Project E-Society: Building Bricks

Edited by
Reima Suomi
Regis Cabral
J. Felix Hampe
Arto Heikkilä
Jonna Järveläinen
Eija Koskivaara

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PROJECT E-SOCIETY: BUILDING BRICKS

IFIP – The International Federation for Information Processing

IFIP was founded in 1960 under the auspices of UNESCO, following the First World Computer Congress held in Paris the previous year. An umbrella organization for societies working in information processing, IFIP's aim is two-fold: to support information processing within its member countries and to encourage technology transfer to developing nations. As its mission statement clearly states,

> *IFIP's mission is to be the leading, truly international, apolitical organization which encourages and assists in the development, exploitation and application of information technology for the benefit of all people.*

IFIP is a non-profitmaking organization, run almost solely by 2500 volunteers. It operates through a number of technical committees, which organize events and publications. IFIP's events range from an international congress to local seminars, but the most important are:

- The IFIP World Computer Congress, held every second year;
- Open conferences;
- Working conferences.

The flagship event is the IFIP World Computer Congress, at which both invited and contributed papers are presented. Contributed papers are rigorously refereed and the rejection rate is high.

As with the Congress, participation in the open conferences is open to all and papers may be invited or submitted. Again, submitted papers are stringently refereed.

The working conferences are structured differently. They are usually run by a working group and attendance is small and by invitation only. Their purpose is to create an atmosphere conducive to innovation and development. Refereeing is less rigorous and papers are subjected to extensive group discussion.

Publications arising from IFIP events vary. The papers presented at the IFIP World Computer Congress and at open conferences are published as conference proceedings, while the results of the working conferences are often published as collections of selected and edited papers.

Any national society whose primary activity is in information may apply to become a full member of IFIP, although full membership is restricted to one society per country. Full members are entitled to vote at the annual General Assembly, National societies preferring a less committed involvement may apply for associate or corresponding membership. Associate members enjoy the same benefits as full members, but without voting rights. Corresponding members are not represented in IFIP bodies. Affiliated membership is open to non-national societies, and individual and honorary membership schemes are also offered.

PROJECT E-SOCIETY: BUILDING BRICKS

6TH IFIP International Conference on e-Commerce, e-Business, and e-Government (13E 2006), October 11-13, 2006, Turku, Finland

Edited by

Reima Suomi
Turku School of Economics
Finland

Regis Cabral
Ict Leap Applied Physics and Electronics
Umeå University
Sweden

J. Felix Hampe
Universität Koblenz-Landau
Germany

Arto Heikkilä
Turku School of Economics
Finland

Jonna Järveläinen
Turku School of Economics
Finland

Eija Koskivaara
Turku School of Economics
Finland

Springer

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CONFERENCE GENERAL CHAIR'S MESSAGE

This volume contains the papers presented at I3E 2006, the sixth International Conference of e-Commerce, e-Business and e-Government, which was held in Turku from 11-13 October 2006. The I3E conference series is organized by IFIP WG6.11, which focuses on Electronic Commerce and Communication Systems and is supported by IFIP Technical Committees 6, 8 and 11.

The piquancy of the work towards the e-Society is that it never gets finished. Over the years we have called the future society many names: industrial society, post-industrial society, information society, knowledge society, network society – you name it. The I3E conference series and consequently this volume are anchored to the concept of the e-Society manifesting itself in e-Commerce, e-Business and e-Government. Regardless of the name, what is important is looking forward towards a better society.

This book will not complete the information society, but hopefully it can deliver some valuable and enduring building bricks towards that end. The "brick" concept is purposefully selected for the name of the book as we want to stress that in addition to its virtual character, the coming e-Society should really deliver concrete and tangible benefits for its members.

The submissions to the conference were quite evenly distributed along the three main topics of e-Commerce, e-Business and e-Government. This really shows that the research community is alive and well, and that new important concepts are sure to emerge in the near future. Some have already gained considerable ground, such as e-Democracy, e-Health and e-Tourism.

I would personally like to thank the many people that made this volume and the I3E conference 2006 in Turku possible. I make the thanks in a chronological order. The first thank you goes to Volker Tschammer, who encouraged me to visit the I3E conferences; he was a motivating role model, who always had time to discuss issues with his younger colleague. Next came Wojciech Cellary and Winfried Lamersdorf, my co-chairs of the IFIP WG6.11. They have constantly supported our team in the process of preparing for the conference and this book, and Wojciech Cellary especially has always had time to answer our detailed and sometimes marginal questions on how to organize the conference. In a similar vein, swift and detailed help was always available from the Chair of IFIP TC6, Otto Spaniol. Thank you very much, all of you.

My long-time friends and colleagues J. Felix Hampe and Regis Cabral helped me navigate through the deep academic seas that need to be crossed when an academic conference is being held. The tens of reviewers that catered for the quality of the contributions worked in a similar role. Thank you very much for your support.

There are several people to thank back at home in Turku. Our Rector, Tapio Reponen, and Dean, Hannu Salmela, created an atmosphere in which I could be sure that working on the conference was understood as a core activity in the university's and our department's portfolio. Assistant Professor Eija Koskivaara mastered the thousands of details that are needed in the running of a conference. Professor Jussi Puhakainen took care of the selection of the review system and Assitant Professor Jonna Järveläinen looked after the review process. Researcher Yan Yang was responsible for the I3E 2006 website. Researcher Arto Heikkilä and Secretary Birgit Haanmäki took care of the administration of the conference.

A big thank you goes to our financial supporters. The Finnish Foundation for Economic Education and Finnish Academy funding ensured that the conference could be made a high-quality one. I also want to express my thanks to Springer for publishing this book.

Finally, I want to thank all the contrbutors to this book, as well as the I3E2006 conference participants. In addition to virtual elements and bricks, the coming e-Society needs spirit. You delivered that.

Reima Suomi
I3E 2006 Turku Conference General Chair

PROGRAM CO-CHAIRS' MESSAGE

With I3E 2006, the 6th time in this series of IFIP conferences, we brought together researchers and practitioners in the area of e-Commerce, e-Business, and e-Government. The conference was sponsored by IFIP TC6 in co-operation with TC8 and TC11.

The conference provided a forum for researchers, engineers and interested users in academia, industry and government to discuss the latest research, cutting-edge practice and upcoming trends in the growing areas of e-Commerce, e-Business and, especially, e-Government. Sophisticated applications as well as the underlying technology that supports such applications were discussed and demonstrated. The conference attracted a wide range of participants representing a significant community of researchers and practitioners from a broad range of countries.

A total of 80 paper submissions and an acceptance rate of 50% ensured a very high-calibre conference. The submissions came from 24 different countries, 10 from non-European countries, so we could truly call I3E 2006 an international event.

The conference was organized along parallel tracks, each track focusing on specific aspects of current research, industry applications and public administration. The papers in this volume have undergone a process of double-blind reviewing – for which we thank the large group of international peers. The insightful comments and suggestions from the reviewers have further improved the quality of the already high-quality submissions.

Thus the quality and success of the IFIP I3E 2006 conference was based on the sound work of all participants and the organizing committee members. Special thanks go to the program committee and reviewers for their intensive and very timely support.

The willing collaboration between all committees and individuals associated with the conference under the guidance of the conference chair, Professor Reima Suomi from the Turku School of Economics made this conference a very valuable and rewarding venture.

J. Felix Hampe and Regis Cabral
I3E 2006 Turku Program Co-chairs

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Identity and Access Management for Remote Maintenance Services in Business Networks

Kari Luostarinen, Anton Naumenko, Mirja Pulkkinen
Metso Paper, Inc., PO Box 587, FIN-40101 Jyvaskyla, Finland
Kari.Luostarinen@metso.com
Information Technology Research Institute, PO Box 35, FIN-40014,
University of Jyvaskyla, Finland
{Anton.Naumenko, Mirja.Pulkkinen}@titu.jyu.fi

Abstract. Access to information systems across corporate boundaries with high demands to privacy and trust result into ambitious research and development targets. This study provides motivation and a roadmap for approaching integrated security management solutions in a business network of partners with heterogeneous ICT and security infrastructures. We aim at describing specifics of identity and access management in inter-organizational collaboration, and a vision and arguments for identity and access management in a business network. A case study with Metso Paper, Inc., the leading manufacturer of paper machinery and related services, validates the results, thus providing a motivating example of the possibilities of e-services.

1 Introduction

Web technologies enable today ICT-supported business processes across enterprise boundaries [2, 11]. However, there are numerous questions to be solved before the information systems of collaborating partners can be set up and made accessible for the exchange of information independent of the geographic location of the provider and the clients. A core issue in building an e-services partnership is mutual trust [6]. To build trust, one of the first thresholds to overcome is the protection of the information systems and data from unauthorized access. In this case study, we examine an enterprise with both its own activities, and the sites of the clients distributed globally, and propose a roadmap for achieving an efficient and trustworthy user identity and access control management. The challenge is to provide secure ways and means to manage the user data and access control both within a geographically distributed enterprise, and for the collaboration with its clients at any location globally.

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1.1 Background

We will refer to the business networks of multiple enterprises according to the definition of Rosenfeld [15]: The business network is "a group of firms with restricted membership and specific, and often contractual, business objectives likely to result in mutual financial gains... Networks develop more readily within clusters, particularly where multiple business transactions have created familiarity and built trust".

For an analytical view to the security infrastructure we use the four enterprise architecture (EA) dimensions Business Architecture (BA), Information Architecture (IA), Applications Architecture (AA) and Technology Architecture (TA) that find support in literature, especially practice related studies [4, 12-14]. To guide the EA management, planning and development, these dimensions are examined at different decision making levels with a narrowing scope of the decisions and respectively more specific level of abstraction. Three levels of abstraction have been found useful in practical EA work [17]: enterprise (strategic management), domain (management of operations; business units and processes) and systems level (information systems management). At the enterprise level, strategic decisions are made. At the domain level, the EA is developed in smaller units defined as domains (either development-time or permanent) with some decision making power delegated to them for more detailed decisions. At the domain level, the enterprise level strategic decisions are materialized into concrete designs of IT architectures and systems. At the systems level, detailed architecture descriptions are made, and fine grained guidelines, policies, patterns and standards for the systems are agreed on.

Today, business networking with web technologies requires management of architectures and business processes across organizational boundaries, both within large, global corporations, and between enterprises. The EA planning needs therefore to be extended to a multi-enterprise framework [8] with business processes supported by the architectures of the collaborating partners. Security issues come specifically into the focus at the corporate boundaries. However, the user data management (user identity and control of access to systems) within one enterprise is coherently controlled when embedded in a well managed EA providing a supporting framework for the enterprise security architecture.

The Identity and Access Management (IAM) area consists of two interrelated parts. The first part is the management of the users' identities that is basically creating, modifying and deleting of user accounts usually in a heterogeneous ICT environment. The second part is the access management which includes authentication and authorization services, management of access control policies, preferably a single sign-on (SSO) system, enterprise-wide access management, etc. [24].

The three areas make the basis of information security: authentication, authorization and audit. The authentication is the process of validating the credentials of a subject of access to guaranty subject's identity [3, 16]. The authorization is a right or a permission to use a system resource and it is the process of granting access [3, 16]. The audit is a review of logs in order to test the characteristics of security procedures, to ensure compliance with established policies and operational procedures, and to recommend any necessary changes [7, 16].

1.2 Metso Paper Inc.

The case company, Metso Paper Inc. specializes in pulp and paper industry processes, machinery, equipment and related know-how and after sales services. The company's offering extends over the entire life cycle of the process covering new lines, rebuilds and various services. Metso Paper's product range is the broadest in the field and covers the whole production chain from pulping to roll wrapping. The company vision is that Metso Paper unquestionably shall be recognized as the leading supplier of processes and services to the pulp and paper industry globally.

The information security issues relevant in providing services over the data networks accentuate the importance of managed enterprise architecture. Metso is an early adopter of cross-functional business processes and has implemented information systems to support them. The complete infrastructure has been built in sequential EA planning and development projects, which gives a readiness for constructing a consistent security architecture that can be extended also to cross-enterprise processes.

1.3 Related Work and Motivation

The paper provides motivation and a roadmap for approaching access control management challenges in a business network of partners with heterogeneous ICT and security infrastructures that together with high demands for privacy and trust result into ambitious research and development targets. This study describes the specifics of access control management, a vision, and arguments for federated access control management solutions in a business network. Research on the enterprise-wide security is richly available, for example Shaikh et al. provide a comparative analysis of existing IAM products and envision future needs of a next generation unified enterprise application security [20]. The works on the IAM in the area of virtual organizations especially using the service oriented architecture relate to the subject of our research and match the current setting of the industrial case [5, 9]. For example Weaver proposed a distributed data security via web services, trust and federation techniques for manufacturing and process industries [21].

This study extends the findings with new insights on challenges and impacts of IAM within the level of business networks and results to a concrete roadmap of research and development of access management solutions exemplified with the industrial case of Metso Paper, Inc. The instantiation of the roadmap using the real-world case of Metso Paper, Inc., improves the alignment of the research results with practical needs and constraints, serving as a motivating example for researchers as well as for ICT providers.

The paper follows in its structure the creation of a roadmap, starting with a vision, or the ideal situation with the access control management in a business network (section 2). Then, in section 3, the current situation and the steps to be taken with the security management for the company's business processes within the network are considered, according to the time axis. Section 4 presents the roadmap from the present situation to the ultimate vision analyzing and discussing the steps. Section 5 discusses the impact of the short-term solutions related to the identity federation. Section 6 summarizes the paper with conclusions.

2 Ultimate Vision

The ultimate vision, an ideal situation for the identity and access management, is here presented firstly, in general and secondly, with regard to the case of Metso Paper Inc. The vision of security infrastructure depends on and aligns with the vision for ICT, as presented at the enterprise level of the EA. However, some features of security are of major interest regardless of the ICT used.

In short, the ultimate vision of the business dimension (of the EA) is that trust between parties and privacy of partners are ensured by a proven high level of security embedded in the enabling ICT that automates business network processes. Security at the level of the business network can be ubiquitous and pervasive enough, mutating from an obstacle to a business opportunity and to an enabler of e-collaboration. Missions, business strategies and visions of partnering enterprises for trust and privacy have to comply with the cooperative mission, the alliance strategy, the vision and the security policy of the business network [6].

The business vision has to be supported with the information dimension by appropriate languages, structures and standards of data representation for formal, shared, flexible, expressive, distributed, and automated specification of business network access control policy. Formal specification refers to the need of having an access control model to mediate heterogeneity of policies and enforcement mechanisms. A shared policy has two features: the policy formats have to be interoperable in a business network and commonly accepted and understood by the partners. The security data structures and standards are flexible to accommodate the dynamics of the business network and technological changes. Heterogeneity of businesses, cultures, strategies, visions and approaches results in an important requirement to expressiveness of the access control policy language. The security infrastructure as presented in the information architecture of the EA has to support automated management of the access control policy in centralized, distributed and mixed architectures of the business network enabling diverse applications and technologies. The most challenging and promising among those architectures is the distributed management of the access control policies.

Information systems and applications at the level of the business network have to implement an access control model with features described above to support a distributed and cooperative management of access rights and user identities for the business network partners.

In the EA dimension of technologies, we need a new generation of authentication and authorization mechanisms that take into account the distributed and multi-owner nature of access control management. In addition to authentication and authorization there are a many other security solutions that need improvement.

Both technological and information systems security infrastructures have to be open enough to allow easy integration of all possible native implementations of security systems and technologies into a solid security infrastructure for a business network. Business network security solutions in all four dimensions of the enterprise architecture have to overcome heterogeneity of architectures of partnering enterprises. Strict alignment of the business network security architecture between all four dimensions and between enterprise architectures of partners is a key to a successful proceeding toward the ultimate vision.

3 Present Situation

For machinery maintenance purposes, the Metso Paper services unit has the need to access data residing in the systems of the clients of Metso Paper. These systems record data from the running paper machines at the paper mills.

Currently, Metso Paper has to send their own staff to install their own computer at the paper mill to be able to access the control systems that run in the client's network system. The clients' access policies are very strict and demand two persons to log in on Metso's computer.

Metso Paper uses Metso Secure Connection Solution (metsoSCS) for data transfer taking place between its network and its computer inside the client's network. The connections are built over public datacom networks with TCP/IP protocol as a VPN (Virtual Private Network) pipe through firewalls. In some cases the connection may be taken directly over modems. At the moment, most of the connections to paper machines are built using metsoSCS. Additionally, numerous tailored connections exist. However, only about 10% of the paper machines owned by clients of Metso Paper have a data communication connection with Metso. All connections go over the Metso Business Hub (eHUB) that directs the traffic between Metso network and the stakeholder networks, and is responsible for the authentication of the users and granting of access rights. Figure 1 illustrates Metso's Business Hub solution.

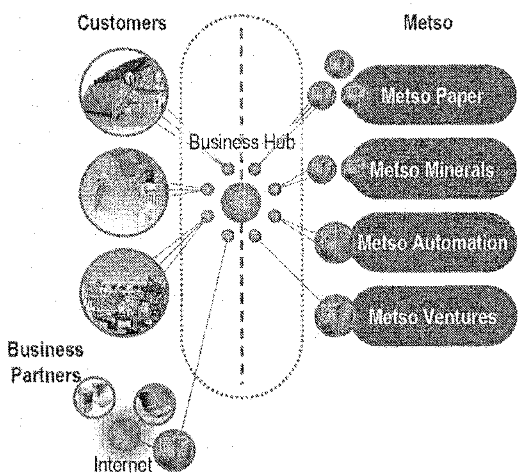

Fig. 1. Metso's ICT environment (adopted from [18]).

ICT environment of the business network has the architecture based on central and site business hubs for the remote maintenance of intelligent paper machines with embedded control and condition monitoring systems. Paper machines of Metso Paper contain control systems delivered by Metso Automation but in the general case could be operated using control systems of other vendors. The control system of Metso Automation follows enterprise application integration (EAI) technologies using service oriented architecture (SOA) [18]. Web services and a business process management system are especially in use for condition monitoring purposes of Metso's experts. Together with maintenance functions, business hubs provide user management (at the central hub) and message security. With the current solutions Metso Paper assures that access to a customer's sites are limited to only Metso's users, the traffic to a customer's sites can be filtered at the Metso's end, the traffic is logged, user's traffic can be traced and reported to a customer. The authentication of Metso's users is done at Metso's site using the ACE/SecureID[1] and at customer's side based on a user's IP that has to be from Metso's pool of IPs; mechanisms of user authorization are not in use at customer's site at all; the logging brings into the correlation users and events of access to customer's network, leaving out of scope a purpose of access and actual activities during an access to control systems; the audit can trace only a time instance and a duration of user's access considering the whole IT infrastructure of a customer as a target of access.

The current setting is expensive because requires several servers, routers and firewalls both at Metso and at their clients. Almost every system and network solution the clients have are different and thus require tailored solutions. Existing isolated security solutions used by partners constrain and complicate the development of security infrastructure at the level of business network.

4 The Roadmap

Present situation without secure up-to-date IAM between Metso Paper and its customers is an obstacle for marketing remote maintenance services. This becomes the main business driver of enhancing the existing security infrastructure to the integrated IAM solution as a part of the maintenance service offering. The IAM has some unique features because of the situation on the IAM market and nature of the IAM offerings [23]. The IAM vendors provide suits of IAM components that result in a need to carefully make the first step and to define plans for long-term integration of enterprises and commercial applications [24].The integration is important strategic issue in the context of the Metso Paper case where clients have heterogeneous IT platforms and environments.

We consider interests of Metso Paper and its partners to motivate changes to their security infrastructures in short, medium and long term. Table 1 summarizes our findings and suggestions for the roadmap of a successful process of Metso Paper and partners to overcome trust and privacy concerns of all stakeholders with a solid, integrated and secure infrastructure in their business network. The proposed roadmap requires investments from all parties. This sets additional needs to motivate and keep in balance both the investments and the outcomes among the partnering enterprises. The roadmap suggests starting with the IAM components in the authentication field, followed by authorization related components and finally to conclude with the solid, integrated and secure business network centric IAM infrastructure. All components of IAM needed for the short and medium term goals are available on the market. They are sophisticated enough. Business network centric access control management as a long term goal is still a research problem for the academic world.

[1] RSA Security, http://www.rsasecurity.com/node.asp?id=1156

Table 1. The IAM roadmap for the business network of Metso Paper and its customers

Goal	Motivation
Short term	
Trusted authentication services of maintenance experts of Metso Paper on customer side: – Federation of identity from Metso Paper to customers. – SSO for maintenance experts.	Authentication of Metso Paper users at customer sites allows remote maintaining that can decrease total cost of ownership for customers and increase competitiveness of Metso Paper services. SSO is expected to allow maintenance using various devices from arbitrary locations.
Integrated authentication management and logging for audit.	Integration of authentication and logging mechanisms and systems automate and reduce cost of security management.
Medium term	
Trusted authentication services of customers for the product data management portal of Metso Paper: – Federation of identity from customers to Metso Paper.	The result is the trust in relationships between partners in the field of user authentication. Federated identity services in both directions allow creating of SSO by all partners. The solution enhances also customer loyalty and retention.
User provisioning – Partners facilitate provisioning of their IT resources to Metso Paper staff. – Metso Paper ensures secure provisioning of product data and services to customers. – Virtual directories integrate and synchronize user profiles and identity information from different authoritative sources.	Deployment of automated user provisioning solution impacts directly costs and improves quality of service level agreements by reducing time of request for access fulfillment. Automated disabling of accounts of terminated user enhances overall security and reduces risks of unauthorized access. Other benefits are the improvement of users' experience and saving in time.
Integrated logging for audit for newly deployed IAM components.	Integrated audit trail reduces risks and vulnerability of solid security infrastructure.
Long term	
Integrated IAM solution between Metso Paper and its partners based on federated extranet access management.	Business network centric IAM solution will fulfill business needs of cooperative partners.
Distributed and dynamic security architecture with improvements of tools for collaborative management of security and integration in all dimensions of business network architecture.	Involvement of all partners to the process of securing their business network raises shared trust and individual privacy that are drivers of long-term economically efficient cooperation.

5 Identity Federation

The identity federation is the first step and the basis for further elaboration of IAM in the business network according to the proposed roadmap. Figure 2 illustrates the place of identity federation in the overall architecture of remote maintenance services of Metso Paper.

