slow, expensive	Interference issue (in unlicensed bands)

2. MARKET DRIVERS

2.1 Lack of Available Options in Underdeveloped Areas

Internet access options in Asia Pacific are generally fragmented. Not many countries illustrate vast potential and domestic challenges of unleashing and harnessing telecommunications and information infrastructure as lucidly as the billion-strong subcontinent of India (Purbo, 2003). As a content-rich country with a free press, an affluent, tech-savvy, diasporas population spread across the world from the Silicon Valley and Sydney to Singapore and Southall, and a huge pool of cutting edge IT and design skills, India has much to offer the domestic and global Internet markets (Purbo, 2003). However, there is also the dark side to the proverbial coin: poor connectivity outside of major cities, low levels of B2B activity online, and government policy foot-dragging in terms of creating a level playing field for infrastructure players (Purbo, 2003).

India has about 10 to 12 million Internet users, 8 million mobile phone users in a country with close to half the population hovering around poverty line (Purbo, 2003). Though India is still a developing country, there is also a burgeoning information society within (Purbo, 2003). As of 2003, 25 percent of its workers are in the service sector, 60 percent in the agricultural sector, and 15 percent in industry (Purbo, 2003). India has more information workers than Japan and the same number as the USA (Purbo, 2003). Overcoming the digital divide in conjunction with other socioeconomic divides will remain one of the key development issues for decades to come (Purbo, 2003). Innovations in low cost devices have yet to reach take-off stage, and the open source movement is making notable but slight inroads into the education and Government sectors (Purbo, 2003). These give rise to the need to deploy wireless solutions which can be less costly.

While the deployment of wireless technologies in underdeveloped areas ensure that the population residing in these areas are always connected, it has been argued that these residents may not even have the need to get connected. Therefore, the cultivation of access to data anywhere and anytime is also seen as an important driver affecting the diffusion of wireless solutions.

2.2 Demands for Broadband Access Increasing

There is a general frustration with the slow deployment and costly services of 3G technology, as well as lingering doubts about whether IT managers should hand over critical network communications to a

telephony carrier (Messinger, 2004). According to the Department of Commerce in US, in 2000 a total of 304 million people worldwide had Internet access, showing an increase of almost 80 percent from 1999 (IEC, 2000). The US and Canada account for 50 percent of the total (IEC, 2000). Asia Pacific is forecasted to continue to dominate global broadband uptake. By the end of 2004, the region would have 56.6 million broadband households, topping North America's 37.7 million and Western Europe's 28.7 million (Baker, 2005). As the Internet market continues to explode, demand for greater bandwidth and faster connection speeds have led to several technological approaches developed (IEC, 2000).

3. MARKET BARRIERS

3.1 Competing Technologies

A number of technologies introduce competition to the adoption of BWA. Figure 2 compares various competing technologies. Fibre and DSL/ cable stand out in terms of faster speed and lower material cost. In terms of mobility, WiMAX (upcoming 802.16e) is ranked after 3G. While Wi-Fi offers hotspot coverage and WiMAX extends this coverage as a BWA solution to metropolitan area networks, 3G provides wide area coverage with full mobility, integral security and automatic roaming to meet the requirements of business users and consumers alike. At later stage, it is possible for WiMAX to support full mobility applications with WiMAX-mesh networks integrated with advanced handoff, roaming and mobility management technologies. Nevertheless, in terms of speed and cost, WiMAX is still faster yet cheaper than 3G.
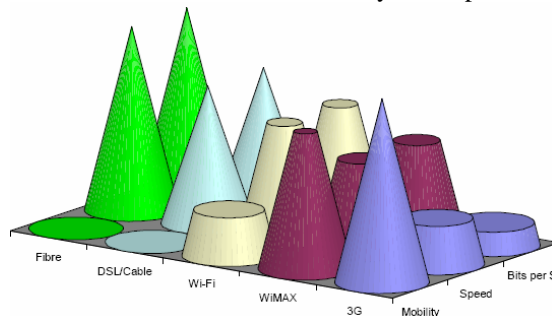
Figure 2. Comparisons between wireless technologies (Prins, 2005)

One of the problems which gives rise to the need to deploy WiMAX is that there have not been effective, standards-based solutions for implementing wireless networks within metropolitan-sized areas (Geier, 2003). Traditionally, companies install proprietary or 802.11 equipment for wireless connectivity over areas outside the confines of a building (Geier, 2003). Proprietary systems are great for meeting performance and security requirements; yet, they tend to be more costly and a bit risky in terms of long-term support (Geier, 2003). They also lack interoperability, something that end-users demand (Geier, 2003). 3G is also more troublesome for telecom carriers to install (Vaughan-Nichols, 2003). To deploy it, telco must upgrade its existing 2G base station in terms of hardware and software. Telco must perform the network planning tasks again as 3G system has a smaller coverage area relative to 2G. Additional base stations should also be installed at crowded areas in order to offer sufficient network capacity. Of course, one must do the same thing with 802.11 hotspots and 802.16 base stations, but while hotspots have far less range, a business class hotspot with advanced smart antennas techniques also can be deployed for about US$1500, while all but the smallest 3G base stations start around six figures (USD) (Vaughan-Nichols, 2003).

3.2 Frequency Issues

With a few dominant communications players controlling the best frequencies, it will be hard to get the type of traction needed with the remaining companies operating in the frequencies available (Novakovic, 2005). WiMax will become extremely robust and displace WiFi as the deployment of choice for commercial deployments, but that will not even begin until the end of 2006 (Novakovic, 2005). Based upon the number

of public hotspots already deployed, WiMax will not be chosen to replace those as they are up and running adequately and personnel involved understand how to work with the technology (Novakovic, 2005).

The use of 802.11-based hardware (e.g. Wi-Fi mesh) for metropolitan-sized networks decreases costs, but 802.11 has performance limitations when supporting larger numbers of users needing guaranteed bandwidth (Geier, 2003). In addition, radio frequency interference is often a significant problem with Wi-Fi (802.11b/g) when covering large areas due to license free operation (Geier, 2003). Potential sources of interference at 2.4 GHz include cordless phones, microwave ovens, and Bluetooth-enabled devices.

Wi-Fi offers only unlicensed frequencies while WiMAX has both licensed and unlicensed frequencies. The problem is that licensed frequencies are a mishmash of different bands, each with separately regulated channel requirements, vastly different propagation characteristics, and power requirements (Telephony, 2005). However, due to less interference and higher transmission power, it gives better performance. Therefore, it is worth investing in WiMAX provided if there are good network planning and a large subscriber base. For example, a trial of long-range broadband technology will begin this year in Taipei (Best, 2005). Its Wi-Fi access already covers 90 percent of its population, and extends to 63 of its underground stations (Best, 2005). The city hopes to extend coverage to all of its citizens by the end of 2005 (Best, 2005).

4. CONCLUSIONS

This paper and the corresponding research currently being undertaken analyse the current state and future trends of WLAN/ BWA deployment in Asia Pacific region by presenting constructive evidence. The paper rehashed the factual information and discussed possible impact on the cellular data market as well as the business outlook for WLAN/ BWA. Based on available statistics, comparisons between competing technologies can be done in order to evaluate new opportunities in Asia Pacific. Players in the industry will be able to screen risk, review competition as well as carry out further assessment to exploit opportunities for wireless solutions in Asia Pacific region. This paper deals with timely issues and serves as a basis for further studies in investigating WLAN/ BWA exploitation opportunities in Asia Pacific region.

REFERENCES

Baker, M. (2005). *Broadband for Everyone*: AOEMA.

Bell, P., & Roberts, M. (2005). *Asian Public Wi-Fi Market Expands 6% in 2Q05*: Wireless Broadband Analyst.

Best, J. (2005). Citywide WiMax Networks Coming This Year and Blanket Wi-Fi to Take Over 100 Cities Soon... *Silicon.com*.

Fellah, A. (2005). *WiMAX and Broadband Wireless (Sub-11Ghz) Worldwide Market Analysis and Trends 2005-2010*. Canada: Maravedis Telecom Market Research & Analysis.

Geier, J. (2003). *A Future Option for Wireless MANs*, from http://www.wi-fiplanet.com/tutorials/article.php/2236611

IDATE. (2004). *Initial Assessment and Outlook with the Advent of WiMAX*: IDATE.

IEC. (2000). *The Evolution of Broadband*, from http://www.iec.org/online/tutorials/evolution/topic02.html

Ikemefuna, A. (2003). *WiFi Vs. 3G*: Cellynk Communications Corporation.

In-Stat. (2005). *Asia Pacific Will Represent 45% of WiMAX Market by 2009*. Retrieved October 12, from http://www.cellular-news.com/story/14239.php

Messinger, R. (2004). *WiMax: The Next Disruptive Technology or The Next Technology Black Hole?*, from http://searchnetworking.techtarget.com/tip/1,289483,sid7_gci989708,00.html

Novakovic, Z. (2005). *WiFi vs. WiMax*, from http://www.mobilein.com/WiFi_vs_WiMax.htm

Prins, H. (2005). WiMAX - Offering More Than Just Broadband and Mobility. *The First APT Operator Forum*, Seoul, Republic of Korea.

Purbo, O. W. (2003). *Digital Review for Asia Pacific 2003/2004: Indonesia*.

Siemens. (2003). *Entering the Mobile Data Mass Market: Public WLAN for Mobile Network Operators*, Germany.

Telephony. (2005). *Complete Guide to WiMAX: The Business Case for Service Provider Deployment*: Telephony.

Vaughan-Nichols, S. J. (2003). *802.11 vs. 3G*, from http://www.wi-fiplanet.com/tutorials/article.php/1577551

Walko, J. (2004). *WiMAX to be 'Clear Winner' in Broadband Wireless*. London: CommsDesign.

WiMAX Forum. (2005). *IEEE 802.16a Standard and WiMAX: Igniting Broadband Wireless Access*: WiMAX Forum.

THE ROLE OF STANDARDS IN B2B COMMUNICATION

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ABSTRACT

Recent developments in e.g. Internet technology have brought new opportunities in how and with whom to do business. Business-to-Business (B2B) is given much attention, and is expected to rise further in popularity. Integration between B2B collaborators is most often undertaken using a B2B standard for the information exchanges. However, it is still unclear what role these standards play in the interactions. This paper analyses four existing standards in order to establish their respective roles. The results show that standards clearly cover different aspects, types, and levels of details of business processes. The choice of standards is therefore complex and requires careful analysis and consideration beforehand.

KEYWORDS

Business-to-Business, Standard, Communication.

1. INTRODUCTION

Recent technological developments have brought new opportunities in how and with whom to do business, which requires solid business processes. This can be achieved through automation, such as automatic responses to electronic customer orders, and automatic notifications of product information updates. Automation removes much of the slow creation, handling, and distribution of business documents (Premkumar et al, 1994; Chau and Hui, 2001). Part of making the business processes solid is to synchronise and integrate them. Standardisation of processes and transactions is one approach, since co-operation is simplified if the same types of standards are used (Emmerich et al, 1999; Burrows, 1999, Hasselbring, 2000; Ghiladi, 2003). The setting of this paper is Business-to-Business (B2B), defined as: "…*the use of the Internet and Web-technologies for conducting inter-organizational business transactions*" (Thompson and Ranganathan, 2004). B2B organisations must form relationships with one another, and inter-organisational systems help improve these links. Standards are a natural part of such systems (Soliman and Janz, 2004). Even though standards are central to business communication, only little research has so far focused on elaborating on what role standards may have therein. This paper will analyse four existing standards for B2B with respect to their role in communication. We use a model of human-to-human (H2H) communication as the basis of analysis. B2B is described in chapter 2, B2B standards in Chapter 3, and the four standards are introduced in Chapter 4. The H2H model is introduced in Chapter 5, the comparison in Chapter 6, and Chapter 7 concludes the paper with a discussion.