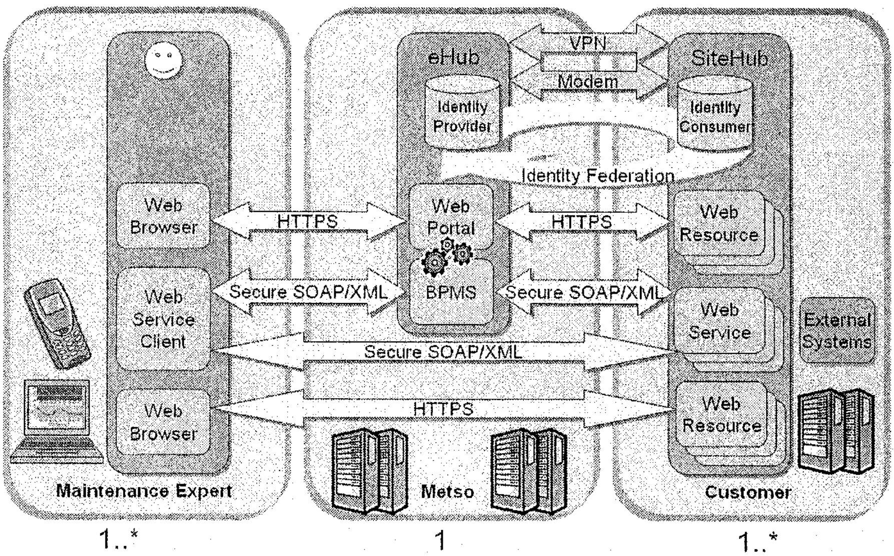

Fig. 2. The identity federation for remote maintenance services.

Metso's maintenance experts perform the condition monitoring remotely from desktop computers and mobile devices using web browsers and applications that access web services of business hubs. Currently connections are expensive and inflexible thus Metso Paper switches to protocols of secure communication using public networks like HTTPS for web browsing and secure SOAP/XML for applications based on service oriented architecture [22]. Metso Paper is going to employ the identity federation technology for providing SSO functionality for users and control over authentication, authorization and audit processes for customers.

There are three relevant open standards for the identity federation. The Liberty Alliance [10] is the project that delivers the framework for the identity federation with account linking, web service federating and linking of identity authorities. The security assertion markup language (SAML) [19] provides the identity federation functionality on the application level according to the well defined framework of sharing security information using XML syntax. The web service federation (WS-Federation) [1] is the specification of sharing authentication, authorization, attribute and identity information. WS-Federation is tightly relates to web service security, trust, policy and secure conversation standards.

Regardless of used standards, there are basically three possible options of the identity federation with respect to the distribution of accounts of users among federating partners. Figure 3 shows those cases.

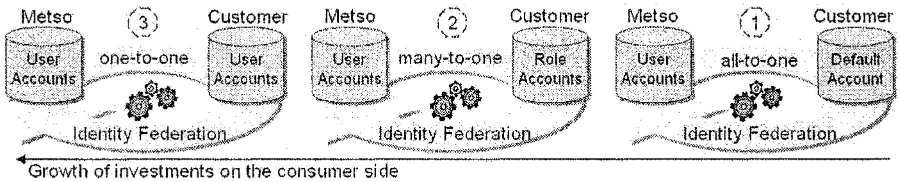

Fig. 3. Three options of identity federation.

The first option is a trusted authentication of Metso's users at customer's site based on public and secret keys without any account linking when Metso proves successful authentication and authorization of users by signing the security assertions or tokens with its secret key and customer provides access verifying the signature with Metso's public key. The second option is an authentication and authorization of Metso's users at customer's site based on role accounts which have links to maintenance experts' accounts at Metso's site. Third option is the user accounts linking when customers have copies of maintenance experts' accounts and authenticate and authorize like internal users.

We observed an experiment that was conducted by joint efforts of research group and representatives from companies to provide proof-of-concept evidences for the motivation of short-term goals. The experiment consisted of series of tests with the real-world identity federation products. The eTrust SiteMinder[2] was used to set up the identity provider server of Metso Paper and the identity consumer application of one customer. The PingFederate[3] was used as the identity consumer application of second customer. Despite of technical problems to run together products from different vendors that claim to comply strictly with the open standards, the results of tests proved in general that the short-term goals are feasible to achieve according to the proposed roadmap. The experiment validated and contributed to analytical conclusions about impacts of different options of identity federation architecture.

The analysis of impact of identity federation options for enabling SSO on the security level of customers factorized to authentication, authorization, audit and administration facets provided that

- one-to-one copying of accounts allow customers to perform authentication, authorization and audit of maintenance experts from Metso Paper like for their internal users, the only overheads appear for the administration part as the result of responsibility for accounts of Metso's experts;
- many-to-one option provides compromising solution of authenticating and authorizing experts based on separately created accounts on customer's site for experts' roles while names of real users could be provided for the logging and audit as part of assertion messages signed by Metso, the overhead again in the administration part is caused by role accounts and the key infrastructure;
- all-to-one option does not provide much improvement except again possibility to supply names of real users for the logging and audit process having overheads of keys infrastructure management.

[2] CA eTrust SiteMinder, http://www3.ca.com/Solutions/Product.aspx?ID=5262
[3] PingIdentity PingFederate, http://www.pingidentity.com/products/pingfederate

Impacts of identity federation options differ for Metso Paper and its customers. For example, copying user accounts to customer's site creates the threat of compromising Metso's security because of vulnerabilities of customers. Investments at Metso's and customers' sides grow along with the level of integration of user accounts from the first option to the third. Metso Paper will take investments even at customers' sites to its expenses because the security is considered as integral part of Metso's offering of maintenance services. Integrating and shifting of control over security related issues to customers rise the level of trust in Metso's business network while decreasing the level of security of Metso Paper itself. Thus Metso Paper does not consider any of identity federation options as the primary target for the development. Instead, portfolio of architectures which support all the options and typical control systems at customer's site, is the solution to achieve cost efficiency and satisfy requirements of customers to the security of remote maintenance services. The main factors for the decision about an option to apply in a particular case are the level of demands of a customer, its current IT infrastructure and mutual trust established already.

6 Conclusions and Further Research

The paper formulates the ideal situation of identity and access management in a business network by analyzing and decomposing it in an enterprise architecture framework of four dimensions: business, information, application and technology architecture. The proposed roadmap defines and motivates targets for further research and development of an integrated, solid IAM infrastructure exemplifying it on the case of a real industrial company and its business network where the provided services are enhanced with remote access to the clients' information systems.

The roadmap targets of short-term were evaluated during experiments with leading tools of IAM. The presented impacts analysis of different options of identity federation at the level of a multi-enterprise network is completed with the finding that none of the federation options is covering enough to substitute the others. Thus, the enterprise needs to provide a portfolio of security architectures that will be the target for more research and elaboration. This experience at Metso, a global large enterprise, could be of interest for other companies who consider federating of identities.

The case of Metso Paper serves as a trigger for further research. The description of the current situation, the envisioned ideal situation, long term goals and the business models of Metso Paper and its partners can be applied to similar settings. Further, they can be turned into numerous research questions, mainly in the area of security infrastructure integration and management of highly distributed, dynamic and heterogeneous ICTs at the level of multi-enterprise networks with high demands to privacy management solutions and trust. A major research area in the field of IAM is the data and application integration and its impacts in all EA dimensions within a multi-enterprise network as well as in adapting the network standards to the partnering enterprises. Further, there is a need for research on security infrastructure governance in a business network and on the alignment of an enterprise's and the business network's security policies and strategies. Information architecture security related models, languages and standards are expected to enable easy integration of business network centric IAM solutions. As for the application and technology architecture dimensions of EA, there is a large area for more practical research on integration of different native security systems, mechanisms and tools.

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Elderly People and Emerging Threats of the Internet and New Media

Janne Lahtiranta and Kai Kimppa
Janne Lahtiranta:
Turku Centre for Computer Science (TUCS), Health and Medical Informatics Institute (HMII), University of Turku, Department of Information Technology, Information Systems.
janne.lahtiranta@it.utu.fi
Kai Kimppa:
Turku Centre for Computer Science (TUCS), LABORIS Information Systems Laboratory, University of Turku, Department of Information Technology, Information Systems
kai.kimppa@it.utu.fi

Abstract. Today the Internet is a playground for the young. Tomorrow the elderly people will use the same technology and emerging forms of new media in their everyday life. The elderly people of tomorrow have to rely more and more on their technological skills in order to cope with their every day activities, and to contact their relatives, authorities and different service providers. In the near future, technology-orientation will be one of the key requirements for uncompelled and independent life at home for the elderly people. This emerging and increasingly more utilized service channel also raises questions about the user integrity and safety. What kinds of risks and threats the elderly people can encounter when using these electronic service models and what kind of measures must be taken in order to ensure that the integrity and safety of the elderly people is guaranteed in the ever-changing digital world.

1 Introduction

Use of the Internet and different new media as part of everyday activities has increased steadily over the past few years [1]. What was first a technology of a selected few has now gained popularity amongst all population groups. At the moment the Internet is one of the most popular and most important service channels in the modern digitalized world. This widespread adoption of the Internet and new

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media has also created an opportunity for crime and abuse. The very first crackers, hackers, phreakers, etc. attacked against technology, focusing on operating systems and hardware. Now, regardless of the increased public awareness, the attacks have become more sophisticated and more social by nature, focusing on the user behind the technological artifact. For example, wide adoption of different Instant Messaging (IM) services has created new ways for implementing social engineering attacks directly on the users. For example, the CERT Coordination Center has received reports on social engineering attacks on users via IM services [2].

What has also changed, and is constantly changing, are the capabilities, approval and utilization of the Internet and new media amongst the elderly people who are quite different today in their attitudes and technology adoption skills than those of tomorrow. What will also change is the technology; what can be considered as cutting edge technology of today, will be obsolete tomorrow. Even though the technology changes rapidly, the younger generation (i.e. tomorrow's elder people) are used to a rapidly changing environment in the ICT sector. However, these changes combined with the need for different electronic service models, for example for the home care or commerce, are creating emerging threats for the user safety and integrity in the near future.

2 Macro-level Factors and Development of Electronic Services

At the moment, there are various macro-level factors (economic and non-economic alike), which have an effect on the need and development of different electronic services. The following factors, which affect to the development of electronic health services, have been identified in the literature (for example by, Kestilä et al., [3] and Saritas & Keenan, [4]):

- Health care paradigm shift. More and more of the health care and responsibility of it is changed over to the patients themselves.
- Geographical distribution of the population. The migration from countryside to larger cities and suburbs continues leaving large areas outside the growth centers sparsely populated.
- Need for growing markets for the ICT sector. The technology penetrates more and more lines of businesses when the technology matures and companies seek economic growth outside their traditional business areas.
- Change in age distribution of the population. In western countries the relative amount of elderly people continues to grow creating a need for more cost-effective health care models.
- New socio-technological solutions of the electronic health. In the daily news and trade journals it is possible to see news items about new and emerging service models and innovations for the electronic health (including health and medical informatics, and bioinformatics).
- Increased consumerism. The service users are more aware of different service providers and models, and are inclined to request them.

In addition to the ones listed above, we would like to add the following factors in order to broaden the discussion to cover all forms of electronic services, not just those belonging to the health care, or social, sector:

- Change in technology adoption and skills. More people are competent and familiar with the different forms of ICT and more capable of adapting to changes in it (e.g. Umesh, et al., [5], Grudin & Palen, [6]).
- Preferring of electronic service models. Increasingly, different electronic service models are created, and preferred, by service providers, legislation and customers [7]. This is already happening in banking where electronic services are superseding "traditional" services, i.e. services that involve personal interaction with the bank clerk.
- Technological maturity. The utilized technologies are slowly growing beyond unique and individual technology pilots (for practical examples, see Blakeley & Matsuura [8]). In addition, especially in the field of electronic health, different standards and principles for information interchange between different applications and service providers have been defined (e.g. standards defined by the HL7 standardizing organization).
- Increased global rivalry. Especially in the public sector, the increased rivalry on a global scale is changing the very nature of the (electronic) service industry. Previously closed and government-controlled markets are becoming more open to competition [9, 10]. In addition, the used procurement models are becoming more transparent, creating a pressure to decrease in-house buying, which has been favored especially by the governmental organizations. An example of a more transparent governmental procurement model is the Public Purch@sing Online project [11], which is a pilot project under Germany's federal-level "BundOnline 2005" eGovernment initiative. Due to the increased global rivalry, the public and the private sectors are becoming more converged and the private sector is slowly penetrating to the markets, previously limited solely to the actors of the public sector (such as health care districts and other community organizations). Considering the imminent change in the age distribution of the population, hopefully this change will be realized as services of lower costs and better quality.

Considering the pace in witch the electronic services are implemented and institutionalized today, covering nearly all parts of everyday life, it is probable that in the near future some of the "traditional" or non-electronic service models will begin to diminish as they are already diminishing, for example, from the banking sector. Also, new services which reach the customers regardless of place or time, such as services offering medical information in the Internet or Internet pharmacies will become increasingly common. This change will cause unnecessary stress especially for the elderly people, since some of the service models they have grown accustomed to use, no longer exist. Although it seems that the currently younger generation will learn to accept even a rapid change more readily when they reach elderly age. This change will also have an impact on the quality assessment of the electronic service models since in some cases the original service provided a point of comparison, or a baseline, for the electronic service models.

3 Electronic Services and Elderly People

Amongst others, the electronic services can be categorized by dividing them into synchronous and asynchronous service models. Typical synchronous service models include real-time communication between two or more human participants, or between a human participant and an ICT artifact. An example of such service model is video conferencing, where the participants communicate using a real-time video and audio connection [12]. These kinds of services are used especially in the health care sector where the patient can use the technology to consult the physician over Internet connection. Asynchronous service models are even more commonplace today. These models are used, for example, in banking and in electronic commerce where the user accesses different electronic services using email, Internet browser, or similar.

Both of these electronic service models contain inherent risks to the users. Not to just those with diminished capabilities, but to all users of the Internet and new media. Excluding those with contact to Internet and new media on daily bases (i.e. from home, work or school) we can identify various groups with increased susceptibility to risk. For example the disabled people, those who use Internet and new media without any (direct) support or tutelage, and the ones who have limited access to the used artifacts (such as those who use public computer terminals available in the public libraries). Of the specific user groups, we shall focus on the elderly people, or senior Internet users. The inherent risks related to the use of Internet and new media by elderly people in particular, is somewhat less explored topic. The general studies about the common risks and threats related to the use of Internet and new media fail to take the physical, mental and cognitive declines associated with the aging process into account. Furthermore, the elderly people may have problems with the modern technology since they typically no longer acquire new skills through education or employment, and they have a high risk of being technology-illiterate. Even at the best-case scenario, the elderly people are typically not as familiar with the different forms of ICT as those who use different artifacts on daily basis at their work or on their leisure activities.

In conjunction to these declines, which are always individual by nature, we must take into consideration changes in the user environment. Now, and even more in the future, the users encounter different ICT artifacts in completely new situations and especially the elderly people come into these encounters unaware and unprepared. Different synchronous and asynchronous electronic service models will become even more multiform as different ubiquitous or ambient technologies and services are implemented. This is a key issue due to its potential to enhance and lengthen the period during which the elderly people can stay living at home (or at some other preferred environment).

At the moment, the electronic services are based mostly on existing, non-electronic service models and preferences. Using categorization defined by Kaaya [13], the current electronic services offer initial two-way interaction, or online transactions, leaving comprehensive (government) portals in a minority. The service provides interaction with the user using Internet and predefined forms or e-mail to collect information directly from the user. The more advanced services use different communication channels and terminals, such as mobile phones and high-speed mobile communication networks. In the electronic health services the more progressive service models utilize a real time connection to the service provider (clerk, nurse, doctor, etc.).

The services and products looming in the horizon of the electronic health include (semi) automated drug dispensers, such as the ADICOL, insulin infusion system [14], health and activity status monitors, such as the IST Vivago® system [15], personal assistant robots, like the Wakamaru [16], and even ambient and adapting living environments, as the ones reported by the British Broadcasting Company, BBC [17].

4 Emerging Risks and Threats for the Elderly People

As the people live more and more online, as part of vast and infinite information networks, they become vulnerable in unforeseeable ways. Different ICT artifacts exchange user specific information constantly over home networks, and even over the global Internet. Now and even more tomorrow, the exchanged information has an impact on the users, or their living environments, directly. The exchanged information, and the information available in public directories, web pages and other electronic sources, has already given birth to different forms of identity thefts and misuses of personally identifiable information.

The most common form of personality theft is known as "phishing", where the users are tricked into providing personal information, such as banking access codes to dubious parties, or doing something that users would not normally do on behalf of them. Phishing and other forms of personality thefts are just examples about social engineering attacks, which focus on the users themselves, not directly on ICT artifacts they are using. Those overly trusting users who are not familiar with ICT technologies are more prone to phishing and other forms of personality thefts. This has been already demonstrated by the less experienced and skillful ICT users falling prey to the bank accounts scams. The current elderly people especially fall within this category since the familiarity with ICT artifacts is usually not high amongst them.

As the exchanged information between different ICT artifacts increases and the users become more open about themselves and their activities on the Internet and other new media, they also enable a more exact profiling by the dubious parties. In addition, the users rarely consider the fact that what is put on the Internet for public display can be stored by anyone. It is even said that "what is put on the net, stays on the net", sarcastically reflecting to the fact that at the moment it is nearly impossible to control the flow of information on the Internet. Even if one is able to delete all references in the Internet (although this is unlikely), it is probable that copies of anything even remotely interesting have been stored on hard drives around the globe and there is a strong possibility of the phenomena repeating after a while. The kind of social benefits that a "forgive and forget" policy can create do not exist any more since the Internet does not forget [18]. This kind of information permanency creates a possibility to create more accurate user profiles, which may used for more effective social engineering attacks.

Social engineering attacks focusing on the elderly people create the typical risks related to phishing fortified with the effects of the potentially lowered physical, mental and cognitive abilities. In addition, since majority of the elderly people are also subject to home-based medication, new threats and risks related to the prescription and insurance frauds emerge. The most obvious risks and threats are fraudulent health care products scams, prescription forgeries and falsified insurance claims. This is especially alarming since even the users who do not suffer from declined mental or cognitive capabilities are not able to guarantee the correct medication and health care products from Internet pharmacies due to problems with ICT and media literacy [19], let alone the ones with problems in mental and cognitive abilities.

With the ever-advancing technology, new forms of technology hijacks will probably emerge in this field. For example, the perpetrator could take control of a (semi) automated medical dispenser, or some vital (or costly) ICT artifact and ask for a ransom from the relatives. This way the risks and threats focused on elderly people may have an impact on the relatives and care providers as well.

5 Conclusions and Recommendations

In electronic commerce, trust has been identified as one of the key factors for a successful adoption [20]. In more general terms, trust can be considered as a prerequisite for all electronic services. There are various ways in which trust can be achieved. One can trust the technological environment and infrastructure, such as digital signing and used encryption. Or, the user can trust the mediating agent, partner, or the actual service provider. Especially when one examines electronic health services, one can trust the authorities and (other) regulating parties. In order to achieve as trustworthy system as possible from the user's point of view, the user must have trust on the overall socio-technical system, including the aforementioned technical and social aspects.

One of the problems related to the technical aspects of the electronic services from the senior user's point of view is that the services are commonly developed using the latest technology. This creates a problem for the elderly people since many of them have not had any training on the use of the latest technology, nor have they gained any experience on its use through work. To address the issues related to the trust in general, and to the technical aspects of the electronic service, there are only few viable options: lifelong learning, enhanced familiarity and the use of an ombudsman (of a sort).

Lifelong learning, as a concept, is a challenging one and rarely something that can be put into practice by others than the individual in question. To control one's own overall learning endeavor, one requires personal autonomy, willingness and certain level of ability. The individual in question must also have sufficient familiarity with the subject matter to reformulate existing operational models and to reflect the new experiences with the existing knowledge. Considering the population group in the focus of this article, it is possible that formal institutional support or affiliation might be required to complement the potentially lowered physical, mental and cognitive declines. With formal support, it is possible to create more successful learning experiences, and to help the elderly people with the special subjects, which need more focused attention (such as with a completely new service or communication models).

Enhanced familiarity focuses on implementing the electronic services in the practical terms of the elderly people, using familiar constructs, mechanisms and communication models. In practice this means that when new electronic services are implemented, the existing service models, and models which are familiar to the users, are taken into consideration and used as a point of reference. The problem with this kind of model is the potential burden of the existing, and potentially outdated, technology. It might not be viable to mimic the operation of the legacy systems when more efficient and effective service models are available. Especially if the user groups is more generic, covering different ages and population groups. However, a balance which does not make the systems unusable by an enlarging part of the society must be achieved.

An important aspect, which distinguishes the ombudsman from a civil servant, or some other official, is the person-centricity. On the context of this article, the ombudsman always strives to supervise personal interests of the elderly person in question, not necessarily interests of a certain bureau or compliance to common rules and regulations. Naturally, the ombudsman is bound to follow legislation and to adhere to the rules of conduct specific to one's profession. Often goals of the elderly person and the ombudsman are convergent. In addition to assisting the elderly person in question, the ombudsman can also be a user of the ICT artifact in question (such as in the case of an information system used for medication follow-up). When the ombudsman has multiple roles in relation to the ICT artifact a special attention must be given to the personal interests of the elderly person in question. These interests should be kept as primary especially when the ombudsman uses electronic services in which the actual beneficiary may not be explicitly presented.

What is required of an ombudsman is that he or she possesses sufficient knowledge about the used electronic service models and about the used technology, and the personal characteristics required for acting as a personal advisor or teacher. Especially when operating with electronic services related to the health care, the ombudsman can be used to clarify the used professional jargon and special terms. A problem with this kind of model is that if a (semi) professional ombudsman is used, it is probable there will be costs involved in the form of training or labor. Furthermore, the use of an ombudsman also moves the use of artifacts away from the intended user thus lessening the intended effect and intended cost savings unless the teaching function is the primary one the ombudsman is expected to perform. If the use of the electronic services and ICT artifacts then resides on the ombudsman it must be taken into account when the services and artifacts for the elderly people are designed, or when the existing ones are modified. The shift of responsibilities and primary use from the elderly person to the ombudsman can also increase the potential effects of the digital divide, which is always a risk when the electronic services are utilized.

Even if the future generations are more capable of adopting new technologies and ICT artifacts, they too, like the current generation of elderly people will suffer from more or less lowered mental and cognitive capabilities. This means that even with the future generations being more familiar with the pace of change in the field of ICT, they will eventually need to rely on artifacts or services they cannot fully operate. Design, which takes elderly people and their capabilities into consideration must start now and be kept in mind when designing artifacts and services of the future. Otherwise, we will not be able to lessen the financial and human burden that ever growing elderly population places on the society without cutting down the level of service for this group.

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Biometric access control for athletic events

Christos K. Dimitriadis, Despina Polemi
University of Piraeus, 80 A. Dimitriou, 18534 Piraeus, Greece
{cricodc, dpolemi} @unipi.gr

Abstract. The confidence level of citizens, as far as the ability of the organizers to provide security is concerned, is a factor directly impacting their attendance in athletic events. This paper, proposes a system called BioAthletics that implements strong access control, enhancing the safety feeling of event spectators. BioAthletics integrates intelligent biometric access control systems and smart cards for authenticating participants. A pilot version of BioAthletics was deployed and tested in terms of acceptability, information security and performance.