2. B2B STANDARDS

In this paper, a B2B standard is defined as: guidelines for how communication and information sent between organisations should be structured and managed (Söderström, 2004). One common misunderstanding is that standards are the same as the technology used. This is not the case. Instead, messages created based on the guidelines of the standards are sent using the technology. The standard is thus the "glue" enabling alignment and co-ordination of the communication. Standards differ in scope depending on type of information to exchange. Some focus only on the structure and content of messages (document-centric), while others focus

on entire processes for the communication (process-centric). The common language usually consists of either Electronic Data Interchange (EDI) or the eXtensible Mark-up Language (XML). Standards are implemented to facilitate inter-organisational communication and co-operation and make it possible to replace much manual, paper-based communication with a more automated one. We will return to the communication focus in the description of the H2H model and in the analysis.

3. FOUR B2B STANDARDS

The four standards were selected based on their widespread use and on their frequent appearance in scientific papers. They are presented in alphabetic in order to avoid placing any weight of importance on either one. The information is gathered from the respective standards homepage unless otherwise stated.

BizTalk: BizTalk aims to drive the adoption of XML in e-commerce and application integration. It has three parts: BizTalk Server; BizTalk Framework; and BizTalk.org. The **server** provides a visual design environment for business processes and a set of bindings to connect process definitions to technologies. The BizTalk **framework** is an XML framework for application integration and e-commerce, and includes a design framework for how to implement an XML schema and a set of XML tags used in messages sent between applications. **BizTalk.org** is a community of standards users that provides resources for learning about and using XML for EAI and B2B document exchange.

cXML: The aim of cXML is to facilitate the exchange of content and transaction information between buyers and sellers, via a protocol for consistent communication of business documents between procurement applications, e-commerce hubs and suppliers. cXML is a set of XML protocols. More precisely, it is an XML-based infrastructure for standardising electronic exchange, updating, supply and control of catalogue content and e-commerce transactions.

ebXML: ebXML is a modular suite of specifications for conducting business over the Internet. Specifications provide a standard method for business message exchange, trading relationships, data communication in common terms, and storage of business processes in public repositories. ebXML consists of: An infrastructure; a semantic framework; and a discovery mechanism. The **infrastructure** helps ensuring inter-operability through a standard message transport mechanism, and a business service interface for handling messages. The **semantic framework** containing a meta- model for defining business process and information models, a set of reusable core components that reflect business semantics and the XML vocabulary, and a process for defining message structures and definitions related to the business process model. The **discovery mechanism** allows organisations to find each other, agree on relationships, and conduct business.

RosettaNet: The aim of RosettaNet is to establish standard processes for electronic sharing of business information. The focus is on business vocabularies, message wrapping and transportation, and business processes for information exchange. RosettaNet contains the following parts: XML; Dictionaries; Partner Interface Processes (PIPs); and RosettaNet Implementation Framework (RNIF). There are two **dictionaries**: a business dictionary with properties for defining business transactions between trading partners, and a technical dictionary with properties for defining products and services. **PIPs** specify the standard content and format for sending and receiving messages. Lastly, **RNIF** provides exchange protocols for RosettaNet standards implementation, specifying information exchange between trading-partner servers using XML, covering the transport, routing and packaging; security; signals; and trading partner agreement.

4. MODEL OF HUMAN-TO-HUMAN COMMUNICATION

Organisational process-to-process (P2P) communication can be compared to human-to-human (H2H) communication. This does not imply that organisations can or must conform to the shape of human communication, but enables an initial understanding of the role standards play in business communication. We base our comparison on the work by O'Sullivan and Whitecar (2000), who used this approach when looking at the RosettaNet standard. This paper expands their analysis by adding three other standards.

The H2H communication model (figure 2) is constructed from an organisational communication perspective, since the highest level is the *business process*. Since B2B standards are used in organisations,

the model is thus relevant for comparison. The most basic part of H2H communication is *sounds*. The combination of sounds is used to make up letters in the *alphabet*. These letters can be combined to form *words*. Words are combined into sentences using *grammatical rules* in order to e.g. describe and discuss phenomena that exist in the world. Sentences are used in *dialogues* between humans, and are the basis of business processes and the work performed therein.
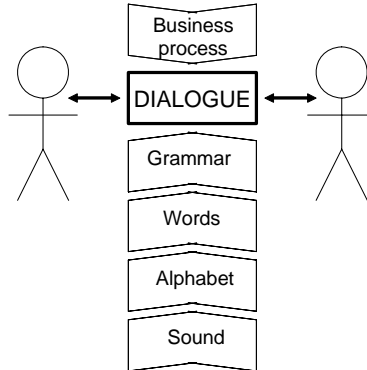

Figure 2. Human-to-Human communication (adapted from O'Sullivan and Whitecar, 2000)

Business processes may contain multiple, or sets of, dialogues. One difference between business and human communication concerns the type of actors in communication, since actors in business communication need not only be human, but can be systems or applications as well.

5. THE H2H MODEL VS. B2B STANDARDS

Just as dialogue is at the centre of attention in the human-to-human model, standards are the focus of standards-based P2P communication (figure 3). Several references to the example standards will be made to exemplifying the correspondences, and figure 4 illustrates how each of these standards relate to P2P. *Standards* are exchangeable with dialogue, since they enable and are part of e-business processes. Existing standards vary in naming and level of detail. For example, BizTalk and ebXML use "Messages" to denote dialogue, while RosettaNet has its PIPs at the same level, and cXML its Business documents. This indicates differences in level of detail, since a business document may imply more high-level and general information than a message. One commonality is that all standards deal with some type of written business information, where the senders and receivers are business processes. However, BizTalk and cXML are document-centric standards, while RosettaNet and ebXML are process-centric standards.
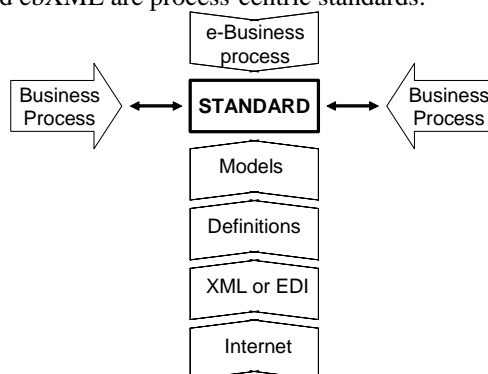
Figure 3. Process-to-Process communication (inspired by O'Sullivan and Whitecar, 2000)

A standard is made up of different *models* that can be graphical, textual, etc. Examples are XML schemas (BizTalk), protocols (cXML), and frameworks (RosettaNet). All standards have a set of rules for how to structure either just the messages, or both them and the processes. Before model construction, *definitions* of concepts must be known. It must be clear what the message means. Our standards describe this in different

ways, for example: BizTalk: defines XML tags similar to word construction, ebXML: defines concepts that refer or correspond to words, and RosettaNet: provides dictionaries of word definitions. Concepts can be defined using a common *alphabet*. This is essential for achieving inter-operability. In B2B standards, the alphabet is either XML or EDI. The most basic means through which standards-based communication takes place is *Internet* technology, corresponding to sound in H2H communication.
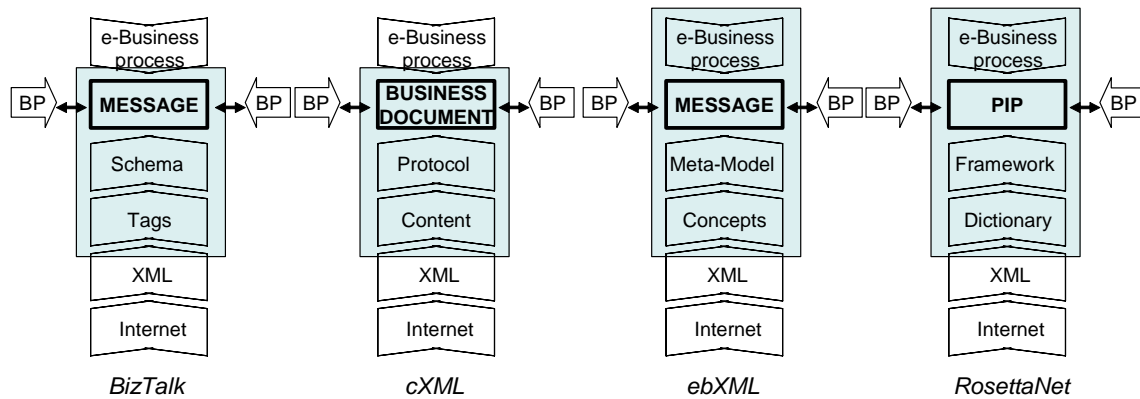
Figure 4. Human-to-human model versus four B2B example standards

A summary of the comparison is presented in Table 1, outlining similarities and differences for each aspect. All standards use the same naming for e-business processes. They also differ in process coverage, since they are either document-centric or process-centric. The two process-centric standards differ between them, in what type of processes they cover. RosettaNet focuses on a few industry branches, while ebXML takes a more general approach. All four standards deal with exchange of written business information, but differ in their naming convention. The same differences in processes as with e-business apply here as well.

Table 1. Comparison summary

Human-to-human	Process-to-process	Similarities	Differences
Business process	e-business process	Naming	Process coverage
			Types of processes
Dialogue	Standard	Transportation of written business information	Naming of concepts
			Process coverage
Grammar	Models	Some rules are provided	Naming
			Concept content
Words	Definitions	Support for words exist	Naming
			Concept content
			Support for one or multiple words
Alphabet	XML or EDI	All use XML	None
Sound	Internet	All use Internet technology	None

In grammar, all standards provide some rules for how to combine "words into sentences", even though the approaches and names differ. For example, BizTalk: XML schemas, cXML: communication protocols, ebXML: an inter-operability meta-model, and RosettaNet: a communication framework. The exact contents of the concepts differ, and rules are thus provided in different ways. The same applies to words, where all standards have some support. Differences are naming, concept content, and support of either single (BizTalk – tags, ebXML – concepts) or multiple words (cXML – document content, RosettaNet – dictionaries). All standards are alike in alphabet and sound, since all use XML and internet technology.

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6. SUMMARY AND CONCLUSIONS

The focus of the paper was to analyse four B2B standards with respect to their role in communication we discussed. Results showed that the standards cover different aspects, types, and levels of details of business processes. Even though several of them deal with e.g. information sharing, they do so in different ways. The comparison provides an insight into how much and what parts of an organisation that will be affected using a standard. The differences call for a thorough analysis of standards content, to enable better decision-making about standards, as well as for an analysis on what organisations themselves want to standardise – which will affect their standards choice. In the long run, it will not be enough to scratch the surface of standards. Future research will focus on providing organisations with a tool for comparing standards.

REFERENCES

BizTalk: www.biztalk.org

Burrows, J. (1999), Information Technology standards in a changing world: the role of the users, Computer Standards & Interfaces, pp.323-331, Elsevier Science B.V.