1 Introduction

Modern biometric technologies provide enhanced security levels by introducing a new dimension in the authentication process called "proof by property". However, the design and deployment of a security architecture incorporating biometric technologies hides many pitfalls, which when underestimated can lead to major security weaknesses [1]. Although biometrics have been deployed in pilot systems for protecting access to athletic events in the past, no integrated solution has been proposed taking into account the related security standards and no complete studies ever proven the benefits of such deployments.

This paper, proposes a system called BioAthletics that implements strong access control, enhancing the safety feeling of event spectators. The system integrates intelligent biometric access control systems and smart cards. A pilot version of BioAthletics was deployed and tested in terms of acceptability, information security and performance, within the framework of a research project of the Greek Secretariat of Research and Technology. The authors would like to thank GSRT for funding part of this work.

2 Access control systems in stadiums

During the Athens 2004 Olympic Games, almost 70,000 security personnel was overseeing the event, with the help of technology. More than 1,100 poles topped with video cameras, speakers and microphones created a distributed net of surveillance posts aimed at locating disturbances quickly [2]. Barcode scanners and ID cards allowed athletes and trainers into the Olympic Village. In Sydney 2000 Olympic Games, a security system integrated with intelligent camera functions was deployed, in order to provide security, surveillance and access control [3]. The systems consisted of the combination of security, CCTV Switcher, Smart Card

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Access Control and Photo Identification Systems and provided a total solution to monitor and report on all activities. Furthermore, in the Commonwealth 2002 Games in Manchester, a security system protected almost 6,000 athletes and officials representing 72 countries and territories [4]. The system involved the installation of a sophisticated CCTV system that included 79 cameras in the athletics stadium, which enabled Greater Manchester Police to zoom in on every single person in attendance. There were also installed an access control system with intruder alarms, fire alarms and an emergency telephone network in the main stadium. The Millennium Stadium also completed a £2.8 million project, to supply and install systems for crisis management such as fire detection, security and CCTV and PAVA (Public Address Voice Alarm), as well as a system for the distribution of radio, television, data and telephone signals [5].

Biometrics and smart card technology is widely used during athletic events of known stadiums inside the UK. Manchester City Football Stadium, Crystal Palace, England Rugby Supporters, Chelsea and Bolton Wanderers have come up with a high-tech way to profile their sport fans and accredited persons in an attempt to drive revenue, improve the game environment and provide the greater security in order to better control the flow of crowds from possible crisis situations around and in the stadiums. This was a centralized authentication solution, using personalized smart cards –in some cases the cards configured to include biometric data such as fingerprint- to provide secure and better service. Similar systems have been adopted by the Belgian Football and PSV Eindhoven Stadiums. In the Cricket World Cup (South Africa, 2003) bar coded tickets were deployed, using a two-dimensional barcode, which cannot be duplicated or forged [6]. The system handled 825.000 ticket sales. The bar code allowed for scanning and verification through a sophisticated venue access control system, which in turn generated a customer database holding valuable information on all ticket purchasers. In addition, all stadiums were monitored with CCTV, (eight cameras per event) and had full digital recording facilities.

The various systems that were implemented proved that technology consists of an integral part in the athletic events. Such systems fulfill the requirements of the organizers, but there are not always effective and efficient in large-scale athletic events, mainly because there is not an integrated system for addressing completely a crisis situation. In 2002 World cup in South Korea, all stadiums were monitored with CCTV cameras. A problem occurred with the metal detector checkpoints causing delays and many fans were unable to enter in time. It was recognized that such incidents wouldn't have occurred if an effective coordination centre was developed [7]. Athletic related crimes require more mature and tested systems for implementing secure access control.

3 Biometrics and smart cards

The biometric technology has been recognized as a key technology for improving security and trust in different fields of modern society [8]. Biometrics is defined as *the automatic use of human physiological or behavioral characteristics to determine* *or verify an identity* [9]. The system conducts a measurement of the features of the user, encodes the data creating a *template* and compares it against a physical measurement from the user each time accessing the system is attempted. The most widespread biometric technology in today's markets is fingerprint recognition [10]. The sensor's size is conveniently small (area of a few square centimetres, thickness of a few millimetres), enabling easy incorporation into any fixed or mobile terminal and the weight of the sensor is negligible. Reusability on a wide scale is possible through the use of different encodings and undergoes continuous improvement as standardisation is gradually taking effect. Fingerprint recognition systems fit quite well as an integral part of any fixed or mobile terminal. For all the above reasons, fingerprint technologies have achieved the dominant position in the year 2005 in terms of total revenue, achieving approximately 48% of the total biometric market [10]. The biometric component of the system takes into account all relevant aspects including technological, societal and legal issues. More specifically security, performance, privacy, standardization, scalability, responsibility, interoperability, usability, acceptability and liability issues, were studied, targeting to the development of a biometric component that meets all necessary state-of-the-art specifications. This was accomplished by the exploitation of results of research projects, such as FP6-001766 (BIOSEC) "Biometrics and Security".

The smart cards that use contacts are in line with the guidelines determined in the Standard of ISO 7816 Part 1. The reliability of these smart cards has been improved constantly during the previous years, because of the increasing experience in the manufacturing of such cards. On the other hand, the contacts remain one of the more frequent sources of problems in electromagnetic systems. For example, some problems can result from the attrition of contact. Since the contacts, placed in the surface of card are connected immediately with the inputs of the integrated circuit that is incorporated in the card, there is a danger of damage or even destruction of the integrated circuit from the electromagnetic discharges - load of enough thousands of volts is not infrequent. These technical problems are overcome with the contactless (wireless, RFID) smart cards. Apart from its technical advantages, the wireless technology offers also to the issuer and the holder of the card some interesting new applications [11]. For example, the contactless cards do not need to be imported essentially in a card reader, since there are RFID reading systems that function in a distance of up to one meter. This is a big advantage in access control systems where a door or a circular gate should be opened, since the granting of access of an individual can be checked without the requirement of the card to be removed from the wallet or the pocket and to be inserted into the reader. An extensive range of applications for this technology is the public transportation systems, in which a big number of passengers should be identified in a very short time interval. In addition, the wireless technology is suitable in systems that require the deliberate import of the card into a reader, since it is not important how the contactless card will be inserted into the reader. This is in contrast to case of the magnetic or smart cards with contacts, that function only if they are inserted in a consistent way. This freedom of the orientation restrictions simplifies the operation and increases the user acceptance [12]. Apart from the simplicity of use, this solution is attractive because it considerably decreases the danger of vandalism (for example, with the placement of chewing gum or glue in the slot of the reader). Up to now, the wireless cards have been mainly used for the public transportation systems, acting as electronic tickets. These systems currently employ single-use cards that are cheap to develop. Nevertheless, there is an increasing demand for the incorporation of additional features into the electronic ticket. For this reason, the employment multi-use RFID cards with incorporated microprocessors will be increased in the near future.

4 Architecture Description

The architecture of the proposed system is depicted in the following figure.

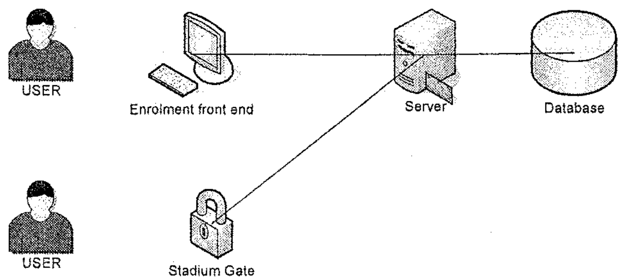

Fig. 1: System architecture

The system comprises of an enrolment front-end, an application server, a database (DB) and the equipment in the stadium gate, used for user verification. The following steps describe the user enrolment procedure.

1. The sports fan visits the stadium's desk with the ID documents, which are checked for duplicate registration.

2. Once his identity is verified, a smart card is issued to him and the card gets personalized.

3. The user enrolls in the biometric system and a biometric template is created.

4. The template is encrypted using a key known only to the proposed system. The template is stored encrypted in a tamper-resistant memory module of the smart card

5. The template is erased from any intermediate storage mediums.

6. A file of the user is created in the DB, including his ID number, name, smart card serial number etc (not the template).

7. The user receives his smart card and the PIN of the smart card.

For gaining access to the stadium, the user follows the procedure described below:

1. The sports fan visits the gate of the stadium.

2.The smart card is accessed by an RFID smartcard reader.

3. The user puts his finger on the sensor for the biometric measurement.

4. A template is generated by the measurement and compared to the pre-stored template (decrypted by the stadium's gate equipment)

5. If the comparison is positive, a request based on the serial number of the smart card is submitted to the DB server for downloading the privileges of the user.

6. If the decision is positive and the privileges permit entrance to the stadium, the user passes the gate after showing his ticket.

At this point we present a procedure for understanding the complete operation of the system, which is independent of the final decision of which approach (centralized or not) will be used.

1. The sports fan who causes trouble in the stadium must be arrested by the authorities.
2. His/her name and ID number are registered by the authorities
3. The authorities inform the organization responsible for the system to update the database and change a flag in the file of the user for not permitting entrance in future events (perhaps for a certain period of time).

5 Testing environment

A pilot version of BioAthletics was implemented in a stadium hosting athletic events, including basketball games, athletics and gymnastics. The main target of evaluation was system security, performance and acceptance.

6 Acceptance testing

For testing the acceptance and usability of the BioAthletics pilot system, an extended version of the Davis' Technology Acceptance Model was deployed [13]. TAM contains two dimensions: usefulness (divided into accomplishment and efficiency) and ease of use (divided into learnability, control and mental effort). The extension to the TAM was provided by Amberg et al. [14]. They introduced a Dynamic Acceptance Model for the Reevaluation of Technologies (DART) including dimensions of perceived ease of use, perceived usefulness, perceived network effects and perceived costs.

Based on DART, a survey regarding acceptance and usability of BioAthletics was conducted, focusing on the biometric access control system, taking into account possible privacy consideration of the users. A total of 110 participants, 45% female and 55% male filled the questionnaire, during a 2-month period. Their age varied between 18-65 years. Most participants were familiar with the use of automated systems. The aims of the study were to investigate participants' acceptance and general attitudes towards biometrics and more generally BioAthletics. The questionnaire was answered in three phases: before informing the user regarding the operation of BioAthletics, after informing the user and finally after the user was enrolled and tested the system in practice, during an athletic event.

During the first phase, the acceptance of biometrics was relatively high amongst the participants. The overall mean of the attitude was 3,24 measured in a five-point scale (1=negative, 2=quite negative, 3=neutral, 4=quite positive, 5=positive). Similarly, the acceptance of BioAthletics in total was high, with an overall mean of 4,01 measured in the same scale as above. During the second phase, the acceptance of biometrics was even higher amongst the participants. The overall mean of the attitude was 4,14. Similarly, the acceptance of BioAthletics in total was high, with an overall mean of 4,68 measured in the same scale as above. The main reason for this increase in user acceptance, was that the users' privacy concerns, especially regarding the collection and use of biometric data were minimized, after being informed of the operation of the system and especially regarding the fact that the users carry within their smartcards their own biometric data in encoded and encrypted forms, while no storage takes place in any central database. During the last phase, the acceptance and usability of biometrics had an overall mean of 4,43, while the acceptance and usability of BioAthletics has a mean of 4,77 measured in the same scale as above. The participants recognized the benefits of the system and reported that it would increase their level of security while attending an athletic event, without compromising issues, such as usability and privacy.

7 Information Security and Privacy Assessment

Risk analysis was conducted, during the implementation of BioAthletics, for evaluating its security level, focusing on the use of biometrics and RFID smart cards, in relation to the users personal, biometric and medical data. For this purpose a specialized methodology and knowledgebase of vulnerabilities, risk and countermeasures for security and privacy was deployed [15]. The vulnerabilities addressed by BioAthletics are described below.

The utilization of the template in two or more applications with different security levels (i.e. convenience applications and security applications) tends to equalize these security levels, by decreasing the higher security level to the lower one - if a template is compromised in one application, it can be used for gaining access to the other. The biometric algorithm of BioAthletics is custom, producing unique biometric templates hence this vulnerability was addressed.

Capturing the power consumption of a chip can reveal the software code running on the chip, even the actual command. The application of Simple Power Analysis and Differential Power Analysis techniques is possible to break the matching mechanism of the biometric system or reveal the biometric template, or even medical data stored in smart card. Timing attacks are similar and measure the processing time instead of the power consumption. The RFID smart card had countermeasures implemented against these types of attacks, including low power consumption chips, noise generators and time-neutral code design.

Poor biometric implementations are vulnerable to spoofing and mimicry attacks. An artificial finger made of commercially available silicon or gelatine, can deceive a fingerprint biometric sensor. This vulnerability is addressed, since vitality detection features were implemented in the fingerprint sensor and the environment was controlled.

Poor enrolment, system administration and system use procedures, expose the biometric system. During the enrolment phase, raw biometric data and biometric templates can be compromised and databases can be altered or filled with imprecise user data. Poor system administration procedures, in addition to the above, might lead to altered system configuration files, with decreased False Acceptance Rates, making false acceptance easier, thus security weaker. Similarly, a user might exceed his/her authority, threatening the system. This vulnerability was addressed, since enrolment, administration and system use was implemented according to international standards and best practices.

Server based architectures, where the biometric templates and medical records are stored centrally inherit the vulnerabilities of such systems. A possible attack can be realized when the impostor inserts his template in the system under someone else's name, or attacks the central database in order to breach the confidentiality or integrity of medical data. This vulnerability was addressed, since the template was stored in the protected memory of the smart card.

Data could be captured from a communication channel, between the various components of a biometric system, in order to be replayed at another time for gaining access. This vulnerability was addressed, since the biometric component was limited in a hardware security module, with physical security countermeasure implemented and the environment was controlled by the personnel of the stadium.

Off-limit power fluctuation or flooding of a biometric sensor with noise data - for example flashing light on an optical sensor, changing the temperature or humidity of the fingerprint sensor, spraying materials on the surface of a sensor or vibrating the sensor outside its limits - might cause the biometric device to fail. Since the corresponding part of the security policy implementation ensured a controlled environment for the biometric devices.

The residual biometric characteristic of a user on the sensor may be sufficient to allow access to an impostor (e.g. a fingerprint the sensor). The attack is realized on a fingerprint sensor with a residual fingerprint from the previous measurement, by pressing a thin plastic bag of warm water on the sensor, by breathing on the sensor or by using dust with graphite, attaching a tape to the dust and pressing the sensor. This vulnerability was addressed, since the sensor deployed was capacital and not applicable to these types of attacks. Furthermore the environment is controlled by personnel, not permitting such attacks.

A user having a similar template or a similar characteristic with a legitimate one, might deceive the system, especially in identification applications, where one to many template comparisons are conducted. This vulnerability was addressed, since the algorithm performance had adequate performance references, according to international best practices for performance testing.

The impostor is attempting continuously to enter the system, by sending incrementally increased matching data to the matching function until a successful score is accomplished. Biometrics however are more resistant to this attack, than traditional systems, since the impostor has to find a way to insert the trial data to the system, thus combine this vulnerability with one of those described above. This vulnerability was addressed, since the environment is controlled by personnel, not permitting such attacks.

Regarding the remainder of the infrastructure, a security study was conducted, including a vulnerability assessment for the network elements, the database, the operating systems, the applications and the servers. All necessary network security controls were deployed, including firewalling and intrusion detection systems, as well as network device hardening and the deployment of secure network protocols. The database security controls were deployed according to best practices, for realizing confidentiality, integrity and availability especially for the user data. Operating system hardening and application level countermeasures were also deployed, implementing a standard security policy. The security policy also covered security organization issues and personnel procedures, being compatible with ISO/IEC 17799:2005: Information technology - Security techniques - Code of practice for information security management.

8 Performance evaluation

During the pilot operation, we examined a number of performance factors, including: delay time. Compared to the manual user access, the mean time of user access was almost equal, since the biometric template comparison was one-to-one – comparison of the on-spot generated template by the biometric measurement, with the pre-stored template on the smartcard. In that sense, access control through RDID smartcards, facilitates user entrance, as also proven in similar access control systems described in the state of the art section of this paper. User access was acceptable according to the response of the users during the evaluation assessment. Regarding the performance of the biometric device, the point of equalization of the false acceptance and false rejection rates (called equal error rate) was 0,001, according to evaluation tests that were conducted by following international best practices on biometric performance testing [16]. One-to-many biometric template comparison in identification applications may have increased the delay time and user false acceptance or false rejection. The overall system performance was found compatible with the specifications.

9 Conclusions

Bioathletics was evaluated in terms of acceptability, security and performance. Acceptability was a very important factor, since the deployment of biometrics usually have a negative impact to the public due to the consideration of privacy issues. The acceptance assessment however, revealed that especially after informing the users regarding the system operation, biometrics were not only accepted by the users but also recognized as a mean to increase security and relief users from the anxiety of incidents during an athletic event. System security was mainly focused on the biometric component of the pilot implementation. A specialized methodology was deployed for assessing the risk of the biometric component of Bioathletics and all necessary countermeasures were developed within the system in order to address all known vulnerabilities. The performance of Bioathletics finally revealed that biometrics can be deployed without causing significant delays in user entrance, while the total operation of the system was found more than useful to the administrators of the stadium. Future work, involves a full deployment of the system and the system testing in total in athletic events of different types.

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An Analysis of Plug and Play Business Software

Andreas Jacobsson and Paul Davidsson
Department of Systems and Software Engineering, School of Engineering,
Blekinge Institute of Technology, SE-372 25 Ronneby, Sweden
{andreas.jacobsson, paul.davidsson}@bth.se

Abstract. The ability to realize the potential of innovations is important for societies to be successful. The core of the concept of Plug and Play Business is an integrated set of ICT-tools that support innovators in turning their ideas into businesses by forming virtual enterprises for inter-organizational and interoperable collaboration. In this paper, we analyze the concept of Plug and Play Business and present a formalization of relevant aspects, such as the different tasks involved in virtual enterprise formation and collaboration. We explore the functional requirements of Plug and Play Business software, and make an assessment of the usefulness of existing technologies for its implementation.

1 Introduction

The fact that innovations are important to create both private and social values, including economic growth and employment is well-known. From an innovator's perspective there are some common obstacles for realizing the potential of innovations, such as shortage of time to spend on commercialization activities, lack of business knowledge, underdeveloped business network, and limited financial resources [18]. Thus, the innovator requires support to develop the innovation into business, something often seen as the specific role of the entrepreneur, which is to search, discover, evaluate opportunities and marshal the financial resources necessary, among other things [13].

The concept of Plug and Play Business [9] relies on an integrated set of ICT-tools that supports the creation and management of businesses despite the obstacles mentioned above. We envision Plug and Play Business as a helpful ICT-measure to enterprises, small and medium-sized enterprises (SME) in particular, in realizing innovations. ICT-infrastructures for business creation and collaboration are particularly relevant to SMEs, due to their size and high specialization and

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flexibility. While allowing themselves to maintain their business independence, SMEs are able to reach otherwise unreachable markets and to take advantage of economies of scale with the support of ICT [5]. After having deployed the Plug and Play Business software, companies are connected to a networked community where all participants share one common goal; namely to increase business. In that way, the purpose of Plug and Play Business is to stimulate the realization of innovations without interfering with the individual goals of the Plug and Play Business companies. Together with the autonomy, heterogeneity, and possibly conflicting goals of the involved parties of a Plug and Play Business community, this requires ICT-solutions that are able to handle dynamically evolving and distributed business partnerships and processes that cross the borders of various enterprises. Thus, the interoperability between the information systems of the involved enterprises belongs to the technological core of the concept of Plug and Play Business.

This paper partially builds on previous work [10] in which we have made a proof of concept with regards to interorganizational interoperability of enterprise systems. In Carlsson et al. [6], we analyzed the security risks related to such collaboration. In this paper, we first describe the concept of Plug and Play Business and identify the requirements of the supporting software. Then we provide a formal model of Plug and Play Business, including crucial aspects such as virtual enterprise formation and collaboration. The lack of appropriate theoretic definitions and formal models has been argued to be one of the main weaknesses in the area of virtual enterprises [2,3]. We also review current state of the art and identify useful technologies for the implementation of Plug and Play Business software. We conclude with some suggestions for future work. However, we begin by describing the concept of Plug and Play Business, its functional requirements, and by exploring its quality attributes.

2 The Concept and Requirements of Plug and Play Business

Central to Plug and Play Business is the concept of *virtual enterprises* (VE), or more generally *collaborative networks* [2]. A VE is a temporary alliance of enterprises that come together to share skills or core competencies and resources in order to better respond to business opportunities, and whose cooperation is supported by computer networks [2,4]. Other important concepts for implementing Plug and Play Business are:

- *Internet communities*: Enterprises dynamically join a Plug and Play Business community by installing and running the Plug and Play Business software and by describing and validating the resources of the enterprise, e.g., production capacity, distribution network, intellectual capital, etc. The community is dynamic in the sense that enterprises may (in principle) join and leave the community at any time. However, there may be a need for a specific *gate-keeper* that enhances security by regulating the entering and leaving of the community, thus making it a *semi-open artificial society* [8].
- *Roles*: Each member of the Plug and Play Business community plays one or more roles, e.g., innovator, supplier/provider (of goods, services, expertise, etc.), distributor, marketer, financier, seller, etc. The choice of role depends on the

company's core competencies and business intentions. An important role in the life cycle of businesses is the entrepreneur and we make a distinction between this role and that of the innovator. One of the main purposes of Plug and Play Business is to automate as much of the entrepreneurial role as possible, for instance by using intelligent agent technology, thus increasing the probability of turning an innovative idea into a business.

- *Crystallization*: A member of the Plug and Play Business community, typically an innovator, may at any time initiate an attempt to form a collaborative coalition in-between the members (similar to the broker within VE breeding environments [3]). This process may be viewed analogous to crystallization, where a catalyst (innovator) initiates a process resulting in a precise form of collaboration, i.e., the formation of a VE. The main role of the entrepreneur, which to a large extent is automated by the Plug and Play Business software, is to drive this process. It may be a more or less elaborate process starting with just a seed of an innovative idea without any pre-defined business structure, or it may be a full-fledged business idea with well-defined needs to be met by potential collaborators.