Chau, P. and Hui, K. (2001), Determinants of Small Business EDI Adoption: An Empirical Investigation, Journal of Organizational Computing and Electronic Commerce, 11 (4), pp.229-252

cXML: www.cxml.org

ebXML: www.ebxml.org

Emmerich, W., Finkelstein, A., Fuggetta, A., Montangero, C. and Derniame, J.-C. (1999), "Software Process - Standards, Assessments and Improvement", in: Derniame, J.-C., Badara Kaba, A. and Wastell, D. (eds.), Software Process: Principles, Methodology, Technology, pp.15-25. Springer Verlag

Ghiladi, V. (2003), The Importance of International Standards for Globally Operating Businesses, International Journal of IT Standards & Standardization Research, Vol.1, No.1, January – June 2003, pp.54-56, Idea Group Publishing

Hasselbring, W. (2000), Information System Integration, Communications of the ACM, June 2000, vol.43, no.6, pp.33-38

O'Sullivan and Whitecar (2000), Implementing an Industry e-Business Initiative: Getting to RosettaNet, Intel Technology Journal, 1st quarter, February 3, 2000

Premkumar, G., Ramamurthy, K. and Nilakanta, S. (1994), Implementation of Electronic Data Interchange: An Innovation Diffusion Perspective, Journal of Management Information Systems, Fall 1994, Vol.11, No.2, pp.157-186

RosettaNet: www.rosettanet.org

Söderström, E. (2004), B2B Standards Implementation: Issues and Solutions, PhD Thesis, Department of Computer and Systems Sciences, Stockholm University, Akademitryck, ISBN 91-7265-942-4

Soliman, K. and Janz, B. (2004), An exploratory study to identify the critical factors affecting the decision to establish Internet-based inter-organisational information systems, Information & Management, 41 (2004), pp.697-706

Thompson, T. and Ranganathan, C. (2004), Adopters and non-adopters of business-to-business electronic commerce in Singapore, Information & Management, In press

Posters

THE MULTI-CHANNEL DISTRIBUTION STRATEGY OF THE PORTUGUESE BANKING SECTOR

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ABSTRACT

The intensification of the relationship between clients and banks provides a higher level of segmentation and stratification, leading to a very hostile environment where the competition for the more profitable clients increases. From this assumption, products and prices' personalisation becomes an evident need, being the origin of web portals that represent alliances between important banks and communication companies. Those alliances are a result of the sector's liberalisation; however, they can origin new barriers and are motivated not only by the creation of complex structures but also by the capacity to control the information that runs in the electronic nets. This way, the major goal of this research paper concerns about the fact that, nowadays, we cannot expect an institution to adopt a standard strategy for all its customers. In fact, it should adopt a multi-channel distribution strategy, selling the right products to the right customers.

KEYWORDS

Electronic Distribution Channels, Portuguese Banking Sector.

1. INTRODUCTION

In order to give an appropriate response to the market and institutions' reforms, the banking sector has been changing its activity procedures, and the advantages and disadvantages of those changes have been a relevant subject of discussion. On the one hand, *"fusions and banking acquisitions, when successfully done, promote cost reduction and increase profitability, bringing obvious benefits to clients and stakeholders"* (Baliño and Ubide, 2000). On the other hand, if consolidation is too high, it can bring undesirable dominance positions and/or incoherent situations (*e.g.* when an institution is considered too large for bankruptcy). On this basis, according to Dias de Figueiredo *et al.* (2000), it is necessary to overcome two main barriers that are related to the technological adequacy of infrastructures and the reengineering of the value chain (concerning logistic and distribution aspects). In both cases, the problem consists in evaluating if the joint production of two institutions represents an inferior cost compared to the sum of the independent cost of those same institutions. For Baliño and Ubide (2000), as a result of the banking activity concentration, *"the number of institutions decreases but their dimension increases"*. Thus, investment in new distribution nets and/or sophisticated computerized systems can significantly reduce the joint production costs of different institutions[1].

2. THE MULTI-CHANNEL DISTRIBUTION STRATEGY

Nowadays we cannot expect an institution to adopt a standard strategy for all its customers. In fact, financial and banking institutions should sell the right products or services to the right clients. In such context, instead of developing innovative products and services in order to promote differentiation, the present trend focuses

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[1] Between other variables, the microeconomic theory indicates that an institution optimal dimension depends on its cost function. This way, for a certain technology, there will be opportunities of scale economies when the unitary costs curve decreases. On this basis, high fixed costs (as installation of a distribution net or central computerized systems) can reach decreasing unitary costs. See Porter (2001).

on the client's orientation. In other words, unlike a few years ago, financial and banking institutions *"found out that products and services can be easily copied and improved"* (Henriques, 2000), and the investment in products and services' improvement does not make sense any more. According to this idea, the importance of the new online channels is inevitable and, in a short time period, Portugal can be qualified as a case study in the adoption of financial services' multi-channel distribution strategies, where the reduction of the traditional agencies net is the most immediate consequence. This idea seems to be shared by Tavares (2001), who states that virtual agencies will behave as true attackers in the financial markets. According to this idea, it seems urgent to understand that ICTs' use is no longer simply convenient, but also an important factor of competitive advantage in the financial markets, where qualified teams are formed in order to improve knowledge transfer processes.

3. CONCLUSION

The irruption of a highly competitive scenario demands a positive and effective response from the institutions that are operating in the financial markets. As referred in Henriques (2000), *"challenges increase according to clients' expectations, (...) and those expectations increase according to the emergence of new transaction methods based on new technologies"*. The new information and communication technologies, with special emphasis to the Internet, easily increment the access to information, bringing important changes not only in customers' behavior but also in financial institutions' activity. In this logic, it seems clear that if banks and financial institutions achieve: good information about clients and competitors; automatic systems for products and services' configuration; immediate access to information; opportunities' management systems; and processes and routines' flexibility, they will be able to establish a preferred interaction with clients, *"fulfilling their needs"* (Henriques, 2000). Nevertheless, behind the existence of different distribution channels (Internet, PC banking, phone, ATM and traditional agency), the majority of the Portuguese banking institutions recognize the deficient use of those technologies. This way, an optimistic attitude concerning ICTs' use is required, even if this optimism becomes the basis for deeper reforms in the banking system.

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REFERENCES

Almeida, P., 2000. Novos Canais, Mais Flexibilidade. *Economia Pura*, n.º 27, August, pp. 30-35.

Baliño, T. and Ubide, A., 2000. Uma Possível Missão Impossível. *Economia Pura*, n.º 27, August, pp. 46-49.

Dias de Figueiredo, A.; Celorico, J. and Coelho, P., 2000. *Empresas que em Portugal Operam no Domínio do Correio Electrónico*. Pedro Nunes Institute, Coimbra.

Ferreira, F., 2002. *Inovação Tecnológica no Sistema Financeiro Português: Evolução e Perspectivas*. MSc Dissertation in Economic Sciences, Faculty of Economics, University of Algarve, Portugal.

Henriques, J. 2000. Serviços Financeiros no Séc. XXI. *Economia Pura*, n.º 27, August, pp. 39-41.

Nunes, R., 2000. Tecnologia Força Reestruturação. *Economia Pura*, n.º 27, August, pp. 24-29.

Porter, M., 2001. Strategy and the Internet, *Harvard Business Review*, March.

Tavares, L.V. 2001. Inovação: Que Engenharia e Tecnologia para os Próximos 20 Anos? *Economia Pura*, n.º 32, January, pp. 46-47.

CONTRIBUTION FOR DETERMINATION E-READINESS INDEX OF SERBIA

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1. INTRODUCTION

E-readiness refers to a country's ability to take advantage of the Internet as an engine of economic growth and human development. The first step in any approach to introduce ICTs is to consider the ability or "readiness" to integrate ICT's. An evaluation based on objective criteria (indicators) to establish basic ICT benchmarks is one way of assessing e-readiness. An e-readiness assessment can be used as an information-gathering mechanism for countries as they plan their strategies for ICT development. It can help a society better understand what impediments to Internet development exist and what initiatives are needed to overcome them (Deign, 2005).

A variety of assessment tools have been developed to measure e-readiness, and assessments have been conducted in many countries. Each of these tools uses a slightly different definition of e-readiness and different means for measurement. Since 2000, the Economist Intelligence Unit has published an annual e-readiness ranking of the world's largest economies. Serbia and Montenegro is not on this list. This survey tries to make a platform for change of this situation.

2. FACTS FOR E-READINESS INDEX OF SERBIA

According to (Budhiraja, Sachdeva, 2005), we will present all information grouped as main e-readiness objectives: e-infrastructure, e-economy, e-society and e-governance.

E-Infrastructure: The statistics about fixed and mobile telephony in Serbia are: in 2004 there were 2.415.676 fixed lines (with teledensity 32,92) and more than 3.000.000 user of mobile phones (with teledensity 316,7). Digitalization of fixed lines is 95%. There are more than 300.000 installed and unused lines in fixed telephony. Also, there are more than 22.000 installed ISDN lines, 683 Frame Relay and 273 X.25 users. The most popular connections to Internet are still dial-up, with the throughput up to 56 kb/s. Only free connection to Internet is thru the Academic net, all the others are paying to the providers (between 0,15 and 0,50 Euros for an hour) and local telephone call. ISDN connections have the throughput of 64 or 128kb/s, cable companies from 128 to 256kb/s, with the payment rates from 0,035 to 0,05 Euros/Mb, point-to-point digital lines have of 2Mb/s for more than 1000 Euros and digital lines with the provider have almost double price. Wireless connections have 256kb/s and monthly price 400 Euros. There is more than 50 Internet providers *4 are making more than 80% of transactions).

E-Economy: The effects of ten years slow economy development and isolation of Serbian economy are also evident in the case of low investment rates in information technology (IT) and the development of telecommunication infrastructure. Brain-drain and enlargement of digital divide between Serbia and the other European countries is also evident. On the other hand, there are actions concerning the introduction of ICTs in all sectors of work and economic activities.

The largest investments in ITC were made in financial sector. Most banks use home-made application modules for the core-banking, while foreign banks mainly use foreign application modules (one of the most

often used is Halcom). Applications for account opening, recording, and reporting about the executed transactions are added to existing core-banking systems. Virtual banks are also popular in Serbia. Among financial institutions Beokliring and Belgrade Stock Exchange are also good examples in using ICT.

A research, comprehending 50 institutions, was made in order to get objective impression about the motivation of various Serbian companies to introduce e-business (Jošanov, 2001). Some main results of this research are:

- The existing personal source possesses formal high structure, but training and knowledge innovations have not been completely realized during the last 15 years.
- The experiences in computer network use exist, but it is extremely small number of established electronic exchanges of certain business data structure. Still, there is significant number of ERP implementations in last years.
- Information systems are usually applied in almost all segments of work, and they very often use a unique system of data, usually centralized database with real time maintenance.
- The better state of information systems is found in banks, insurance companies and large productive organizations, and the lowest level of information systems are found in SME.

In the results of this research we can find that private sector, although mostly with low level of their existing information systems, is more flexible and oriented on changes and new technologies. Some important examples of e-commerce can be found in retail practice in Serbia. Virtual bookshops are very popular. Other virtual shops, organized as malls, found that the only way of paying which work is COD.

E-Society: After 10 years of dictatorship and economic sanctions, with about 400.000 refugees and with separation processes of Kosovo and Montenegro, Serbia became poor country of well educated people with European manners, who lost all illusions about normal life and equal rights. GDP in Serbia is now only $2.620 per capita and annual growth rate is 4%. Inflation rate is between 13 and 14% in last 4 years. More than 10% of population lives under the poverty line. More than 200.000 highly educated people left Serbia in last 15 years, making Serbian Diaspora very large.

There are about 800.000 PCs in use, more than 1.000.000 people are using Internet on more than 20.000 hosts. There are more that 12.000 Web sites in use and about 17.000 registrated domains. Annual growth rate of Internet users is about 150% (Maruzelli, 2004). On the list of 10 most popular sites in Serbia & Montenegro there are 4 search engines, 3 sites of daily newspaper publishers and 3 sites that are intended to our Diaspora. All those Web sites are owned by private companies.