Plug and Play Business has some resemblance to the work described by Chituc and Azevedo [7] in that dynamic collaboration processes for agile VEs are emphasized. However, this work excludes crucial aspects such as the formation of VEs and security management. The concept of Plug and Play Business is also similar to the concept of breeding environments as described by Camarinha-Matos and Afsarmanesh [2,3]. However, one distinction is that Plug and Play Business software focuses on promoting innovations by automating as much as possible of the entrepreneurial role in the VE formation and collaboration process. They state that "there is a need for flexible and generic infrastructures to support the full life cycle of VEs, namely the phases of creation, operation and dissolution" [3] and we believe that the Plug and Play Business software has the potential of constituting such an infrastructure. Moreover, they provide further motivation for our work by emphasizing the need for research on generic, interoperable, pervasive, free (low cost) and invisible (user-friendly) infrastructures that include methods for the creation of business (e.g., negotiation, methodologies for transforming existing organizations into a VE-ready format) and business collaboration (e.g., coordinated and dynamic resource sharing, administration and management of distributed activities and risk management).

2.1 The Requirements of Plug and Play Business Software

In order to realize the vision of Plug and Play Business, the software should enable the different community members to use their resources efficiently in VEs. We will now specify a set of functional requirements for the Plug and Play Business software. These requirements are extracted from interviews with representatives for SMEs, but are also based on previous work, e.g., on requirements for breeding environments (cf. [3]).

First of all, a Plug and Play Business community requires certain general functionalities. One example is the gate-keeper facility that regulates the entering (and leaving) of enterprises and registers them as members of the community. Moreover, a surveillance mechanism that monitors the behavior of members may be necessary in order to cope with malicious users.

In the *VE formation (crystallization) phase*, when the catalyst initiates the VE, the following functions are helpful in forming a successful collaborative coalition:

- Finding: To find candidates suitable for a potential collaboration alliance is an important function. This function primarily concerns the catalyst of the business idea to provide the requirements of the preferred abilities of a potential collaborating partner. The finding functionality may include the possibility both for search, based on specific needs specified by criteria, e.g., role, type of products, and business model, as well as for posting general needs or ideas that other members may suggest solutions and/or resources for. Further, the software should also provide the feature of suggesting actors for collaboration based on, for example, content-based recommendation and collaborative recommendations.
- Evaluation: When a set of potential collaborators have been found they need to be evaluated. This requires support for using track records and potentially support for certification schemes of, for instance, the trustworthiness of the actors. Further, decision support for evaluating trade-offs between a number of characteristics are needed, e.g., trade-offs between cost of product/service, cost of transportation, and time to delivery of product/service. Which actors to choose for the formation of a VE should be based on the evaluation and the estimated value of collaboration with other actors in the alliance.
- Negotiation: When the catalyst has selected actors for the necessary roles of the VE, agreements between the actors with respect to financial and products/service transfers need to be settled. The Plug and Play Business software should provide support for different types of contracts of agreement including support for intellectual property rights.

When the crystallization phase is finished and a VE is formed, the Plug and Play Business technology should provide support also for the *collaboration phase*, i.e., the management of the actual business activities within the VEs. This support may be on a quite shallow level, e.g., transactions of information between actors. On a deeper level, the Plug and Play Business software should support and facilitate complex coordination and synchronization of activities. A wide range of information types needs to be transferred in an efficient way in order to reduce the administrational costs of the actors as well as reducing the risk of inaccuracy in information. The management of the VE requires support for controlling the flow of activities between the involved actors. It concerns activities with potential long-term consequences (e.g., initiating product development) as well as regular business activities (e.g., decisions of production and distribution). With respect to enterprise collaboration, the Plug and Play Business software must support the following (functional) requirements:

- Information resource-sharing: This is related to the content and purpose of the exchanged information with tasks ranging from administrative information exchange to complex operations planning. An example of a simple administrative task is ordering and invoicing, whereas a more complex task may concern making critical information available to the cooperating partners in order to improve operations by better and more efficient planning and scheduling, i.e., resource optimization.
- Multi-lateral collaboration: The more parties involved in the cooperation, the more complex the solutions may be. The simplest case concerns cooperation between only two enterprises, whereas the general case involves a large number

of enterprises cooperating with each other in different ways (many-to-many cooperation).

2.2 Exploring the Quality Attributes of Plug and Play Business Software

In addition to the functional requirements presented above, there are some relevant non-functional requirements that should be met which we will discuss in terms of quality attributes, i.e., software attributes that can be measured using some metric. Based on interviews with SMEs and on previous work by Camarinha-Matos and Afsarmanesh [3], we believe that the following quality attributes are important for Plug and Play Business software:

- Scalability. A Plug and Play Business community may be very large and the number of involved enterprises can be large.
- Flexibility. Being adaptable or variable is important due to the heterogeneity of enterprises, relationships and actors in a VE. Hence, Plug and Play Business software must be flexible to the varying needs of member organizations.
- Performance. Although there may not be many hard real-time requirements for the Plug and Play Business software to meet, response times and other delays must be kept on a reasonable level.
- Cost. High costs associated with joining and participating in a community is considered an obstacle for any growing network [16].
- Usability. A user-friendly interface is crucial in order to get interaction from the humans involved in the chain of collaboration.
- Confidentiality. Prevention of unauthorized disclosure of information is a crucial security aspect of the software (and of the prosperity of the community).
- Integrity. As with the latter attribute, prevention of unauthorized modification of information is a critical characteristic of the Plug and Play Business software.
- Availability. Prevention of unauthorized withholding of information indicates that all security-enhancing mechanisms must be carefully considered so that they do not interfere with the other quality attributes.

The choice of system architecture is closely related to the system's performance in terms of a number of these attributes. Compared to a centralized architecture, a distributed architecture supports many of the quality attributes, e.g., flexibility, scalability and dynamicity. Also, the risk of single point of failure may be avoided increasing the robustness of the system.

A decentralized paradigm such as peer-to-peer (P2P) may be preferable for the Plug and Play Business software, because no central authority determines how the participants interact or coordinates them in order to accomplish some task. A P2P infrastructure self-configures and nodes can coordinate autonomously in order to search for resources, find them and interact together. P2P being a paradigm that allows building dynamic overlay networks, it can be used in order to realize an environment that manages a dynamic network of business relations. Dealing with business sensitive assets (e.g., innovators' knowledge), searching and retrieval of contents, as well as discovery, composition and invocation of new services, should be made secure and trustable. The P2P infrastructure realizes an environment in which every organization can make its knowledge and services available to other organizations keeping control over them. In a P2P infrastructure, each organization can autonomously manage this task without having to delegate it to an external central authority that could be perceived as less trusted than the organization itself, and should be the object of an external (to the collaborating network) agreement between all the involved organizations.

3 A Formal Model of Plug and Play Business

In order to make the concept of Plug and Play Business more precise (so that the requirements of Plug and Play Business software can be crisply defined), we will now formalize the most relevant aspects. A Plug and Play Business community, p, can be described as a tuple:

$$p = \langle A, R, VE, g \rangle$$

where

- $A = \{a_1, \ldots, a_n\}$ is the set of actors (typically enterprises) in the community,
- $R = \{r_1, \ldots, r_m\}$ is the set of roles that the actors can play,
- $VE = \{ve_1, \ldots, ve_l\}$ is the set of virtual enterprises currently active in the community, and
- g is the gatekeeper facility that regulates the entering (and leaving) of actors to (and from) the community. In order to become a member of p there is a set of criteria that must be fulfilled, e.g., VAT number must be declared, and business intentions and information systems must be specified. Thus, some of the aims of the gatekeeper are to ensure that this type of information is available to the Plug and Play Business community and to verify the identity of the actors.

Note that all these entities change dynamically, but with different frequency. New virtual enterprises may be formed (and dissolved) relatively frequently, actors enter and leave the community every now and then, and new roles may be added although this is not expected to happen often.

Moreover, we can describe an actor as a triple:

$$a = \langle h, i, b \rangle$$

Where h is the person representing the actor/enterprise, i is the relevant information systems, and b is the Plug and Play Business client software (possibly composed of a set of intelligent agents and supporting an (agent) communication language, a set of relevant interaction protocols/patterns, a set of relevant ontologies, etc.) acting on behalf of the actor/enterprise.

Finally, we can describe a virtual enterprise as a pair:

$$ve = \langle AR_{ve}, O_{ve} \rangle$$

where

- AR_{ve} is a set of pairs $\langle a_i, r_j \rangle$ where $a_i \in A$ and $r_j \in R$ i.e., the actors and their roles in the virtual enterprise, and
- $O_{ve} = \{O_1, O_2, \ldots O_n\}$ is a set of obligations for each of the n actors to the virtual enterprise.

In Figure 1, we illustrate an example of a Plug and Play Business community consisting of five actors of which three have formed a virtual enterprise.

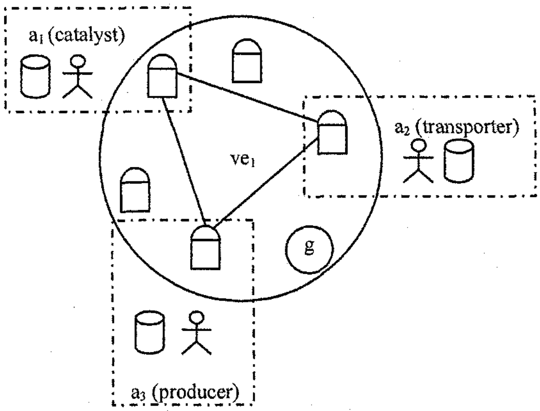

Fig. 1. An example of a Plug and Play Business community.

As mentioned earlier, there are two main activities that are supported by the Plug and Play Business software, namely *(virtual enterprise) formation* and *collaboration.* We will now formalize the different tasks involved in these activities using the model presented above.

3.1 Formation

Formation consists of three subtasks and is initiated by a catalyst, c, where $c \in A$.

- *Finding* requires that c has a list of the roles that must be filled in order get a functional/working virtual enterprise. (This list is provided by h_c, i.e., the person representing c.) Then for each of the roles, the task for b_c is to find the set of candidate actors K where $K \subset A$ that are able to play the role.
- In the *evaluation* task, c should rank the actors in K according to a set of requirements Q_r where $Q_r = \{q_1, q_2, \ldots q_k\}$ (provided by p_c). (Alternatively, c may select the one with the highest rank k where $k \in K$.)
- The goal of *negotiation* is to establish an agreement between c and k concerning k's set of obligations O_k in ve.

3.2 Collaboration

We separate between two levels of collaboration: *administrational* and *operational.* They are defined by the type of *interaction protocols* they support. Administrational collaboration includes only protocols using the "weaker" *performatives,* such as, *ask, tell, reply,* etc. Let us call this set of interaction protocols IPW. Operational collaboration supports protocols also using the performatives that actually manipulate the receiver's knowledge, such as, *insert,* where the sender requests the receiver to add the content of the message to its knowledge base, and *delete*, where the sender requests the receiver to delete the content of the message from its knowledge base. Let us call this set of interaction protocols IPS. Moreover, we make a distinction between bi-lateral and multi-lateral collaboration. Thus, we have four types of collaboration:

- *Bi-lateral administrational collaboration* between two actors a_i and a_j (where $a_i \in A$ and $a_j \in A$) in a virtual enterprise ve should support the use of a set of interaction protocols, IPW_{ij} where $IPW_{ij} \subset IPW$, between the two actors' information systems (i_i and i_j) and mediated by the actors' Plug and Play Business client software (b_i and b_j).
- *Multi-lateral administrational collaboration* between a set of actors A_u (where $A_u \subset A$ in a virtual enterprise ve should support the use of a set of interaction protocols, IPW_u where $IPW_u \subset IPW$, between all the actors' information systems and mediated by the actors' Plug and Play Business client software.
- *Bi-lateral operational collaboration* between two actors a_i and a_j (where $a_i \in A$ and $a_j \in A$) in a virtual enterprise ve should support the use of a set of interaction protocols, IPS_{ij} where $IPS_{ij} \subset IPS$, between the two actors' information systems (i_i and i_j) and mediated by the actors' Plug and Play Business client software (b_i and b_j).
- *Multi-lateral operational collaboration* between a set of actors A_u (where $A_u \subset A$ in a virtual enterprise ve should support the use of a set of interaction protocols, IPS_u where $IPS_u \subset IPS$ between all the actors' information systems and mediated by the actors' Plug and Play Business client software.

4 Useful Technologies

Based on the functional requirements and the quality attributes, we hereby make a brief review of some relevant technologies that might be useful when developing Plug and Play Business software.

4.1 Finding and evaluating potential partners

The tasks of finding and evaluating (e.g., business partners) have been the object of a lot of research within the area of recommendation systems (cf. [1]). Here, the main idea is to automate the process of "word-of-mouth" by which people recommend products or services to one another. Recommendation systems are usually classified based on how they are constructed into three categories: content-based recommendation (based on previous interests of actors), collaborative recommendations (based on preference of similar actors), and hybrid recommendations (a combination of the two previous ones). So far, recommendation systems have successfully been deployed primarily in consumer markets (see, for instance the collaborative filtering system at book-dealer Amazon.com).. As most existing recommendation systems are not developed for B2B applications, they generally exclude the negotiation process. As recommendation systems are already deployed in large-scale consumer systems it can be assumed that they enable scalability, flexibility, usability and cost-efficiency. Thus, they may be a beneficial alternative to use when meeting the requirements of VE formation. Also, since they can take the history of a potential collaborator into account they may also contribute to the enhancement of security and trust.

In the area of intelligent agents, middle agents or brokering agents [19,20] have been used to locate other agents in an open environment like the Internet. Here, each agent in the community typically advertises its capabilities to some broker. These brokering agents may simply be match-makers or yellow page agents who match advertisements to requests for advertised capabilities. Brokering agent systems are able to cope quickly and robustly with a rapidly fluctuating agent population [21], which indicates both a high level of flexibility, scalability, robustness and performance. This may make them appropriate to use in Plug and Play Business software.

4.1 Establishing an agreement

There is a long tradition in the area of agent-based systems of studying this topic, for instance using the Contract Net protocol [17] and computational auctions [15]. Auctions are generally considered to be a useful technique for allocating resources to agents [21]. However, they are too simple for many settings as they are mainly concerned with the allocation of goods or resources. For more general settings, where agents must reach agreements on matters of mutual interest and including complex constraints, richer techniques for reaching agreements are required. Here, negotiation may be a promising alternative (cf. [12] for an overview). Four different components are relevant for the Plug and Play Business setting:

- A negotiation set, which represents the space of possible obligations that agents can make.
- A protocol, which defines the legal obligations that the agents can make.
- A collection of strategies, one for each agent, which determines what obligations the enterprises will make.
- A rule that determines when the negotiation is over and the deal has been closed.

Here, the concept of obligations is an important component. Much work on obligations has been done, for instance in the area of electronic contracts, which are to be regarded as virtual representations of traditional contracts, i.e., "formalizations of the behavior of a group of agents that jointly agree on a specific business activity" [5]. Electronic contracts usually have a set of identified roles to be fulfilled by the parties involved in the relation. Three types of norms can exist within a contract structure, namely obligation, permission or prohibition. Plug and Play Business software focuses on obligations, i.e., that an agent has an obligation towards another agent to bring about a certain state of affairs before a certain deadline.

Agent-based auctions, negotiation protocols and electronic contracts may be sound technologies to enable the establishment of agreements within Plug and Play Business since intelligent agents can be designed to cope with individual goals and conflicting behavior (which may occur in the Plug and Play Business community). Also, they usually are fit for flexible and scalable interaction.

4.2 Collaboration

Several examinations on current state of the art technologies useful for building ICT-infrastructures with the purpose of business collaboration within VEs have been undertaken (cf. [2,3,11]). Some common conclusions are that multi agent technology constitutes a promising contributor to the development of support infrastructures and services. Internet and web technologies, such as web services, represent a fast growing sector with large potential in inter-enterprise collaboration support. However, further support in terms of supporting multi-lateral collaboration is necessary. A number of other emerging technologies, e.g., service-oriented architectures, the semantic web and countless collections of software standards (cf. the ebXML framework) are likely to provide important contributions. However, as stated by Camarinha-Matos and Afsarmanesh [2] "publicly funded research should avoid approaches that are too biased by existing technologies".

It seems that Microsoft's BizTalk Server [14] is the most sophisticated solution for inter-enterprise collaboration widely available. BizTalk is based upon a central server through which all exchanged information passes, it uses XML and supports the main protocols for email and http. However, BizTalk does not support multi-lateral communication and it is not fit for interoperable information resource sharing. Also, being a centralized proprietary client-server solution it has several disadvantages, such as, making the actors dependent of third party, being expensive and having possible risks for communication bottlenecks thereby failing to meet requirements such as scalability, flexibility, robustness, cost and security.

Based on our previous review [11], we believe that there are some technologies that may be useful for the collaboration task within Plug and Play Business software. One promising alternative for multi-lateral collaboration is the use of decentralized intelligent agents. As mentioned in the introduction, Davidsson et al. [10] describes a general wrapper agent solution based on open source freeware that makes it possible (in principle) for any business system to exchange (administrational) information with any other business system. Carlsson et al. [6] suggests further improvements to the wrapper agent technology by addressing security issues as well as an extended, possibly dynamic, set of involved companies and higher levels of cooperation (i.e., operational resource sharing). Another possibility is to use computational auctions [15,0]. They can be used within the collaboration task as a method for dynamically solving resource allocation within the VE. Possibly, auctions can also be deployed within multi-lateral administrational collaboration when allocating work tasks in-between partners of a VE. Table 1 summarizes candidates candidate technologies for meeting the functional requirements of Plug and Play Business software.

VE Formation		VE Collaboration
Finding and evaluation	Establishing agreement	
Recommendation systems and intelligent agents	Auctions, negotiation protocols and electronic contracts	Wrapper agents based on service-oriented architectures and (eb)XML

Table 1. Possible candidate technologies for addressing the functional requirements.

5 Conclusions and Future Work

One of the main weaknesses in the area of VEs is the lack of appropriate theoretic definitions, formal models and consistent modeling paradigms. The main contribution of this paper is a formal model of VE formation and collaboration and their associated tasks. In approaching a technology platform for Plug and Play Business, we have also made an assessment of useful technologies and related work. Based on this review, we can conclude that some of the evaluated technologies may be used for the tasks of Plug and Play Business software. With respect to finding and evaluating partners for a VE, recommendation systems show numerous fruitful examples that can be applied. For the process of establishing an agreement in-between the catalyst and the highest ranked actor in the evaluation process, the Contract Net protocol and broker agents may be promising alternatives. Relevant approaches for supporting collaboration include Microsoft's BizTalk solution, wrapper agents and computational auctions.

The next step will mainly focus on further analyzing the components of the Plug and Play Business software and refine the non-functional requirements that were only briefly discussed. We will also continue to refine the formal framework presented above. In particular, we will further develop the concepts of roles and obligations in the context of Plug and Play Business. Also, what finally constitutes the technology platform of Plug and Play Business remains to be determined.

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Application of Electronic Currency on the Online Payment System like PayPal

Rafael Martínez Peláez, Francisco J. Rico Novella
Technical University of Catalonia (UPC), Department of Telematics Engineering
C/Jordi Girona 1 i 3, 08034 Barcelona, Spain
{rafaelm, f.rico}@mat.upc.es,
http://www-entel.upc.es/

Abstract. Credit card payment system is the most popular way to make a purchase on electronic commerce. The main problem about using it is that the customer gives his personal information and credit card number to merchant or payment service provider when he makes a purchase in Internet. The result of this action is the lost of customer's anonymity and privacy in both the real world and Internet. We propose a new electronic currency scheme which guarantees customer anonymity and privacy. Also, we integrate our scheme with PayPal system.

1 Introduction

The success of electronic commerce has created the need to develop an electronic payment system to pay for goods and services. Many different electronic payment systems have been proposed [1-8]. Different researches and analysis have been realized about its evolution [9, 10, 11] obtaining a common result, the acceptance of an electronic payment system extended on great scale. Among other reasons, that avoid the acceptance of an electronic payment system are the following: security problems in a public network [12], vulnerabilities in customer's terminal and merchant's server [9], and deficiencies in web applications [13].

Credit card is the mean most popular to develop electronic payment systems [14, 15] accepted by customers and merchants in Internet. Unfortunately, it is not the best method from the anonymity and privacy point of view. Financial institutions (MasterCard and Visa) and payment service provider are still developing systems [16, 17] to motivate the use of credit card in the electronic commerce.

Electronic currency is an alternative to develop electronic payment systems. The concept was introduced by Chaum [18]. Researchers and financial institutions have proposed many systems based on its use [1, 3, 4, 6, 19]. However, its adoption by the

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customers is low. The causes that affect its market penetration are: integration between different e-payment systems, security and technological aspects. Some challenges are the global implementation, and the absence of incentives to use electronic currency [19].

In this paper, we propose to integrate the use of Electronic Currency in an Online Payment System (OPS) accepted by customers and merchants of electronic commerce. The paper begins with an electronic currency overview in section 2. In section 3, we examine an Online Payment System: PayPal system, and present a comparison study of efficiency with other OPS based on credit card. We present our proposal and compare it with the current PayPal system in section 4. In section 5, we present our conclusions.

2 Electronic Currency Overview

Money represents the price of products and services on the present society. It is the way most used by customers to make purchase in the real world. The money has different utility in the current economy: store of value, medium of exchange and standard of value [20]. The users of electronic commerce require an electronic currency with similar characteristics to the real money. The electronic currency must be for exclusive use in Internet. Additional, the electronic currency must to permit low value payments and reduce the cost per financial transaction.

2.1 Characteristics and Properties

Electronic payment systems based on electronic currency involve the following participants: customer, merchant and TTP (Trusted Third Party). In the payment protocol where only participate the customer and merchant is named offline payment. In this case, the use of a secure device is necessary. Smart card is a tamper proof device that can to control spending limits of money for customer [6, 9]. For other hand, the protocol that involves all the participants is named online payment. The TTP (bank or payment service provider) must verify the authenticity of electronic currency in each transaction [6, 9].

The success of use of electronic currency in e-payment system depends on the following characteristics [3]:

- Anonymity: The real identity of the customer must be protected. An adversary should not have the option to monitor the customer's activities or knowing the payment's source.
- Acceptability: The electronic currency must be accepted for different financial institutions and payment service provider.
- Scalability: E-payment system based on the electronic currency must be efficient at any time. The increase of users or fails in the communications must not represent a problem in the performance of the system.
- Security: Double spending detection and forgery prevention are basic requirements.

According on the e-payment system, the electronic currency may to satisfy one or all the following properties [20]:

- Atomicity: Permits to link multiple operations logically, so that either all of them are executed or none of them. In Tygar [21], are explained three different levels of atomicity (money, goods and certified delivery) for protecting the protocols and e-commerce.
- Consistency: The participants of an economic transaction must agree about the price of the good and settlements.
- Isolation: The transactions should not interfere with others at the same time. Each transaction must be considered independent of the other ones.
- Durability: The system must be able to recover the information after a disaster. The transaction must be recovered in the last state before the communication was interrupted. If the information stored is modified, the system must recover it.