E-Governance: The most of the government's officies and agencies have their important information on the Web. Speaking about G2C, G2B and G2G, it is possible to find information and download a lot of paper documents, but you can not make any transaction with any of these institutions. Government of Serbia invested in large project of egovernment and the first part of that project is electronic register of all business subjects in Serbia. Some regional governments implemented egovernment functions in practice and the best example is Indjija, where it is possible to create a document and look after until the answer is created. The lack of legislation is huge problem. Telecommunication and copyright law exist from 2003. The digital signature law camein 2004, although it was prepared 5 years later and it was used as a model in some neighbor countries. Legislation about ecommerce and cyber criminal does not exist. Privacy is regulated according to the European standards.

REFERENCES

Budhiraja R., Sachdeva S*.: E-Readiness Assessment*, MIT, Department of Information Technology, 2005

Deign J.: *Global Information Technology Report Reinforces the Link between ICT and Competitiveness*, News@Cisco,March 9, 2005

Jošanov B.: *Model vrednovanja mogućnosti uvođenja kooperativnih otvorenih interorganizacionih informacionih sistema*, Doctoral disertation, Institute for mathematics, University of Novi Sad, 2001

Maruzzelli G.: *Investing to the Internet and IT sectors in Serbia: challanges and possibilities*, Gallo ECF, Belgrade, May 2004

Pocajt V.: Primer razvoja eposlovanja - baza podataka Key-to-Steel, in Josanov B., Perić D.: *Elektronsko poslovanje - pogled iz Srbije*, Viša elektrotehnička škola, Beograd, 2005.

Vidas-Bubanja M., Jošanov B., Vuksanović E.: Role of e-business in transition of Yugoslav Economy, *Proceedings from 15th Bled Electronic Commerce Conference e-Reality: Constructing the e-Economy*, Bled, Slovenia, 2002

DESIGN OF DEVELOPMENT ENVIRONMENT FOR MOBILE-COMMERCE SYSTEM

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ABSTRACT

Due to the growth of wireless environment and mobile network, mobile commerce (m-commerce) has been being evolved from electronic commerce (e-commerce). Although m-commerce is similar to e-commerce in aspects of functionalities, m-commerce devices are more small-sized and operated in narrow bandwidth. Therefore, we propose an approach to design of software architecture for m-commerce system, which considers constraints of m-commerce compared to e-commerce and explain supporting environment for this approach.

KEYWORDS

m-commerce, architecture, design

1. INTRODUCTION

With the passage of time, the price of wireless devices is declining. Thus, wireless devices are quickly spreading. Moreover, a PC is not needed to access the Internet because the Internet can be accessed via smart phone or other Internet-enabled wireless devices[1]. Additionally, the needs of using mobile commerce (also known as m-commerce) are being increased gradually through the improvement of bandwidth which affects convenience of mobile devices. Compared with e-commerce, m-commerce has the following characteristics:[1,2,3]

- Ubiquity: A user can access real-time information at any location in a real-time environment.
- Instant connectivity: Mobile devices enable users to connect easily and quickly to the Internet, Intranets, and so on.
- Personalization: Personalization enables the preparation of information for individuals.
- Localization: Localization enables offering relevant services by knowing where a user is physically located at any particular moment.

In this paper, in order to support developing quickly m-commerce system by taking consideration into these above characteristics, we propose an approach to design of software architecture for m-commerce.

2. RELATED WORKS

Varshney et al.[4] proposed a framework that allows developers and providers to effectively implement m-commerce applications. The framework consists of four levels: m-commerce applications, user infrastructure, middleware, network infrastructure and provides a developer plane, a content provider plane and a service provider plane to address the different needs and roles. And they defined necessary functional components at each level in the framework. But this framework doesn't mention how to design application architecture for m-commerce applications.

In [5], a methodology of developing mobile agent-based applications is proposed. This approach is to design mobile agent-based applications by applying design patterns. And the methodology has three levels: platform independent architectural design, platform independent detailed design and platform dependent detailed design. In the architectural design, mobility patterns and task patterns are applied for mobile agent. This methodology can be applied to design mobile agent-based applications rather than general m-commerce

applications without mobile agents.

Mobile computing devices have restriction in small screens and input devices as compared with PC environments. Due to these restrictions, most m-commerce applications get information through sequential steps and each step gets one kind of information. Besides, communications with the m-commerce server quite often occur to get information to be shown to a user every step. Because of this, if the amount of information is huge, each step takes a long time. Thus, only necessary information of each step should be delivered to user.

Additionally, m-commerce can be executed on the wireless network, bandwidth have to be considered. Therefore, contents download time has to be considered since m-commerce users expect real-time results. Allowing for contents download time, m-commerce systems should provide essential information that a user want to know. Further, a user should be able to find desired functionalities and information quickly and easily because real-time-ness is important in the m-commerce environment. In this respect, it should provide personalized information or minimize a user's inputs using the user information such as the user's location data[6].

3. M-COMMERCE SYSTEM ARCHITECTURE DESIGN

In order to support developing a m-commerce system that considers given above characteristics, we propose an approach to design of m-commerce architecture for commerce wireless services.

3.1 Configuration of functionalities for m-commerce users

First of all, to design software architecture for m-commerce, functionalities should be defined taking m-commerce characteristics into consideration.

M-commerce application is generally composed of multiple steps and has input forms that can get one kind of information per each step considering mobile devices. To minimize user's input, functionalities have to extract as many as possible information using minimal inputs.

Also, to abbreviate steps, functionalities should be defined taking real-time and current location into consideration so that a user can only input essential information not going through unnecessary several steps.

For example, in case of searching functionality, user's current location can be related with location of the search target. In this case, a searching functionality can be defined to include the functionality which calculates shortest distances using user's current location although the user doesn't input any information.

3.2 Design based on relationship between m-commerce and e-commerce

Second, we have to consider e-commerce because differences between e-commerce and m-commerce lie primarily in utilizing the user's information such as location data. Therefore, m-commerce would be regarded as extension of e-commerce since commerce has similar forms and existing e-commerce components can be reused in m-commerce. In this respect, m-commerce architecture should be defined in view of existing e-commerce components.

To support reusing existing e-commerce components, it is necessary to discriminate e-commerce functionalities from m-commerce functionalities. Then, m-commerce specific functionalities should not include common e-commerce functionalities.

Consequently, as shown in figure 1, m-commerce architecture can be formed as a hierarchical structure which has three tiers as follows: the first tier for clients UI components, the second tier for providing m-commerce specific functionalities, and the third tier for common e-commerce components and mobile user's information components.
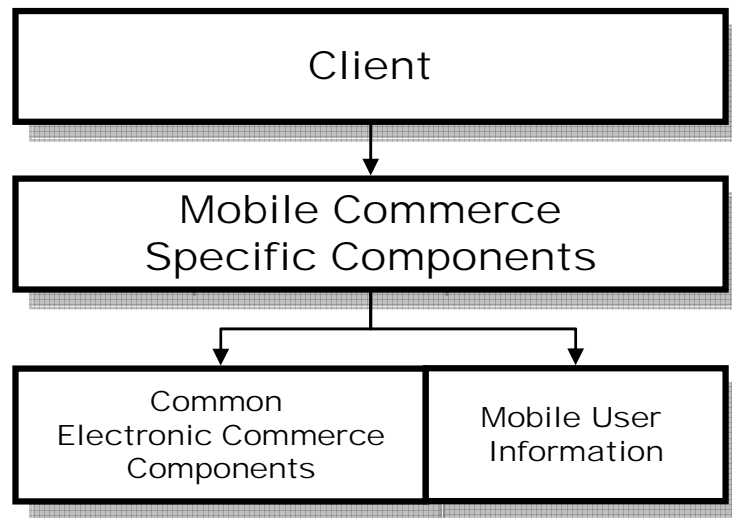
Figure 1. M-commerce architecture

3.3 Design of m-commerce specific components

Third, direct connection between m-commerce specific components and e-commerce components should be minimized. That is, required interfaces of m-commerce specific components should be minimized. Thus our approach uses indirect connection with connectors instead of required interfaces. If functionalities of required interfaces are required before/after business logics of components, these functionalities should be executed before/after business logics rather than in the logics. Thus these functionalities can be included in connectors easily since they are not needed to be included in the logics.

If functionalities of required interfaces are required in business logics of components, dependency on other components can not be avoidable. In this case, voluntary required interfaces can be defined instead of actual interfaces of other components. Since voluntary required interfaces do not correspond with the actual interfaces, connectors are defined between voluntary required interfaces and actual interfaces.

3.4 Supporting environment for m-commerce architecture style

To satisfy m-commerce architecture consideration, we designed m-commerce architecture style and language based on MOF. This language has its own notation, thus we designed modeling tools and supporting environment. In this environment, at first, an architect should design an architecture model using our modeling tools and verify using model simulation function and then finally complete architecture models. This model would be transformed into platform specific model such as EJB platform or .NET platform by MDA technology. From this platform specific model, we will get platform specific initial skeleton codes. Programmers would write more codes from these skeletons. This architecture model has also information of m-commerce constraints. Using this information, we can generate test cases from this model automatically. The architect can check whether programmers implemented codes correctly as architect designed more easily. Figure 2 shows this development flow.
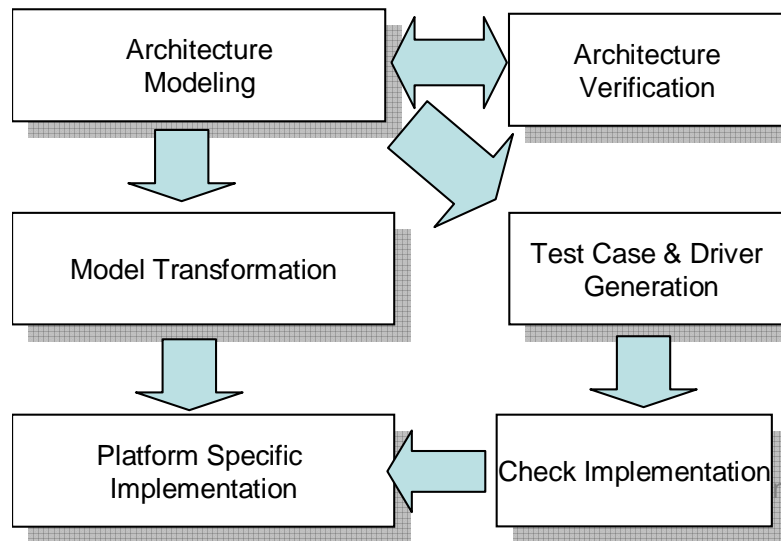
Figure 2. Development flow for m-commerce architecture

4. CONCLUSION

In conclusion, our approach proposed how to form mobile services in a m-commerce architecture considering users and mobile devices, and build the architecture allowing for reuse of existing e-commerce components, and design m-commerce specific components independent of existing components. Then we explained the flow of design and implement for m-commerce architecture and also we made prototypes for this approach. In the future, we will evaluate this approach's substantiality by applying to more practical examples. Also we will research on description for m-commerce architecture using UML 2.0.

REFERENCES

[1] E. Turban, D. King, J. Lee, and D. Viehland, Electronic Commerce A Managerial Perspective 2004, Prentice Hall PTR, 2004.

[2] C. Lee, W. Hu, and J. Yeh, "A system model for mobile commerce", 23rd International conference on Distributed Computing Systems Workshops, pp.634-639, 2003.

[3] J. Park, Successful m-commerce business strategies, ebeecom, 2001.

[4] Varshney, U.; Vetter, R., "A framework for the emerging mobile commerce applications", Proceedings of the 34th Annual Hawaii International Conference on System Sciences, Jan 2001 pp.10, 2001.

[5] F. P. Guedes, P. D. L. Machado, and V. N. Medeiros. "Developing mobile agent-based applications", CLEI 2003, 2003.

[6] R. Unni and R. Harmon, "Location-based services: models for strategy development in M-commerce", PICMET '03., pp.416-424, July 2003.

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