2.2 User's Requirements

Internet is an opportunity for organizations and institutions to know the customer's purchase habits, make a market research, and trace the customers, making possible the Big Brother problem. The customers of electronic commerce need the following features in e-payment system [22].

- Anonymity: The electronic currency should not disclosed information about the customer's real identity to any participant in the transaction (merchant and TTP).
- Applicability: The electronic currency should be accepted for different merchants and financial institutions.
- Trust: The electronic currency should be durable all the moment. In case of attack, the electronic currency must not give any information to the adversary.
- Convertibility: The electronic payment system must accept different foreign currency.
- Efficiency: If the customer requires generating his/her EC the process should not implicate a high computational cost, and the use of an external device.
- Reliability: The electronic currency should be verifiable by any TTP.

2.3 Micropayments

Micropayment systems were developed to reduce the transactions cost and permit low value payments. Several schemes have been proposed. Each of them can be divided by the representation of the electronic currency: hash value chain, random token and script.

Hash chain

A hash function is a computationally efficient function mapping bits strings of different length, to bits strings of specific length. Hash function H() is computationally unfeasible to find two distinct inputs which hash to a common value. Given a specific hash value y is computationally unfeasible to find an input x, such that h(x) = y. Hash chain was introduced by Lamport [23]. The application of hash chain in electronic payment system was proposed in [24]. Hash chain is a collection of values, such that each value Z_i is a one-way function of the next value Z_{i-1}. The system is initialized by a seed. The customer randomly chooses a seed X and compute:

$$Z_i = X, Z_{i-1} = H(Z_i), Z_{i-2} = H(Z_{i-1}) \ldots Z_0 = H(Z_1)$$

When a customer wants to make a payment sends the value Z_{i-n} and Z_0 such that is possible to verify the exact payment. In order to verify its validity and authenticity a TTP signs the root value (Z_0) using a public key algorithm. The hash chain technique is used in [5].

Random token

Random token was introduced in Chaum [25]. The random token is based on public-key cryptography and blind signature scheme. The customer executes the blind signature protocol to obtain his/her electronic currency signed by the bank. Blind signature provides the double spending detection, forgery prevention and avoids tracing a customer, keeping his anonymity. The user's anonymity is based in the option to verify the authenticity and validity of electronic currency for any entity using the bank's public key. Moreover, the signer does not know anything about the correspondence between the payer and payee. With this initiative, many protocols have been proposed [6] and basic security requirements have been defined for electronic payment systems [9, 11].

Script

Medvinsky and Neuman [3] proposed the use of new electronic currency based on a script. The script is a set of specific information as IP address, monetary value or time stamping. A characteristic is the use of public key cryptography to encrypt message between participants. Unfortunately, the information stored in the script contains more information that can be used to reveal the users' identity, payment source and gives the ability to know the user's behaviour. Other electronic payment systems based in the script appear in Sirbu and Tygar [7].

3 Online Payment System: PayPal

PayPal is an Online Payment System. It is built on the existing financial infrastructure of bank accounts and credit cards. The main advantage of PayPal is the acceptation by customers and merchants to make payments in Internet. Customer requires creating a system account. When the customer gets an account he/she can have access to resources and services offered by PayPal. PayPal stores user's personal information and credit card information, that can be divided in three subset: (1) create an account (first name, last name, address, city, state, ZIP code, country, and home telephone), (2) PayPal account login (Email address), and (3) payment information (credit card type, name on card, card number, and expiration date).

3.1 PayPal Payment Model

The participants involved in the payment systems are: customer, merchant and PayPal. This system has multiple agreements with different financial institutions like MasterCard and Visa. PayPal works as authorization system in the payment process between the customer and the merchant. The merchant must have a business relationship with PayPal in order to use the payment tools offered by PayPal. With the same account the merchant has the option to maintain the funds in his account of PayPal or transfer it to his bank account [26].

3.2 PayPal Transaction Protocol

The payment protocol begins after the customer decided to pay for an item in a web shop. The price negotiation is outside the PayPal payment protocol. To make the payment in Internet using PayPal, the customer needs to choose "pay with PayPal" (Fig. 1 step 1). The merchant's web site redirected the customers to PayPal Web site (Fig. 1 step 2). After the step 2, the communication between the customer and PayPal is a secure connection by SSL (Secure Socket Layer). PayPal requests to customer's identification through his account (Fig. 1 step 3). The customer log in or sign up to PayPal (Fig. 1 step 4). PayPal ask for confirmation or "You made a payment" in PayPal web page (Fig. 1 step 5). The customer accepts or rejects the charge (Fig. 1 step 6). If the customer accepts receive a notification, in the other case, the protocol transaction finishes. PayPal shows to customer the reviews payment information (Fig. 1 step 7). Finally, PayPal redirects the customer to merchant's web shop.

3.3 Protecting Electronic Payment

PayPal creates a secure connection to its server through SSL [14]. SSL is a protocol used to manage the security of the message in a transmission of data across a public network. SSL integrate security services in the session layer for applications as encrypted and integrity over Hyper Text Transfer Protocol (HTTP).

The fraud problem is resolved by the authentication service. This process involves the knowledge of a password that only knows the owner of the account. The repudiation problem is resolved by the authorization of the payment. As additional security parameter the customer receives a notification with the payment details by email

The privacy problem is not resolved, because the user discloses his/her personal and financial information to PayPal. In addition, the financial institutions can obtain knowledge about the customer's purchase habits. In comparison with other electronic payment system, PayPal requests information to the customer only in the process of creation an account. The information is stored in a central server. In the other case, the user must deliver his/her information to many companies.

Another advantage is the use of pseudonym inside the system. With this pseudonym the merchant does not know the real identity of the customer and does not receive any information directly to him/her [26].

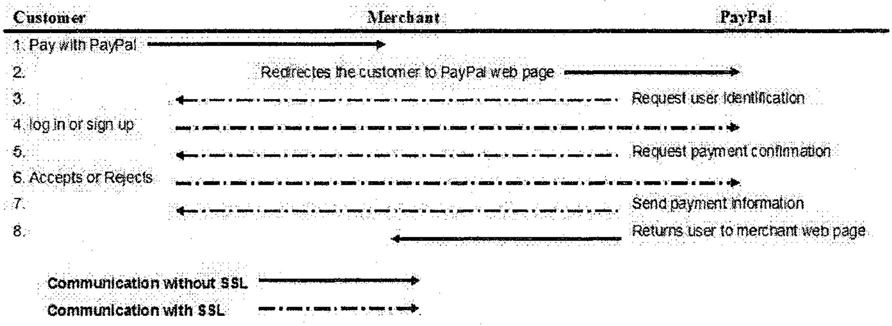

Fig. 1. Transaction Protocol

3.4 Comparison of the current Online Payment System based on Credit Card

Nowadays, there are four online payments systems based on the use of credit card with good acceptance by customers and merchants. The characteristics of SSL, SecureCode (MasterCard), 3-D Secure (Visa) and PayPal are compared in Table 1.

Table 1. Comparison of the actual Online Credit Card Payment System

	SSL	SecureCode	3-D Secure	PayPal
Acceptability	Very popular	Good	Good	Very popular
Anonymity	External entities are able to know information	Only the issuer bank knows information	Only the issuer bank knows information	External entities are not able to know information
Authenticity	Use weak authentication	Use of a secure code	Use of a PIN	Use weak authentication
Compatibility	Good	Good	Good	Good
Convenience	Good: Consumer only need to have a credit card	Good: Customer need to create his private code in his issuer's Web bank	Good: Customer need to create an account in 3D-Secure	Good: Customer need to create an account in PayPal
Financial risk	All the participants can be victims of a fraud	Good	Good	Good
Mobility	Yes	Yes	Yes	Yes
No-repudiation	No	Yes	Yes	Yes
Payment confirmation	No	Yes	Yes	Yes
Privacy	Faulty	Good	Good	Acceptable

4 Proposed New Electronic Currency Scheme

Our proposal provides an alternative scheme to make payments with different merchants using OPS accepted by customers and merchants. With this scheme the issuer of electronic currency and merchant does not have the ability to determine the identity of the payer in the withdrawal and payment transaction. For illustration purpose of the electronic payment scheme, we applied it in PayPal system.

4.1 Generation of electronic currency

In this section, we defined the protocol to generate the electronic currency. Each authenticate customer can to create an electronic currency. The structure of the electronic currency in our scheme includes among other field the last hash value chain signed with the PayPal private key. This signature identifies the value of the coin. The customer randomly chooses a seed X and compute the hash chain $Z_i = H(X)$, $Z_{i-1} = H(Z_i)$, $Z_{i-2} = H(Z_{i-1}) \ldots Z_0 = H(Z_1)$. An i_{max} field is part of the electronic currency allowing a PayPal to determine the denominations. Its value defines the maximum number of hash chain operations that represents the value of the electronic currency. The value_added field specifies the value of the electronic currency. The customer requests the cash that wants to spend using the value_added field. Foreign_currency field indicates the foreign currency that must be used on each payment. PayPal applies the signature on the electronic currency corresponding to the value indicated in the value_added field. The structure of the electronic currency is the next:

$$EC = s^1(Z_0 \| i_{max}, \text{value\_added}, \text{foreign\_currency})$$

4.2 Withdrawal phase

The scheme is based on the infrastructure of accounts. The customer must to have an account in PayPal system. In order to open an account the customer must to give personal information to PayPal system. PayPal stores specific information about the user, such as first name, last name, age, street address, city, state, ZIP code and country. Only authenticated customer can withdraw EC. First, the customer decides the value that wants to buy a PayPal and indicates it in the value_added field. Then, the customer chooses the distribution of the electronic currency denomination by the i_{max} field. The denomination permits low value payments and guarantees certain number of payments until the money is spent. The customer chooses which kind of foreign currency wants to use in the foreign_currency field during the payment phase. When a customer defines the foreign_currency value is not possible to modify it. For each electronic currency to be withdrawn from a user's PayPal account, the user executes the blind signature protocol. The customer chooses a blind value r^1 such that $r^1(EC)$. Then sends the value c(EC) to PayPal. PayPal ask to customer for confirmation transaction. If the user decided to reject the transaction the protocol is finalized. In the other case, PayPal applies its digital signature $s^1(r(EC))$ according to value_added field, and forward it to the customer. The customer must to apply the inverse value r^{-1} to remove the blinding factor to obtain the electronic currency with the PayPal signature $r^{-1}(s^1(r(EC)) = s^1(EC)$. The withdrawal phase is shown in fig. 2.

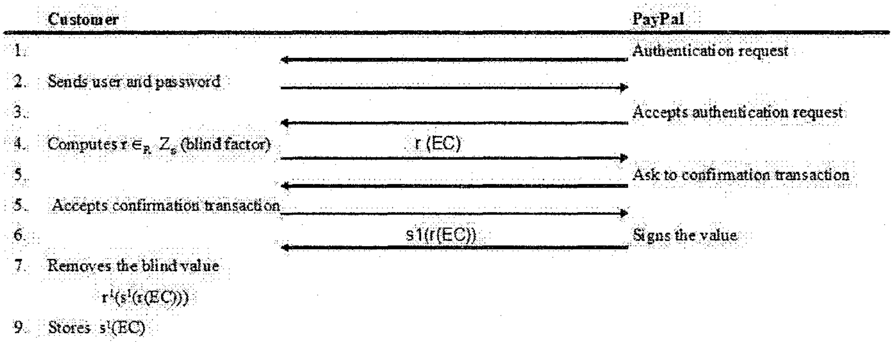

Fig. 2. Withdrawal of electronic currency

4.3 Payment phase

We assume the use of SSL to create a secure communication between the merchant to customer and merchant to PayPal. After the customer and merchant have an agreement about the item to purchases and the amount, the result is recorded in the AEPO (Agreement of Electronic Payment Order). The AEPO is an effort to represent a common payment process made everyday for a person. It contains specific information to make the payment. The payment for field specifies the item to purchase. This field represents an identifier of the product. The quantity field explains clearly how many items are purchased. The gross amount is specifies in the amount field. The cost of transportation is recorded in the shipping field. Fig. 3 shows a payment protocol.

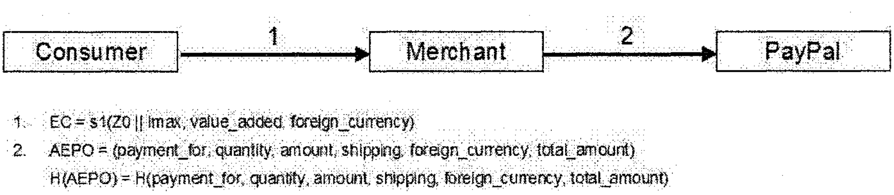

Fig. 3. Payment steps

In order to pay the money to the merchant, the customer sends a clear text message $M = s^1(EC)$, Z_j, J, V, to the merchant. The hash value chain that indicates the payment is Zj. J is a pointer that represents the last value of the hash chain used in a purchase phase. V defines the number of hash chain operations that PayPal carries out from Z_j to Z_{i-n}. After verifying $s^1(EC) \equiv s^{-1}(EC)\ mod_n$, the merchant forwards the message, AEPO and it hash value H(AEPO) to PayPal. PayPal receives the AEPO, H(AEPO) and $s^1(EC)$ from the merchant, and applies the verification proof subprotocol to verify the H(AEPO) and $s^1(EC)$. If the EC is valid, PayPal computes Z_j - Z_i to the last value of the hash chain indicated for J. The operations carried out by PayPal must be the same that the indicated it on V. In the first payment the value of J is equal to 0. PayPal stores all the payments transaction to avoid double spending. The description of the verification proof subprotocol is explained:

Customer SEND M = $s^1(EC)$, Z_j, J, V TO Merchant
Merchant stores M
Verification proof
IF($s^1(EC) \equiv s^{-1}(EC)\ mod_n$)
  Merchant SEND M, AEPO & H(AEPO) TO PayPal
  PayPal stores M, AEPO & H(AEPO)
  Verification proof
  IF($s^1(EC) \equiv s^{-1}(EC)\ mod_n$) && (AEPO == H(AEPO))
    PayPal stores Z_j, Z_i, J, and V
    PayPal computes Z_j - Z_i
    PayPal stores finished New Z_i, and J
    PayPal SEND confirmation payment TO Merchant
  ELSE
    PayPal SEND rejects message TO Merchant
ELSE
  Merchant finished transaction

PayPal knows the relationship between the merchant and his bank account; therefore, PayPal can maintain the funds in merchant's PayPal account for future use or transfer it to merchant's bank account. After the payment phase is completed, PayPal sends a confirmation payment to Merchant. Then, the merchant shows the confirmation payment through its web page. We present an example of the payment phase.

	Z_i	Z_j	J	V
Initial State	Null	0	0	0
PayPal Stores	Z_0	5	0	5
PayPal Computes	$Z_j - Z_i$ $H(Z_5) = Z_4$, $H(Z_4) = Z_3$, $H(Z_3) = Z_2$, $H(Z_2)=Z_1$, $H(Z_1) = Z_0$			
PayPal Stores finished	Z_5	0	5	0

4.4 Security Analysis

Properties

- Anonymity: When PayPal signs the electronic currency knows the customer's identity (he/she must be authenticated) but PayPal does not know the value EC because it is blind under the value r. In the payment phase, PayPal and merchant can not know the customer's identity.

- Privacy: Anyone including PayPal and merchant can not determine to who purchase the item. PayPal and merchant know nothing about the payment source.
- Unforgeable: Only registered customers are able to obtain the PayPal signature. The security parameter in the electronic currency is the value Z_0. Nobody can compute the same hash value such as given a specific hash value y is computationally unfeasible to find an input x, such that $h(x) = y$.
- Unlinkable: In the payment phase, the merchant and PayPal do not have any information about the customer's identity.

Attacks

- Double spending detection: A customer sends the EC, Zj, J and V to make the payment. PayPal must to verify that EC is authentic. Then, compare the new value of J with the last value stored of J and PayPal verifies the number of operations from the new value Zj to Zi with the value of V too. If the result of both verifications is not the same, a double spending attack is detected.
- Forgery prevention: To have an authentic EC, the customer must to get a PayPal account. The authenticity of the EC is based on PayPal signature. If an attacker sends an EC without a legitimate signature, a forgery attack has been detected.

4.5 Comparison of the current PayPal system vs. Proposal

In Table 2 list the pros and cons of our proposal and PayPal system are measured against the user's requirements and characteristics described in Section 2.

Acknowledgments

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5 Conclusions

In this paper, we paid attention to introduce a new electronic currency scheme and its integration with PayPal. The application of this new electronic currency in an online payment system with good acceptability by customers and merchants has two benefits. First, the use of electronic currency with an Online Payment System extended to great scale can improve its adoption and finally its market penetration. Then the customer's anonymity and privacy in payment phase is maintained. We focus on explain the advantage and disadvantage of one of the most popular electronic payment systems at this moment. We make a comparison between the four current electronic payment systems based on the use of credit card. Finally, we comment the pros and cons of our proposal vs. the current PayPal system.

Table 2. PayPal based on credit card and electronic currency

	PayPal based on Credit Card	PayPal based on our proposal
Anonymity in payment phase	Partial: PayPal knows the customer's identity.	Good: No body knows the client's identity
Applicability	Good	Good
Convertibility	Yes	Yes
Confirmation	Yes: The client receives an email that confirms the payment and includes payment details for this purchase	Yes: The client receives a payment confirmation by the merchant
Ease of use	Yes	Yes
Efficiency	Good	Good
Information stored	Good: Only information about credit card and personal	Faulty: Its necessary to maintain a large database and records of electronic cash
Mobility	Good: Client requires have only a connection to Internet and a browser	Partial: Client requires to install an additional software
Privacy	Partial: PayPal knows the customer's activities and purchase habits	Very Good: Any entity know the customer's activities and purchase habits
Scalability	Good	Good
Traceability	Faulty: PayPal, the bank and other entities can trace the client in both the real world and Internet	Good: Any entity can't trace the client in both the real world and Internet
Transaction information	Merchant sends information about the purchase to PayPal and the client confidences credit card information to PayPal	Customer sends EC and merchant sends AEPO and H(AEPO) to PayPal
Transfer funds	Merchant receives the founds immediately while the bank receives the founds later	PayPal receives the founds before the electronic cash can be used it by the client, the merchant receives the founds immediately, and the bank receives the found later

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Architecture of an ERP System Supporting Project-Oriented Management

Willy Picard, Grzegorz Wojciechowsk
Department of Information Technology
The Poznań University of Economics
ul. Mansfelda 4
60-854 Poznań, Poland
{picard,gwojc}@kti.ae.poznan.pl
http://www.kti.ae.poznan.pl/

Abstract. Existing ERP systems provide an IT solution to the management of enterprise resources based on the function-oriented management approach. With an increasingly wide adoption of the project-oriented management, new models are needed for ERP systems to support the management of enterprise resources in a project-oriented manner. This paper presents an architecture of an ERP system supporting project-oriented management. Two characteristics of the project-oriented management are integrated in the proposed architecture: first, social protocols are used to model interactions between actors (humans or software agents) within a given group. Second, the concept of group actions is detailed as a way to integrate group dynamics to social protocols.

1 Introduction

Enterprises are increasingly using ERP systems in all areas of their business activity to improve their business processes. The main reason for that is to achieve value-added differentiation over competitors , to ensure brand awareness, and client satisfaction. ERP systems aim at providing an integrated solution to the management of resources of the enterprise. Current ERP systems aspire to support all tasks required to achieve operational goals of the enterprise.

In management theory, two approaches to management of operational goals may be distinguished: function-oriented and project-oriented management.

The function-oriented management is usually used in environments where a set of relatively simple tasks are frequently performed. The function-oriented management implies that tasks are handled in a routine manner where each employee has his/her own function in achieving operational goals. A manager does not coordinate the execution of tasks for each goal, employees just react on the incoming documents, phone calls, etc., by completing tasks they are assigned. In existing ERP

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systems, the function-oriented management is supported via *data-flow engine*. The data-flow engine, which is the core of ERP systems, is responsible for managing the co-peration of ERP modules by providing modules with appropriate data, potentially from other modules.

The project-oriented management is usually used when the achievement of operational goals required the coordinated interactions of various persons possessing different skills. In a project-oriented management approach, a project manager usually supervises the work being done. The project-oriented management implies that tasks are performed within groups where employees are cooperating to reach a common goal. Within a given group, employees are usually assigned with various roles depending on the skills and/or the position of a given employee. Depending on their role, employees may perform different tasks.

As a consequence of the increasing complexity of business interactions, enterprises are moving from function-oriented management to project-oriented management. The lack of support for project-oriented management in ERP systems is currently a real obstacle to a wide adoption of project-oriented management by enterprises, and therefore an obstacle to their efficiency and competitiveness.

Existing ERP systems improve business processes especially by supporting employees to perform single tasks effectively. Due to many years' enhancement of data-flow engines, employees may execute tasks in an efficient way. However, the solutions applied in data-flow engines should also be available in ERP systems supporting project-oriented management.

In project-oriented management a project manager needs to coordinate activities performed by employees and software agents. In regard to ERP systems, they support coordination and orchestration of business process activities but not sufficiently to entirely take advantage of project-oriented management. Workflow solutions[5][3] or business process execution solutions such as BPEL[1] to automate business processes are often offered but a critical element of project-oriented management remains missing, i.e. support of *collaboration with group management*.

In our opinion, the following areas concerning business process improvement are crucial to implement project-management support in ERP systems: activity efficiency which is human-to-machine interactions; coordination and orchestration called machine-to-machine interactions; and collaboration which is human-to-human interactions (Figure 1).

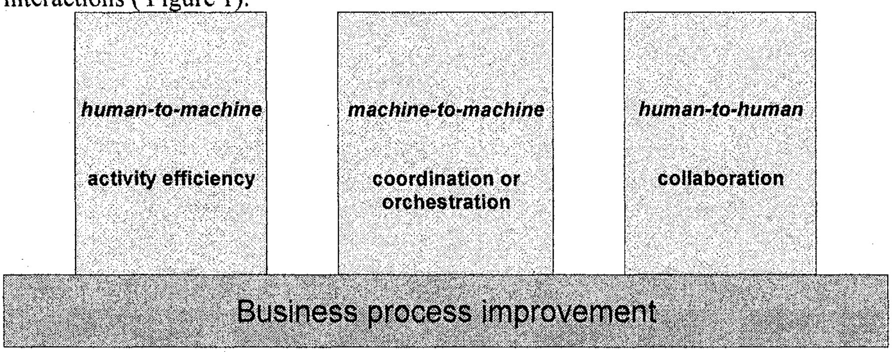

Fig. 1. Pillars of business process improvement

As it has been already stated, existing ERP systems concentrate their efforts on improving human-to-machine and machine-to-machine interactions. The proposed architecture of an ERP system supporting project-oriented management is built on the architecture of existing ERP systems. Therefore, the solutions of human-to-machine and machine-to-machine interactions are integrated into the presented architecture. The remaining problem of collaboration with group management is addressed by social protocols and group actions concepts.

The rest of this paper is organized as follows. In Section 2, the concept of *social protocol*, used to model collaboration processes, is presented. In Section 3, group management in collaboration processes is described. Next, the architecture of ERP system supporting project-oriented management is presented. Finally, Section 5 concludes the paper.

2 Social Protocol Definition

In the project-oriented management approach, all tasks required to achieve operational goals are performed within groups, as a result of interactions among actors, humans or software agents. Efficiency of the work may be improved by structuring interactions among actors. Therefore, a model for structured interactions is required. A main contribution of this paper is the concept of *social protocols* which are used to model structured collaboration processes.

A social protocol is a formal definition of possible actors-to-actors interactions. A social protocol has to capture characteristics of human-to-human, machine-to-machine, and human-to-machine interactions. Interactions are strongly related with social aspects, such as the role played by actors. The proposed model integrates the concept of role, which may explain the choice of the term "social protocols".

Roles need to be integrated to social protocols as various actors may play different roles. Depending on its role, an actor may perform different tasks. For instance, during the decision-making concerning a delivery date for an order, two humans may collaborate: one of them plays the role of a shipping company representative, while the second person plays the role of a worker responsible for servicing client's order. A role r is a label which is assigned to an actor. Let's denote R the set of roles existing in a given social protocol.

Interactions among actors are modeled with the concept of *action*. An action a is an execution of a software entity. The software entity is a web service used to call an external program. The execution of actions is a part of the common knowledge of the group, i.e. all actors are aware of the execution of an action by one of the members of the group. Depending on the fact that an actor executes actions or not we differentiate two types of actors: *passive actors* which only monitor the execution of the social protocol or *active actors* which perform actions. A passive actor may be a client of the company which observes the decision-making concerning the production date of ordered goods. Let's denote A the set of actions available in a given social protocol.

Each action may be associated with *metadata*. Metadata m are information about their associated action. Metadata consist of two parts: a metadata type and a metadata content. The two-fold aspect of metadata found its origin in the speech act theory by John Searle[14]. In the speech act theory, an utterance consists of both a propositional content and an illocutionary force. The illocutionary force of an utterance specifies the purpose of the actor. Similarly, metadata for social protocols consist of a metadata content and a metadata type which explicitly specifies the purpose of the actor.

Two kinds of metadata may be distinguished: unstructured and structured metadata. Unstructured metadata are metadata with unstructured metadata content. Unstructured metadata are typed with a content potentially written in natural language. Unstructured metadata are adapted to human-to-human communication. An example of an unstructured metadata could be an explanation for why ordered goods can not be produced at a specific date. In this metadata, "explanation" may be the metadata type, while "our plants are overbooked till the end of the month" may be the unstructured content. Such unstructured metadata may cause the worker responsible for servicing client's order to propose a new delivery date. Structured metadata are metadata with structured metadata content. Structured metadata are typed with a structured content. Structured metadata are adapted to machine-to-machine communication. Let's denote M_t the set of metadata types available in a given social protocol.

Triplets *(role, action, metadata type)* are called *behavioral units*. The concept of behavioral unit comes from the idea that the behavior of an actor is to a large extent determined by the role he/she plays, the actions she/he may perform and the type of metadata she/he may send. Therefore, roles, actions, and metadata types have to be associated to determine the behavior that an actor playing a given role should expose. Let's denote BU the set of potential behavioral units. Formally, $BU=R\times A\times M_t$.

One may say that a behavioral unit is executed. A behavioral $bu=(r,a,m_t)$ is said to be executed if an actor playing the role r executes action a, while sending a metadata with type m_t. It should be noticed that only actors playing the role r can execute the behavioral unit $bu=(r,a,m_t)$. Examples of behavioral units that may be executed during the decision-making process concerning the establishment of a delivery date for ordered goods are:

bu = (worker responsible for servicing client's order, propose date, $\varnothing$)
bu = (shipping company representative, accept date, information)
bu = (shipping company representative, reject date, counter-offer)

A state s is a label associated with a given situation in a collaborative process. Let's denote S the set of states that may occur in a given social protocol.

A transition t is a triplet $(bu, s_{source}, s_{destination})$. Let's denote T the set of transitions that may occur in a given social protocol. Formally, $T=BU\times S\times S$.

A ***social protocol*** p is a finite state machine consisting of $\{S_p, S_p^{start}, S_p^{end}, Tp\}$ where S_p is the set of states, $S_p^{start}\subset S$ is the set of starting states, $S_p^{end}\subset S$ is the set of ending states, $S_p^{start}\cap S_p^{end}=\varnothing$, and T_p is the set of transitions from states to states.

Following a given social protocol, actors are "moving" from state to state via the execution of behavioral units. In other words, the execution of behavioral units are transition conditions. As mentioned before, a behavioral unit may be executed only by an actor playing the appropriate role. The conditions that protocols have to fulfill to be valid, both structurally and semantically have already been presented in [9].

The last concepts related with social protocols are *role-to-actor mapping* and *social protocol instance*. A social protocol is a model for a class of collaboration process. A given collaboration process may be structured according to a given social protocol on the condition that the following additional data are known:

- the current state in which the collaboration process is,
- the role-to-actor mapping which associated at least one actor with each role specified in the social protocol.

The role-to-actor mapping is related to the current state, as actors may play various roles during the collaboration process. A ***social protocol instance*** is a triplet $(P, RAM, S_{current})$, where P is a given social protocol, RAM is the role-to-actor mapping, and $S_{current}$ is the current state.

3 Group Management in Collaboration Processes

A social protocol models interactions among actors within a given group. However, in the project-oriented management approach, the work related with the achievement of the operational goals is usually performed within many groups. Moreover, the interactions taking place within these groups are different, as roles, actions and metadata types may be different from group to group. For instance, brainstorming and negotiations are two classical techniques used during the realization of projects. Therefore, various social protocols may be involved in the realization of a single project, with some actors playing potentially many different roles depending on the group they are participating to at a given moment of time. The possibility for actors to modify protocols during the realization of a project has been presented in previous works [10,11].

Since interactions between humans take place in groups and various groups are created, modified, and destroyed during the realization of a project, social protocols have to support group management. Group management has to be designed to be interoperable with social protocols. The integration of group management and social protocols is required to be able to specify social protocols in which group creation, modification, and deletion may be seen as transitions from a given state to another one.

The proposed solution is based on the used of specific actions, called *group actions*. Group actions are actions – usable in social protocols – responsible for group management. Therefore, all actions that may be used to modify the set of groups related with the realization of a given project are group actions.

The following group actions have been identified:

Join – adds at least one collaborator to the set of collaborators of an existing group. Formally:

Join: $RAM \rightarrow RAM'$, where $\exists_{RAM'' \subset RAM'} : RAM = RAM' - RAM''$

Quit – removes at least one collaborator from the set of collaborators of an existing group. Formally:

Quit: *RAM*→*RAM'*, where $\underset{RAM''\subset RAM}{\exists} : RAM - RAM'' = RAM'$

Split – splits an existing group in two or more new groups and the union of the set of collaborators of the created group equals the set of collaborators of the existing group. Formally:

Split: *RAM*→*RAM₁*, *RAM₂*, ..., *RAMₙ*, where $RAM = (R, A_c)$, with A_c denoting the set of actors involved in a given social protocol instance, $\underset{k}{\forall} RAM_k = (R_k, A_{c,k})$, and $A_{c,1} \cup A_{c,2} \cup \ldots \cup A_{c,n} = A_n$

Merge – creates a new group consisting of the union of the set of collaborators of at least two groups. Formally:

Merge: RAM_1, RAM_2, ..., RAM_n →*AA*, where $RAM = (R, A_c)$, $\underset{k}{\forall} RAM_k = (R_k, A_{c,k})$ and $A_{c,1} \cup A_{c,2} \cup \ldots \cup A_{c,n} = A_n$

Create – creates new group. Formally:

Create: $\varnothing \rightarrow RAM$

End – deletes an existing group. Formally:

End: $RAM \rightarrow \varnothing$

ChangeRole – change role of at least one collaborator in an existing group. Formally:

ChangeRole: *RAM*→*RAM'*, where $RAM = (R, A_c)$ and $RAM' = (R', A_c')$, $A_c = A_c'$, and $\underset{(r',a_c')\in RAM'}{\exists} : \underset{(r,a_c)\in RAM}{\forall} (r', a_c') \neq (r, a_c)$

The presented list of group actions is not exclusive. Other group actions may be defined. However, the group actions proposed above address the most common actions related with group management.

4 ERP System Architecture

The proposed architecture of an ERP system supporting project-oriented management is based on the concepts of social protocol and group actions. A diagram presenting the proposed architecture is given in Figure 2.

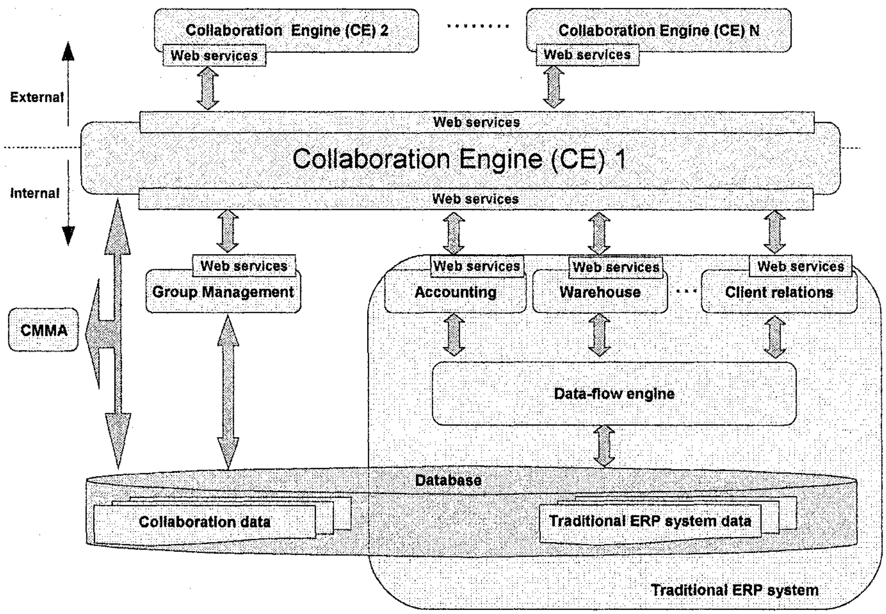

Fig. 2. Architecture of an ERP system supporting project-oriented management

The proposed architecture consists of the following elements:
Database – stores data of a traditional ERP system necessary to manage an organization. Additionally the database stores data specific to collaboration, i.e. group management data (existing groups, history of groups), social protocols defined in an ERP system, running instances of social protocols and history of finished instances of social protocols.

Group management module– provides features related with the interactions between the collaborative engine and the social protocols stored in the database;
ERP system modules – supply the ERP system functions as actions to social protocol;
Collaboration Engine (CE) – parses definitions of social protocols and executes instances of social protocols. In the ERP system, some special actions (for example ordering goods by a client) may trigger the creation of a new instance of a social protocol. Despite that the engine takes care of persistence, queues, and other execution details.

Collaboration Management, Monitoring and Analysis (CMMA) – supports management of social protocol definitions and instances, supports traceability of actual instances to find bottlenecks, supports analysis of finished instances of social protocols to detect friction points, enabling modifications of social protocols to improve the execution of future instances.

The communication between Collaboration Engine and all modules relies on web services to facilitate interoperability and integration. There are two types of internal communication, i.e. communication that take place inside one ERP system: first, communication may take place between the CE and ERP modules used to call services of an ERP system functions. Second, communication may take place between the CE and the Collaboration module used to call group actions of a social protocol.

The CE may also communicate with external ERP systems, specifically CE 1 may call actions of external CEs as it is shown in the Figure 2. The external communication is especially applicable in a case of collaboration among actors from two groups of different ERP systems. The 'join' and 'split' group actions are used to start and finish collaboration respectively.

Actions invoked by an actor in a social protocol may be executed in either a synchronous or an asynchronous way. In the synchronous scenario, results of the execution of an action are immediately returned as an output message of invoked service. In the asynchronous scenario, the architecture has to support the push model and/or the pull model for asynchronous communication. In the push approach, the Collaboration Engine looks up in the database for the results of former action executions at a given interval of time. The push approach implies a high load of the network because of the polling of the database, but ERP system modules do not need to know about existence of the Collaboration Engine. In the pull approach, the Collaboration Engine has to expose a callback interface (marked as web service interface in Figure 2). Once the results are available, they are returned from an ERP system module via callback invocation on the Collaboration Engine. The usage of the pull model minimizes a network load but ERP system modules have to know how to return action results. A pull model is a solution well adapted to the case of asynchronous communication between different CEs and may be implemented using WS-Addressing[15] standard or a mechanism similar to the correlation sets concept used in the BPEL specification.

5 Discussion

As process modeling is concerned, many works have already been conduced in the research field of workflow modeling and workflow management systems. Paul Buhler and Jose M. Vidal [2] proposed a mechanism allowing for enacting workflows in an adaptive way using multi-agent systems (MAS). Robert Müller and al. presented in [8] various mechanisms for adaptation of workflows to deal with exception occurrences in running workflow instances, with an application to medical treatments. However, to our best knowledge, current works concerning workflow adaptation focus on interactions among software entities. Characteristics of interactions between humans, such as the importance of social aspects, are not or insufficiently taken into account by these works. Moreover, these works are lacking support for group management.

Some interesting works have been done in the field of electronic negotiations to model electronic negotiations with the help of negotiation protocols. In [7], it is stated in that, in the field of electronic negotiations, "the protocol is a formal model, often represented by a set of rules, which govern software processing, decision-making and communication tasks, and imposes restrictions on activities through the specification of permissible inputs and actions". One may notice the similarity with the concept of social protocol. The reason for this fact is that the model presented in this paper was originally coming from a work on protocols for electronic negotiations [12,13]. However, these works are by nature limited to the field of electronic negotiations which is just a subset of the field of human collaboration, and may not be applied directly to ERP systems.

6 Conclusion

While the function-oriented management is currently well supported in ERP systems, the project-oriented management lacks support in ERP systems. In this paper, an architecture for ERP systems supporting project-oriented management is presented. The proposed architecture is based on the concept of social protocols. The concept of social protocol aims at being a start of the answer to the question of computer support for social collaboration. The introduction of group actions allows to support group dynamics, i.e. structured collaboration "spread" in a dynamic way within many groups.

The main innovations presented in this paper are 1) the concept of social protocols, integrating social aspects with roles, communication aspects with metadata, and structured collaboration based on the use of behavioral units as transitions in a finite state machine, 2) the concept of group actions which allows to integrate group creation, modification, and deletion to social protocols, 3) an architecture for ERP systems integrating support for social roles and using web services as an interoperability mean. The proposed concepts are currently under implementation as extensions to the *DynG* protocol [6], a social protocol-based platform.

The next steps will include a refinement of the concept of role, so that relationships between roles, e.g. specialization, compositions, may be integrated to the presented model. Another area to be investigated is the adaptation of social protocols, so that actors may modify a social protocol to tailor it to their own needs at run-time.

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Inter-organizational information systems in cooperative inter-organizational relationships: Study of the factors influencing to success

Marko Mäkipää
Department of Computer Sciences
FIN-33014 University of Tampere
Finland
Marko.Makipaa@uta.fi
http://www.uta.fi/~mm55954

Abstract. Significance of inter-organizational information systems (IOSs) in inter-organizational relationship (IOR) has been highlighted recently. IOSs are not only technical solutions to enhance communication across organizations, but they are also supporters and enablers of cooperation as well as symbols of formal IORs. The success or failure of these systems can have severe effects on cooperative relationships. In this conceptual-analytical research based on existing literature the role of different factors influencing to success of IOSs are considered. When considering implementing an IOS the role of these factors should be asserted to be able to enhance cooperation in IORs on one hand and successfully implement IOSs on the other hand.

1 Introduction

Increased competition in world markets has led companies to concentrate on to few core processes and development of their own core competencies [32] while outsourcing other processes where reasonable [12, 33]. Specialization increases productivity [9], but outsourced parts of processes create dependencies between companies and those relationships have to be managed. Engagement in Inter-Organizational Relationships (IOR) means that also design of work processes has to cross the organizational boundaries [40]. This development has raised the issue of cooperative inter-organizational arrangements [34, 40].

Engagement in IOR has a deep effect to many aspects of organizational life. One of the most important subjects for development of cooperation is to ensure fluent information flows between cooperating partners. Modern information and

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communication technologies (ICT) have a great influence how these information flows are shaped and handled today. Hong [20] even argues, that 'there is a shift in the role of IT - from a competition weapon to a cooperation enabler among businesses'.

Nevertheless of its importance, companies are facing all kind of difficulties when implementing different kinds of Inter-Organization Information Systems (IOSs) to support cooperative IORs. Even very simple information sharing projects can fail for numerous of reasons, which include at least technological, economical and socio-political factors [7, 25]. The IOS projects greatly differ from conventional Information Systems (IS) projects focused on single company, as in those cases legal boundaries of a company is not penetrated. In contrast to inter-organizational systems, traditional intra-organizational systems have two characteristics that facilitate their management [41]:

1. One organization can always fully control the information system
2. The cost caused by the information system can always be addressed to one single organization, so can the benefits they create

As Suomi [44] noted: 'In one word, the world of IOSs will be that of cooperation'. IOSs are needed to enhance ever growing needs of inter-organizational cooperation. On the other hand, IOSs are also accelerating this development by offering opportunities for redesigning cooperative networks and to outperform. Cooperative environment, dyadic relationships and multi-partner exchanges increase the complicated and political nature [6] of these systems and thus the result of IOSs are often a result of negotiation process in which interests and power play significant role [7]. Consequently, understanding these and other factors influencing the success of IOSs is important as failure in IOS can have severe effect on cooperative relationship in addition to loss of invested time and money. Despite the evident importance of IOSs in today's networked competitive environment not too many articles have been published about the influencing factors. This study tackles this issue and seeks to increase knowledge on factors influencing success and failure of IOSs used in cooperative IORs.

Applying a conceptual-analytical research approach based on existing literature the role of different success factors of IOSs is discussed. Research question can be formulated as "what factors influence the adoption decision, success and failure of IOSs". Considering the nature of cooperative IORs in Section 2 starts the examination. In this study the cooperative IORs constitute the context in which IOSs are implemented. The role and effect of IOSs in cooperative IORs is discussed in Section 3. In Section 4 different influencing factors found from extant literature are reviewed. In Section 5 we supplement and compile these existing lists, classifications and models of factors influencing the adoption of IOSs in cooperative IORs. The conclusions are drawn and further subjects of research are suggested in Section 6.

2 Cooperative Inter-Organizational Relationships

According to [11] an economy based on knowledge favor alliances and any kind of inter-firm cooperation. However, cooperation within networks, or in other words inter-firm or inter-organizational cooperation, is not a new phenomenon. Research concerning factors of successful innovations as far back as in the 1970's illustrated the significance of external resources and knowledge to innovations [16]. The global distribution of work and changes in competitive environment put the pressure for companies to develop cooperation in their business networks.

Inter-firm cooperation is important as it also influences on the way companies' competitiveness is formulated. Conventional strategic thinking has focused on individual firms as the competitive unit in any industry [24]. However, in today's networked business environment competition is moving from individual companies to networks of businesses [15, 37, 40]. As a result, efficiency seeking has exceeded the company limits to consider the efficiency of the whole business network. Creating close collaboration and integrating whole value chain in a way, that brings unique value for customers, can be source for sustainable competitive advantage [31]. Thus, collaboration can be seen as the key to value creation [37].

However, it is not purposeful to deeply collaborate with all companies in business network. Rather that trying to intensify cooperation with all companies in business network, companies should identify the key partners with whom to boost the cooperation. In fact, key network management has been recognized to be efficient way to cooperate in business networks [29]. The importance of different companies should be asserted to be able group companies to different groups. With each group company can then aim to have different kind of cooperation.

Kumar and van Dissel [25] divide business relationships according to level and nature on *interdependency* to pooled dependency, sequential dependency and reciprocal dependency. However, their classification seems to be concentrating more on nature of dependency, not so much on level. For example, they consider pooled dependency to be of least contingency and requiring only the simplest coordination mechanisms. Here, they ignore the level of importance of dependency. Shortage of some pooled resource immediately increases its importance, like occasions of shortage in oil or microchips show. More commonly, the importance of any pooled resource for company depend on its importance for company's own production: oil refinery can not supply its customers with gasoline if it can not acquire oil from its own suppliers; mobile phone manufacturer can not produce any more phones than what it can acquire chips to its phones. Thus, it seems to be more appropriate to divide relationships according to level of interdependency instead of nature. This division can be done, for example, according to classical division to operational, tactical or strategic issues [2]. Note, that in this study we are concentrating on cooperative IORs and excluding the market transactions on one hand and vertical integration on the other hand as well as IOSs built for those purposes from our examination.

In the first group (operational) are companies, with whom the company is doing business with on a little bit more sustainable basis than mere market transactions, e.g. buying some MRO (maintenance, repair and overhaul) materials or other goods or services needed in daily business operations. With these companies, cooperation is mainly targeted to increase efficiency e.g. by implementing some automated ordering systems or sharing information on stock levels or increasing other kind of communication between organizations.

In the second group (tactical) are companies, with a significant importance for company. The reason for importance can be, for example, nature of the object of trade, which might be a non-commodity with increased complexity and novelty. It can also be rare with imperfect markets or a critical component of firm's own production that requires accuracy from deliveries. Also, the dependencies between consecutive tasks spanned across organizations can increase and especially if production is time-sensitive where time span of separate tasks overlap, the coordination of tasks between different performers is needed. In these cases, the dependencies between companies are usually at least somewhat mutual. For example, a trade-relationship might require relationship-specific investments and thus continuity is highly appreciated.

In the third group (strategic) are companies that's importance can be evaluated to be strategic from nature. Collaboration with these companies can be seen necessary in areas where uncertainty prohibits company to achieve its goals or to operate properly. The distribution of work might have developed so far and complexity and novelty of objects of cooperation can be so high that only way to be able to achieve consistent products is to combine the knowledge and expertise of different parts and of different partners. Collaboration might also be required because of a radical shift in markets or technologies or to develop new boundaries crossing products and service to better serve the customers. Companies can seek new ways to capitalize on new technological or customer originated innovations in collaboration. Core competencies can be developed in collaboration to create efficient and effective ensemble of complementary competencies. With these companies there exists a long-term mutual dependence.

The above classification was presented to show the importance of level of dependency in addition to nature. These classifications were also introduced to highlight the fact that it's not worthwhile to try to cooperate with all companies in business network in similar levels and ways, but to use different approaches for different groups of companies. Accordingly, it's not worth trying to introduce same kinds of IOSs to every IOR but to only implement appropriate systems supporting/enabling the cooperation with each firm.

3 The role of Inter-Organizational Information Systems in IORs

Inter-organizational information sharing is conducted through both formal and informal channels. Beside the more informal personal relationships companies might decide to build inter-organizational systems [43] to support information sharing across company boundaries [23]. IOSs may promote major interests of organization, e.g. by enhancing cost efficiency, speed and flexibility or to create new distribution channels for new products and services [7]. On the other hand, IOSs can also be a threat for organization if it unbalances the current competition or power equilibrium unfavorable or even leads to disintermediation of a company. These factors give IOSs' a political nature.

According to Senn [39] 'all types of inter-organizational systems are increasing in number as business processes are modified so that organizations can respond to new opportunities as well as to the constant pressures for greater responsiveness to the needs of customers and trading partners'. The Internet and related Information and Communication Technologies (ICT) have enabled the cost-effective dissemination of information [14]. IOS can help to improve performance e.g. by lowering transaction costs [42]. Also, the strategic value of Inter-Organizational Systems (IOS) has been well recognized [28]. However, it is important to view IOSs in a broader context that encompasses not only the traditional value chain but also partnerships and strategic alliances among firms [20]. The context in which IOS is implemented is especially important as it has been argued that 'real benefits reside not within the IT domain but instead in the changes in the organizational activities that the IT system has enabled' [13]. This lesson need to be understood: 'if we have learned one thing...it is that IT is at best a catalyst and an enabler. It is never an answer in itself' [19].

IOSs have a central role in formation of formal IORs. IOSs are central for the development of business networks by reducing costs and extending the possibilities for communication and coordination and linking technologies and sources of knowledge to support innovations [45]. Johnston and Vitale [22] studied how inter-organizational systems could also help in creating competitive advantage and created a set of categories to guide exploration. They concluded that inter-organizational systems were an avenue to cooperation on a widening range of initiatives that improved the economic performance of each partner. Thus, inter-organizational systems are not only a mean to achieve objectives of cooperation but also a facilitator of cooperation as they 'necessitate some kind of cooperation because they are technologically and financially demanding projects' [42]. IOSs have a dual role in cooperation; they have both enabling and supporting role in cooperative IORs [25].

Contribution to partner development is partly due to the fact that building IOSs require ex ante investments which reduces the possibility of partners to behave opportunistically (firms being concerned for their investments) and thus, IOSs as a "mutual hostage" increase trust [17]. In other words, the process of implementing and using IOS seems to imply a process of partners deliberately entering into situation where they become dependent on each other [7]. It should also be noted that use of IOS may alter the balance of power in inter-organizational relationships [7], highlighting the evolving nature of business relationships.

The importance of IOSs in IORs is evident just as is the challenges IOSs entail. Understanding the factors influencing the IOS adoption process is important as the success or failure of adoption can have severe effects on cooperation and competitiveness of different partners.

4 Factors influencing to the success of IOSs

Clearly, one of the complicating issues of IOSs compared to traditional information systems is the number of stakeholders involved [7, 27]. Traditional information systems have remained inside the legal boundaries of single organization where at least some level of internal harmony and common goals can be expected. In context of IOSs these issues needs to be extended to next level, that of network.

IOR context introduce new issues to consider when planning adopting an information systems. According to Kumar and van Dissel [25] IOS literature has traditionally relied on economic arguments but actually three kinds of arguments are needed to explain the formation and risks of alliances: rational/economic, technical, and socio-political. Boonstra and de Vries [7] conducted a literature review on selected articles and they found four groups of IOS inhibitors and barriers:

1. technology related;
2. ability-, awareness- or knowledge-related;
3. interest-related;
4. power-related.

Technology related barriers refer to a lack of standards, incompatibility of software and hardware and security problems like encryption of information transfer that rises from heterogeneity of technological platforms and system portfolio of cooperating partners. For example, if one participating company is struggling with its internal information flows between different systems, it's not realistic to expect inter-organizational information exchange to be fluent. Ability-, awareness- or knowledge-related barriers refer to legal barriers when moving information across organizational boundaries or to barriers related to the awareness of the opportunities of IOS or lack of knowledge on how to apply available technologies [7].

Interest-related barriers refer to notion of potential parties for whom the IOS does not bring enough economic and/or strategic advantages [7]. Or at least this is the perception of participating company. Power-related barriers refer to situation in which potential participating companies doesn't have enough power to establish and to make others use an IOS [7].

Boonstra and de Vries [7] consider overcoming technology related barriers (group 1) and ability-/awareness-/knowledge-related barriers (group 2) as pre-conditions for IOS success and only when these pre-conditions are fulfilled, conditions 3 (interest) and 4 (power) become relevant. I disagree with their view and see situation as a quit contradictory. I see that presence of sufficient interest and power are pre-conditions, because without them there is no reason at all to build an IOS. If built, it would be a failure and waste of money and effort as no party commit themselves to it. Instead, only when preconditions of barriers 3 and 4 have been met the question of barriers 1 and 2 become relevant.

Boonstra and de Vries [7] emphasize 'that only if the appropriate technology is available and if the ability, awareness and knowledge are there, it makes sense to diagnose interest and power positions'. Their perspective seems imply that it is not worth to learn or develop anything new, only use what already exists. I agree that awareness has to be there, at least in an extent that the question of IOS arises. However, for my view awareness of opportunities and knowledge how to apply IOS can be developed gradually through learning [3] or bought from outside, e.g. by hiring some outside consultants. Also, technological issues are rarely too complex to overcome. As Boonstra and de Vries [7] themselves state, 'there are hardly any technical barriers left which are keeping organizations from shifting from mainly internal information systems to systems which transcend organizational borders and connect companies electronically with external parties'. Because of these views, I see that barriers of interest and power are pre-conditions and ones which have to be met before making the decision to design and implement an IOS, and thus to tie required resources to the process.

Comparing to the three arguments of Kumar and van Dissel [25], Boonstra and de Vries [7] add fourth group of arguments, that of knowledge. Rational/economic group of Kumar and van Dissel (1996) is similar to interest related group by Boonstra and de Vries [7] and both have a group for technological issues. However, power-related topics of Boonstra and de Vries [7] are only one issue of socio-political group that of Kumar and van Dissel [25]. Socio-political factors include, in addition to power relations, at least inter-organizational trust [45] and social networks [5, 18] that have an important role in the decision-making process. Also, cultural differences (that of corporate, regional, profession, etc.), conflicting interests between IOS parties, unequal expectations and a heterogeneous organizational environment have to be asserted and managed [21]. Even though Boonstra and de Vries [7] don't explicitly cover these kinds of issues in their list of inhibitors and barriers, their flower auction case example shows the importance of such issues: 'Many retailers also appreciated their relations with wholesalers, which were highly based on trust and personal and informal contacts'. In order for IOSs to succeed and provide sustainable benefits the socio-political risks require also people–based strategies to manage and contain these risk factors [25].

Ruohonen et al. [36] suggest that at least four issues should be considered when studying e-Business innovations in organizations: 1) Business environment evolution, 2) Technological environment evolution, 3) Maturity of adopting organization and 4) Potential to apply new e-Business solutions. In this study, environmental forces are recognized as one group as they lay down the context in which cooperation and implementation of IOSs takes place. These issues might have significant role in decision making, as it is a very common that companies implement same services and systems as their leading competitors are implementing. Public forces, laws and regulations can also influence the decision making. Noteworthy is also public R&D funding that might change the economics of IOS development projects favorable.

Technical issues are recognized as its own group of influencing factors, one group that has earlier been perhaps the biggest obstacle in IOSs projects. Nowadays all kind of common interfaces, standards and mediating technologies exists in addition to building direct customized links between different systems and thus, technological barriers are not as significant as before. However, there still lie many open questions for how to efficiently build an IOS, considering the heterogeneity of organizational IT-infrastructures, different standards used in industry and available solutions for IOSs. If planned incautiously, life time costs can be quite a surprise, e.g. if update of one organizations internal IT-systems require adjustment or rebuilding of all links to other organizations' systems. You can imagine what kind of hassle it could be If these issues are neglected, considering that organizations update their systems once or twice a year, and potentially different cooperating organizations at different time.

Maturity refers to current use of ICT in organizations as well as ability, awareness and knowledge issues. For example, paper based documentation is not a very good starting point for building an IOS. Building an IOS does require some preconditions from implementing partners or else the journey will be long and muddy. Also, previous use of different kinds of ICT-based solutions is usually also indicator of ICT-based capabilities that organizations have, making transition to an IOS easier. Thus, maturity of different companies, in terms of technical as well as knowledge-related, largely defines the potential that these companies have when planning to implement an IOS. Another factor influencing to potential is available resources. This issue belongs to rational-economical group as amount of needed and granted resources are often compared to perceived benefits accrued from an IOS.

Rational-economic issues, like perceived economical gains or strategically improved position, are perhaps most deeply covered influencing factors to success of IOSs [4, 7, 22, 25]. If benefits are unclear and costs can't be justified, companies are more unlike to participate and commit to use of the system. On the other hand, in addition to rational issues many not-so-rational issues can have significant effect on success of these systems. Personal relationships and social networks influence behavior of human beings that also the decision makers are. Compatibility of partners' organizational culture might also affect how closely, despite the contracts, they truly want to cooperate with certain partner. Mutual respect of other partners' professionalism, use of power, direct personal relationships and inter-organizational trust are some issues belonging to socio-political group of influencing factors.

5 A new model of influencing factors

Understanding the most important critical factors influencing the success of IOS is important to be able manage and overcome obstacles and drawbacks and to unleash the full potential of these systems. Figure 1 summarizes the factors discussed above and below that have an influence to success or failure of IOSs. It is argued that these five groups of influencing factors (technological, rational-economic, socio-political, knowledge and environmental issues) influence on decision made and more importantly to the actions taken.

However, we have to acknowledge other factors as well, factors that influence to the final result, relative success or failure. Even the network of businesses would have achieved a harmony and found common goals, even if all companies would have best intentions to take needed actions, some influential factor can ruin the effort. These factors can be, for example, some uncontrollable event like natural disaster, war, criminal action, market discontinuity or some other factor such as bankrupt, change of supplier, fusion, or as simple as change in key personnel. This group of influencing factors is almost totally neglected in earlier studies.

Furthermore, many of the earlier studies has treated different factors as given and ignored the interplay between them. This kind of view promotes static examination of networks that fails to reveal the underlying dynamics. As companies engage to interactions with each other, their knowledge and perception of IOSs will change

[26]. To promote more dynamic and rich picture of IOS adoption the interplay between different factors and actors should be considered.

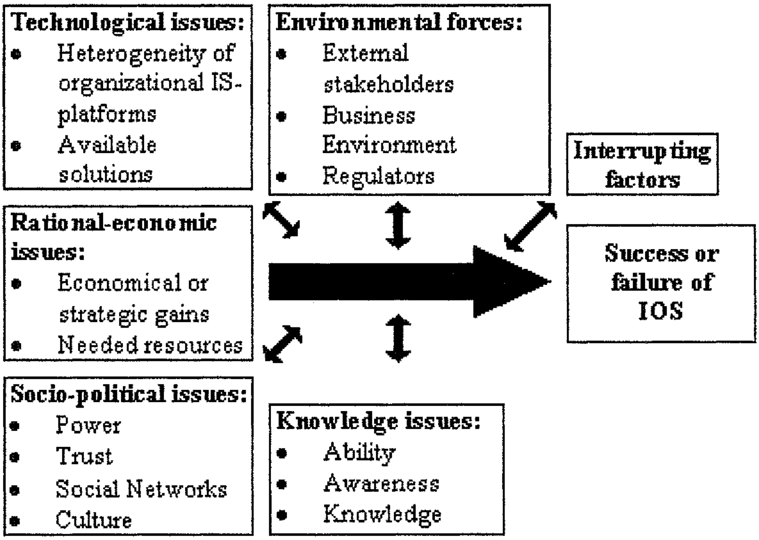

Fig. 1. Factors influencing the success and failure of IOSs

6 Conclusions

The IOS literature considers inter-organizational systems to be strategic instruments of great promise [25]. IOSs have role of enabler and supporter of cooperation. The IOSs are also important because they usually formalize the cooperative relationship. Building IOSs requires ex ante investments and thus bind the partners to the relationship.

Contribution of this study is seen from three perspectives. First, this paper aims to increase the understanding of the important role of IOSs in IORs as a formalizing element of cooperation. According to Kurnia and Johnston [26] earlier studies have tended to give insufficient attention to the inter-organizational context of these systems. Managers need to understand that implementing IOS is not only a technical issue, but requires complex negotiations between different parties with different interests. IOS negotiations can even be seen as an extension to cooperation negotiations or as in some cases, an initiator to them. Second, describing some of the most important influencing factors to success of IOSs may help managers to address these issues before IOS implementation and thus before actualization of possible conflicts. Recognizing the influencing factors may also help managers to make more informed decision to implement or not to implement an IOS. As earlier studies have identified three to four influencing groups of factors, this study seeks to offer broader selection of influencing factors. Third, this study tries to highlight the evolving nature of influencing factors. When each company enters into a complex series of interactions with other parties company's knowledge and perception of IOSs will change [26].

One clear limitation of this study is its focus on organizational and above levels of factors influencing to success and failure of IOSs. This focus can be justified within the IOS implementation context, which is inter-organizational environment. This environment introduces new and somewhat different constrains than traditional organizational environment and studying them is important. Also, the factors considered concentrate on planning and negotiating phase where as factors influencing building, implementing and using phases could be somewhat different [8]. These phases introduce new challenges and lower level factors influencing success that are closer to traditional IS success factors. These factors have been extensively studied in literature [1, 30, 35, 38] but they shouldn't be neglected either in IOS context. For example, failure in organizational change management and change resistance can severely affect the success of an IOS that had been well accepted and agreed in a network level. Thus, it's important to acknowledge organizational influencing factors in addition to inter-organizational factors recognized in this study.

Further studies are recommended to analyze the role of different factors in IOSs. Especially empirical studies are needed to verify and challenge theoretical studies. The interplay between different factors and actors might be difficult to analyze using statistical methods, which suggest the use of in-depth interpretive research methods, such as case studies or action research [26]. Qualitative methods can give greater insights to dynamic and complex interactions between different companies. In addition to empirically test the role of different factors in success and failure of IOSs, one potential perspective for further study could be the stakeholder theory applied to network context. It is seen in organizational context that a strategy and planning is best understood by identifying stakeholders and how goals influence and are influenced by stakeholder perspectives [10]. Another interesting future research direction could be examining the social context in which IOSs are used and how this social context evolves over time. This point of view would especially contribute to dynamic examination of relationships, instead of more static examination of discrete transactions. Also, in this global economy, research on effect of nationality, culture and languages on cooperative IOSs could provide new insights on multinational context.

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The Management of Financial Supply Chains: From Adversarial to Co-operative Strategies

Ian D. Blackman, Christopher Holland
Ian D. Blackman:
School of Information Systems, Computing and Mathematics, Brunel University, Uxbridge St John's Building, Uxbridge, UB8 3PH, UK
ian.blackman@brunel.ac.uk
Christopher Holland:
Manchester Business School, The University of Manchester, Booth Street West, Manchester, M15 6PB, UK
Chris.holland@mbs.ac.uk

Abstract. Information systems have developed along the supply chain to support logistics management in all types of industries. Most of this effort has been focused at reducing the levels of working capital by increasing the efficiency of information flow from market to raw materials suppliers. Similar developments have also occurred to support other business processes, for example connecting together new product design and marketing databases to create virtual corporations. Electronic commerce and associated technologies such as EDI are the norm in advanced supply chains and it is common for their use to be mandatory when trading with large companies. The manufacturing of a product is now seen as a whole process across the supply chain rather than a series of separate operations managed and controlled by different organisations. The management of logistics has been fundamentally re-engineered and designed to focus on quality and time-based strategies. However developments in the handling of financial information between functions within companies and across organisational boundaries have lagged far behind the developments in logistics management. This paper explores the potential benefits of co-operative relationships in the financial supply chain to reduce the time delays and increase the level of certainty regarding financial transactions between separate organisations. The financial benefits are estimated using published data to provide a potential saving of 3.8% of the value of the transaction. An organizational model is presented of likely future developments and steps that can be taken by the financial

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service industry to benefit as integrated providers of financial services to supply chains and the areas for initial implementation are outlined.

1 Introduction - Integration of the Physical Supply Chain

The development of supply chains has been one of the major recent organizational phenomena that have been enabled by modern information and communication technologies [1, 2]. Large corporations have made significant progress in linking their information systems to share data with trading partners and there has been an enormous increase in the use of electronic commerce leading to its almost mandatory use for certain industries [3, 4). E-commerce has been used mainly to improve the logistics of the supply chain by shortening lead times to satisfy customer orders and reduce the stocks held in the supply chain. The direct transfer of the order information between organisations within integrated supply chains ensures trading partners are certain of the date and time of delivery of supplies enabling a reduction in working capital (see Figure One).

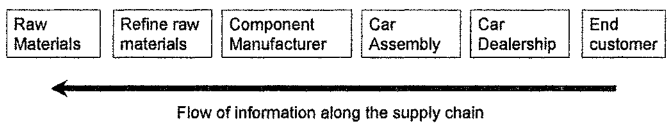

Fig.1. Certain flow of information through the physical supply chain

The market demands for improved manufacturing quality and responsive supply chains have forced companies to co-operate within the supply chain. Closer relationships with individual suppliers are necessary to ensure that components meet the exacting requirements of the end customer and product development cycles can be reduced to meet changes in market demands. The greater reliance on a smaller group of suppliers has enabled the rigorous implementation of Just-In-Time (JIT) strategies and associated quality processes [5]. The improvement in quality is a continuous process and is enabled by information systems which make errors immediately apparent. Similarly the removal of buffer stocks means that production is halted if there is any delay to JIT deliveries or quality problems emerge.

This paper proposes a theoretical model which explores the potential benefits of using inter-connected information systems to link financial information along the supply chain. It describes how the financial risk and transaction costs between separate organisations can be minimised. This is achieved by the finance function adopting lessons learnt from logistics management. One implication is that the finance function must be integrated more closely with other organisational functions and also with the finance functions of trading partners. The roles of the partners are analysed and barriers to implementation discussed.

2 Uncertain transfer of information along the Financial Supply

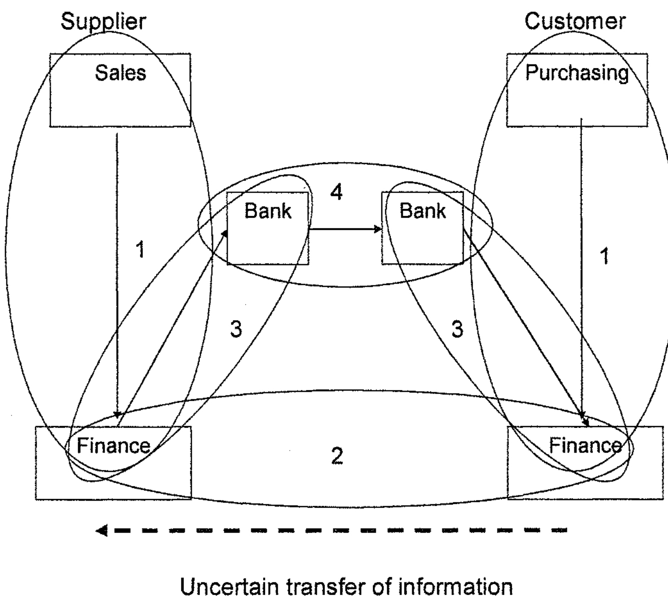

Fig. 2. Uncertain transfer of information

2.1 Purchasing/Sales and Finance Functions

The customer's finance function will set controls on the minimum credit period that the purchasing manager can agree. With international transactions the finance function will encourage the purchasing and sales managers to negotiate a price in their own currency to remove the risk of adverse movements in foreign exchange.

While the finance function can automate the transfer of information with the purchasing and sales functions, they do not act on the information with certainty, and can delay payments to suppliers to match the expected flow of cash into the business [8].

2.2 Finance Functions

Due to the uncertainty of the movement of funds, the relationship between the finance functions of the trading partners is adversarial, illustrated by methods to optimise the cost of orders by delaying payment [9, 10]

2.3 Banks

The process of transferring funds through the banking system often lacks transparency. The use of cheques introduces delays due to the postage system and time to process the cheque [11]. International payments are frequently delayed by up to ten days by the banks involved in transferring the funds [12]

2.4 Bank and Finance Function

The supplier receiving the funds is forced to react to information provided by their bank concerning the receipt of funds, rather than rely on certain information from their customer. Trading foreign exchange is an adversarial transaction. Banks do not charge a consistent margin, and it is up to the corporation to monitor the market price and obtain multiple offers of prices to achieve the best price. Companies that are not large enough to obtain multiple prices direct from the bank trading rooms are compelled to accept less competitive pricing.

3 Implications of Time Delays and Uncertainty in the Financial Supply Chain

The costs generated by time delays and uncertainty in the financial supply chain can be broken down into three main areas: administrative costs; working capital and foreign exchange costs. Each of these is described in turn.

3.1 Administrative Costs

The adversarial nature of relationships in the financial supply chain results in considerable administrative costs due to the effort required to prompt customers to pay on time. An indication is the cost of factoring, typically used by smaller companies [7], to manage the process of collecting payments which can range from 0.75% to 2.5% of the value of the invoice (UK Department of Trade and Industry 2005).

3.2 Working Capital

The lack of certainty within the financial supply chain results in the trading partners retaining excess balances with their banks. The value of excess balances or cash stocks held by the Fortune 1000 companies has been estimated as $90 billion [8]. The key issue with holding surplus cash for smaller companies is that it may use a portion of the limited amount of capital available to fund the development of the company. Credit terms in the UK and US are typically 30 days [6, 11, and 7] but collection times in the UK are typically between 45 and 60 days [7]. Holding two weeks of surplus cash, to compensate for delayed payments, for a company with a cost of capital of 10% equates to an additional cost of 0.8%. In the UK companies are legally entitled to charge interest of 8% above the base rate for late payments. In practice only 3% regularly implement the interest charges due to the potential adverse effect on sales [7]

3.3 Foreign Exchange

Small to medium sized enterprises (SMEs) typically have a higher cost for converting foreign exchange than large companies. The typical cost of converting currency for SMEs in the US has been quoted as 0.5% to 2.5% [14] while multinational companies can exchange currency for less than 0.05%. Foreign exchange rates are continuously fluctuating which can result in a significant variation between the foreign exchange rate at the time a price is agreed and when the payment is made. The amount and mix of foreign currencies outstanding for a company will vary considerably. To illustrate the issue, the company in the model is assumed to have a mix of currency contracts, which match the distribution for total UK exports for 2004 (UK Customs and Excise). The average delay between a contract being agreed and settled is assumed to be three months (Figure 3), consisting of forty five days to fulfil the order and forty five days to receive the payment.

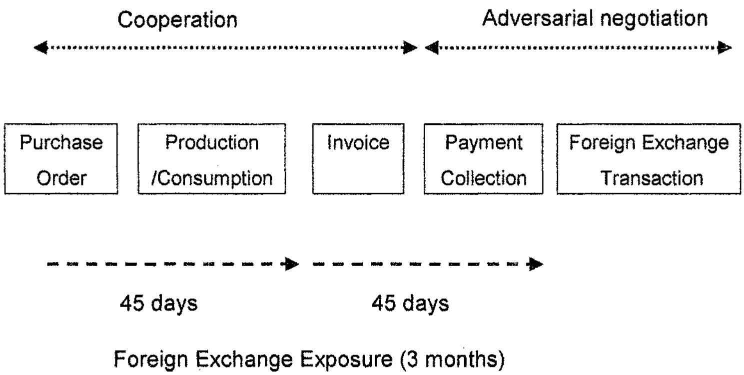

Fig. 3. Time the foreign exchange risk is retained by the supplier

Taking the exchange rate for each currency at the end of each month, over a three month period, the variation in the foreign exchange losses and gains can be estimated (Figure 4).

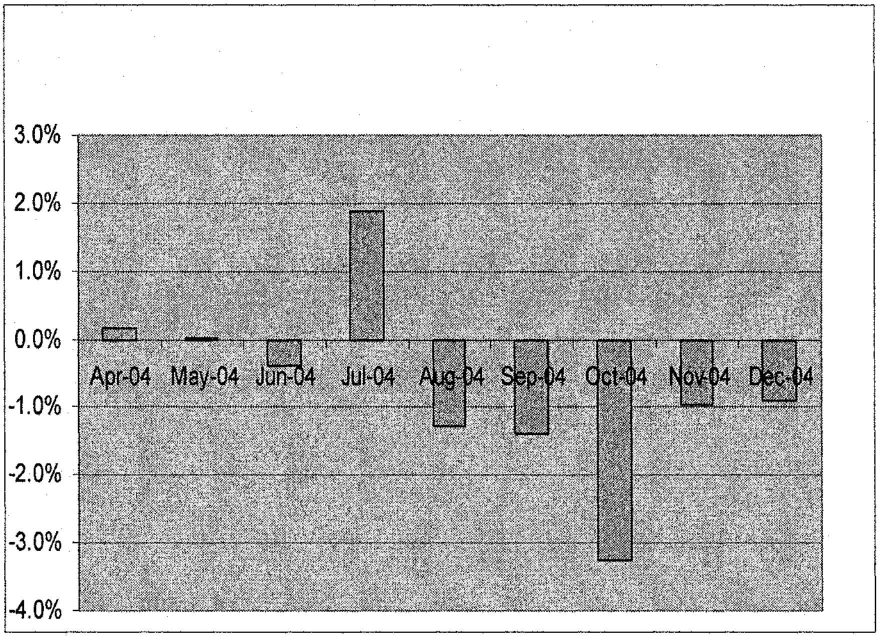

Fig. 4. Illustration of Foreign Exchange Losses and Gains for a UK Company

In the example there is a reasonable level of uncertainty of the value of foreign exchange losses and gains for each month which varies between +1.8% and -3.2%. The figures above are for the average of all the foreign payments and receipts in a month. The range of actual gains and losses for individual transactions would be greater. Empirical studies have shown that smaller companies are less likely to implement a hedging strategy due the high fixed operating costs [15]. To reduce the impact of potential foreign exchange losses on a contract, it is assumed that the smaller supplier would add 1.5% to the price of the order. The conservative estimates suggest that the costs incurred within the financial supply chain due to the adversarial relationships are significant.

Administrative cost	1.0%
Surplus balances (2 weeks)	0.8%
Foreign exchange	0.5%
Uncertainty of rate of foreign exchange	1.5%
Total	3.8%

The total savings across a supply chain can be significant. The implications of the adoption of a cooperative financial supply chain on the financial performance of international trade for a country can be estimated using data from the World Trade Association. The total value of international trade with the UK for 2004 was £1,148 billion. A conservative estimate is that 30% of international financial transactions are adversarial. Therefore there is a potential supply chain saving to the UK of approximately £13 billion.

An area for future research is to determine the trading partners' perception of the financial transaction costs, the actual value of the transaction costs and the typical margin added to the supplier's prices to account for the lack of certainty. One of the few documented examples of a cooperative financial supply chain is Motorola, which integrated its accounts payable function with its central finance function to centralise the corporation's purchase of international payments and foreign exchange [16]. The integration of the accounts payable and foreign exchange systems ensured all of the international transactions could be managed by the central finance function. Their bank, Citibank, provided a certain time frame for their suppliers to receive the international payments. The suppliers were notified in advance electronically of the date their bank would receive the funds. Motorola was able to reduce the costs within its financial supply chain by managing the conversion of the foreign exchange and providing a certain date of payment.

3.4 The Transition to Co-operative Supply Chains

An adversarial relationship can benefit the customer in terms of delaying the payment and stipulating that the transaction is carried out in the customer's preferred currency. However, if the supplier is aware of the extra costs associated with delayed cash flow and foreign exchange transactions, then it should be possible for the customer to negotiate better prices in exchange for prompt payment terms and a shared approach to managing the foreign exchange transaction. For example a large European customer could agree to pay a small U.S. supplier in dollars on the basis that the large customer can deal with the foreign exchange risk more efficiently than the small U.S. supplier. If this is coupled with certainty of payment terms then the supplier is able to plan accurately for cash flow management and can make more efficient use of limited capital. The customer's finance function will need to have a fully integrated process between the finance and purchasing function and its bank to ensure the payment is made on the agreed date. The finance function would also need to be integrated with its purchasing function and bank to minimise the delay between accepting a foreign exchange exposure when agreeing a contract and hedging the exposure.

There is the potential for the finance department to integrate the foreign exchange trading capability with the pricing system of the purchasing department, to assist the negotiation of prices in foreign currency and to immediately hedge a transaction with its bank when a purchase order is issued. Finance departments within large companies are already executing a significant portion of their foreign exchange transactions with their bank partners electronically [17] and the services are being rapidly adopted [18]. The automated trading of foreign exchange removes the transaction costs that limit manual trading to large transaction values. To automatically trade the foreign currency for individual purchase orders the bank will need to move to contractual agreements where it states the margin that they will charge, removing the adversarial nature of the relationship and the requirement for the corporation to continuously obtain several competitive prices for each trade.

In essence a cooperative financial supply chain requires a different way of thinking from the finance function within the trading partners in a supply chain, especially that of the major one. However in information terms the problem is straight forward, compared to that of handling vast amounts of manufacturing data. Similarly this way of thinking is already in operation within the manufacturing component of supply chains where partners work collaboratively to reduce costs and improve the efficiency and flexibility of manufacturing processes throughout the supply chain.

3.5 The Implementation Options for Achieving an Integrated Financial Supply Chain

The enterprise resource planning systems (ERP) of large companies already integrate the information systems between the purchasing, sales and finance functions. These applications allow large companies to collect information on the foreign exchange risk generated, from the entry of purchase orders and invoices. This allows the company to hedge the foreign exchange exposure shortly after it is generated, but does not enable the purchasing and sales functions to determine when there is real financial benefit in generating the exposure. To enable the large companies to exploit their twin advantages of sophisticated information systems and the ability to manage risk, the sales and purchasing functions should be supplied with real time information on the foreign exchange rates that are available to the company to hedge the risk. The sales and purchasing functions can then determine whether the most profitable pricing is in their own currency or their trading partner's.

Large companies are able to use their integrated information systems to ensure that invoices are processed and paid on time. This is more likely to be implemented as a standard means of operation rather than on an ad hock basis. It is technically possible to electronically hedge the foreign exposure of each purchase order with a bank. An automated system removes the capacity restraints of the bank's dealing room and provides the opportunity for the bank to charge the large company for the gross amount of foreign exchange converted.

3.6 Barriers to implementing a co-operative financial supply chain

The technology to implement the proposed solution is already available and is not a barrier to implementation. The key barriers are organisational as the role and relationships between the different functions and organisations will change. With the implementation of JIT time techniques the reduction in working capital was a direct benefit to the large customer. With the changes in the financial supply chain the larger company incurs an additional cost and is required to negotiate a discount from its trading partner that captures a portion of the benefits. Before a supplier is willing to offer a discount it will need to trust the customer to provide the increased financial certainty. The customer may need to provide the altruistic act of demonstrating it can deliver the benefits before the supplier would be willing to provide an additional discount. The supplier may be working with fine margins with the key customer. The cost of payment delays, uncertainty and foreign exchange losses are incurred after the sale and may not influence the initial negotiations. The supplier's finance and sales functions will need to be able to cooperate to determine the potential costs, incurred at a transaction level, before there is a perceived benefit from the increase in financial certainty.

The change in the responsibilities and working practises of the finance functions is significant and is likely to face organisational resistance. There is considerable resistance to changes in a process where it moves responsibilities between functions [20]. The customer will need to accept and manage foreign exchange risk on a real time rather than a periodic basis and will loose the ability to manage their cash flow position by manipulating supplier payments. The movement to electronically trading small amounts of foreign exchange at the level of purchase orders and charging on the basis of the gross amount of funds converted would remove the banks ability to opportunistically price foreign exchange transactions. This would diminish the role of the bank's customer traders, which seek opportunities to widen the bank's margin for trading individual foreign exchange transactions.

An implementation of a cooperative financial supply chain will take time to overcome each of the organisational barriers. Leadership from the senior management within the customer's company will be required to initiate the initial changes in the roles of the purchasing and finance functions. Trust will also need to be built with the finance function of the supplier. The banks will need to recognise the operational benefits of automating the foreign exchange trading process. An incremental implementation will be required for the customer's finance function to adapt to the operational requirements of the process and to accept the reduction in financial flexibility. The financial benefits are potentially significant and the early adopters that invest in overcoming the organisational barriers to building a cooperative financial supply chain should achieve a comparative advantage over competing supply chains.

4 Implications of the movement to a cooperative financial supply chain

The movement to a cooperative financial supply chain reduces the costs incurred within the overall supply chain. The purchase of the financial services is moved to the trading partner with the lowest cost of purchase that should also be able to negotiate the bulk of the financial benefits. There is the potential for producers of scarce components/services to dedicate a larger portion of their production to the supply chain that can provide financial certainty. The key beneficiary is the complete supply chain that is able to deliver the end product/service to meet developing market needs at a lower cost. The supply chains that take steps to implement the cooperative financial process are likely to build a significant comparative advantage compared with their competition due to the time required to respond.

Significant investment in information systems is required by the banks to be able to automate the financial process to deliver the financial services at an acceptable cost and quality. The leading global banks have already made this investment which provides them with the opportunity to build significant scale benefits. It will take time to build the trust required between the finance function and their key bank. The banks that can incrementally implement the changes in cooperation with their key customers should build a significant advantage. The implications for the banking industry are readily apparent. The bank providing the automated services to the largest trading partner will lower its costs of distribution to the supply chains smaller trading partners (Figure 5).

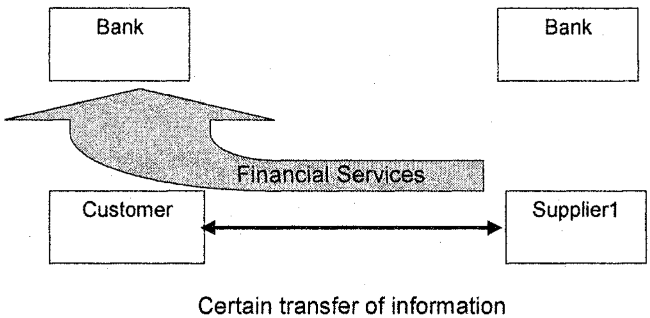

Fig. 5. Company with the lowest cost of banking services consolidates purchases

There is already an increase in the consolidation of the financial service industry and the developments proposed and discussed in this paper will accelerate the process as financial institutions focus on reducing their cost ratios to maintain their financial performance [20]. It is very likely that as organisations strive, under ever-fiercer competition, to make their supply chains even more efficient they will focus on the financial arrangements. Almost certainly there will be a move to make the financial flows mirror product flows, and the various operational and financial systems will come into line. The financial aspects of the supply chains will have to become transparent and much more detailed information will be required. This will enable the financial aspects of the supply chain to be managed as one entity rather than a set of disparate unrelated financial transactions. It will allow for the purchasing power of the largest trading partner to be used to the mutual benefit of the whole supply chain thus making it even more efficient. For banks it will lead to an overall reduction in income, particularly for the smaller players. The banks who can work with supply chains and who are willing to work for greater efficiency will have the potential to develop new markets at the expense of some of their slower competitors. The whole banking industry will be affected by the concepts discussed in this paper which are now ready for implementation and wide scale adoption.

5 Discussion and Conclusions

The paper has extended the concept of JIT for production systems to the provision of financial services in the supply chain. It has demonstrated using case examples how major savings can be made by reducing the time delays in financial supply chains and by co-operation between organisations involved in successive stages of the supply chain, in particular to exploit the trading and negotiation power of large organisations. The IT capability is already in place in the form of enterprise and e-commerce systems and will require only modest enhancements. The pace of change will be determined by the ability of companies to change their internal organisational processes and relationships. The alignment of financial information flows with those of physical transactions is a logical development in supply chain arrangements and will play an important part in their increasing impact on business operations. As there is even more pressure from competition to reduce the costs of supplying product, the financial flows will need to become more transparent and management will focus on the purchase and delivery of financial services in a similar way that they currently do on supply chain operation. Both engineering and manufacturing are now done on a co-operative basis and it is only a matter of time before the same approaches are applied to finance and accounting. The increased certainty and removal of adversarial relationships between the finance functions should increase the trust and deepen the relationship between the trading partners. The early adopters should gain an advantage in the strength of key trading relationships that will take their competitors time to replicate. Given the present supply chain arrangements and future industrial trends, i.e. that of making strong alliances, much more attention will be given to the problem in the next decade. Organisations will reduce their costs of financing their supply chains and make them become even more integrated.

The implications for banks are readily apparent with a reduction of income overall from this activity. Global banks that are prepared to innovate and work with supply chains rather than just the separate partners may benefit from a much larger share of the market even though the unit profitability is lower. The banks who are first into the field may gain significant benefits and have very little to loose. The developments in inter organisational systems enable virtual organisations to be easily created and managed as a single entity, and information systems are the enablers of such major change. There is the potential for the dramatic growth of financial institutions that have integrated their own systems to remove capacity restraints and that are willing to work with key relationship customers and price competitively to increase their market share. The highly integrated financial service companies with strong relationships with the most powerful organisations in each supply chain can dramatically reduce their effective cost of distribution by using their key clients as the intermediary to access the other supply chain organisations. The financial efficiency of an integrated virtual supply chain should match the efficiency of a vertically integrated company where the finance function is centralised and integrated with the core functions of the company.

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Initiating e-Participation Through a Knowledge Working Network

Louise Rasmussen, Elisabeth Davenport, Keith Horton
International Teledemocracy Centre & School of Computing
Napier University, Edinburgh EH10 5DT, UK.
e.davenport @ napier.ac.uk

Abstract. The authors present a study of e-participation within a public sector agency (PSA), where a number of knowledge management initiatives have been introduced since the inception of the UK 'Modernising government' programme of 1999. The agency has attempted to set up an internal participatory infrastructure to manage 'knowledge' across the network of local enterprise companies through which agency policy is operationalised. The trajectory of knowledge management versions in PSA is thus a rich indicator of power-plays in the organisation, and the discussion uses discourse analysis to explore the document base (field notes, textual data paper and electronic, formal and informal) that was produced at three historical moments. The aim is to understand patterns of participation and resistance in a number of e-initiatives within the agency. The authors highlight the choices relating to the stimulating, fostering, encouraging, embracing, contesting, ignoring, and perhaps rejecting of this e-participation project. Such insights are important to our understanding of the influences upon e-governmental initiatives, an area of UK public spending that is littered with IT project failures.

1 Introduction

The concept of E-participation is discussed more in terms of the citizen-government interface than in terms of internal modernisation of government. A paradigmatic OECD report on e-democracy for example, defines e-participation as: 'A relation based on partnership with government in which citizens actively engage in defining the process and content of decision-making' [1 p. 12, 2 passim] The paper presents a study of e-participation within a public sector agency (PSA), where a number of knowledge management initiatives have been introduced since the inception of the UK 'Modernising government' programme of 1999. The study involves participant observation, and the researcher has worked in the organisation for three years, since her matriculation as a doctoral student. The case is an interesting one: the agency is a brokerage of sorts, whose mission is to engage small local enterprises, or facilitate

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the participation of SMEs with government policy to regenerate Scotland's industry. Much of the facilitation depends on ICTs. But in order to ensure that such facilitation is streamlined across regions, the agency has attempted to set up an internal participatory infrastructure to manage 'knowledge' across a network of local enterprise companies through which agency policy is operationalised. The paper explores the provenance of this infrastructure, explains the theoretical perspective and approach, and presents an extract of the case study as an example of what the approach may deliver. Some observations are discussed in the final part of the paper.

Historical analysis of knowledge management (KM) in PSA reveals a number of different initiatives, or 'versions' that emanate from the centre (HQ), that can be mapped on a timeline and plotted in terms of key events (such as seminars by influential consultants and gurus), or shifts in personnel (particularly at senior management level). The versions can be linked to competing KM discourses, championed by different senior agency officers at different times. These discourses problematise organisational knowledge in different ways, and the 'solutions' that they entail provide different groups in the agency with an opportunity to bid for resources. The resource implications of a KM discourse may persuade bystanders to participate in a give initiative, as it is in their interest to do so; where they have no interest, they will take part minimally or not at all. The allegiance of local groups is not guaranteed, and the number of adherents that a given KM initiative attracts may thus be an indication of the power of its proponents.

The trajectory of KM versions in PSA is thus a rich indicator of power-plays in the organisation, and the researcher uses discourse analysis to explore the document base (field notes, textual data paper and electronic, formal and informal) that was produced in KM activity at three historical moments. The aim is to understand patterns of participation and resistance in a number of e-initiatives (albeit KM initiatives) within the agency. But it is hoped that this understanding may also provide insight into ways of researching participation and resistance at other levels of societal interaction. A comparable stud of a public agency was undertaken by Carter and Scarbrough in 2001, one of several that constitute a Foucauldian research agenda in Information Systems Research recently reviewed by Willcocks [3].

2 Background

The research organisation is a QUANGO (quasi-autonomous non-governmental organisation) or Executive NDPB (non-departmental public body), and its remit is to facilitate economic development in Scotland. The organisation was set up under the Enterprise and New Towns (Scotland) Act 1990. It consists of a headquarters and twelve distributed subsidiaries. Collectively, the headquarters and subsidiaries are called a 'network'. Following a business transformation programme, knowledge practitioners' were recruited to form a knowledge network (referred to as the 'network' in the study) that would embed KM into the business. In mid-2002 the organisation proceeded to recruit a number of knowledge practitioners across the organisation to embed KM tools and techniques into the business. This pan-organisation distributed knowledge network consists of a team located at HQ and a distributed team of Knowledge Analysts (KA), each situated within a subsidiary. The research student was recruited in August 2003 to undertake the role of Knowledge Analyst in one of the subsidiaries. A vacancy arose in another subsidiary in August 2004 that included research and evaluation work, as well as a reduced KA remit. This the research student accepted on a 4-day week basis. Two days a week would be spent on research and evaluation, and the other two days on KA related-work. This move afforded the research student the opportunity to study another case in a different subsidiary. The overall study includes three case studies of the pan-organisational knowledge network, the local subsidiary the research student was an employee of between October 2003 and October 2004, and the local subsidiary within which the research student is now situated.

3 The theoretical perspective

An initial approach to the study took a dialogical perspective, an approach that Schultze and Stabell [4] suggest is neglected in the KM literature. The dialogical perspective draws on the pioneering work of Bakhtin and Volosinov [5] who explain discourse in terms of continuous struggle between the different voices ('heteroglossia') that populate the world. Schultze and Stabell [4] suggest that dialogical discourse is similar to critical discourse as it too "is interested in social conflict and the role of knowledge in the exercise of power and control" [4 p. 560]. It differs in the emphasis it places on the mutual shaping and construction of phenomena [4]. It also takes a neutral political stance that doesn't view power as being exerted but exercised [4]. The dialogical approach offers little methodological guidance, and the researcher turned to the work of Michel Foucault who offers a powerful and demanding framework for exploring organizational discourse. This resonates with Foucault's concept of knowledge and power as being mutually constituted, and his view of power as being exercised. What Foucault doesn't do is provide methodological guidelines to undertake research in this area [6, 7, 8]. However, there is a growing interest in examining discourses that describe organisational change and discourse analysis is the method frequently employed to do so [9, 10].

At this point it may be useful to clarify what is meant by 'discourse' in this study. The researcher has worked with definitions from Foucault, a "general domain of statements", an "individualised group of statements", and "regulated practice that accounts for a number of statements" (Foucault cited by [11 p. 123]; from Fairclough "ways of representing the world" [11 p. 124], and from Introna "as a particular way of talking, of making statements, about the world" [12 p. 237]. So, in an abstract sense, discourse is understood in the study as different ways of viewing material, mental and social worlds. A discourse analytic framework was derived for the study on the basis of a literature review, a core source for which was Schulze and Leidner's [13] paper, "Studying Knowledge Management in Information Systems Research: Discourses and Theoretical Assumptions". Five main discourse elements were identified: 'value', 'psychology', 'object', 'practice' and 'structure'. These are briefly summarized below.

The 'value' discourse contends that knowledge is a valuable economic resource that must be managed. The basic assumption is that value is derived from ensuring and sustaining a competitive advantage. In order to do this, the resource-based theory of the firm advocates that resources should be valuable, rare, and not easily be imitated or substituted [14]. Codified knowledge assets can be commercially protected through patents, copyrights or trademarks they become valuable through exploitation. Tacit knowledge, though unique is difficult to define and describe, and as a result difficult to quantify, though methods are emerging for this. The second element of the framework, 'psychology' discourse, suggests that KM success depends on appropriate behaviours, norms and beliefs. The objective is to habitualise and institutionalise 'good' behaviours, norms and values to ensure KM success. Examples are building social capital through social networks; helping leaders "walk the talk", in other words, "do what they say they will do"; implementing reward and recognition programmes; and lastly "creating new heroes" by making individuals' good behaviours and achievements public [15 p. 177]. But, often the onus lies on management to exhibit the right behaviours, say the right things, do what they say they will do, motivate and reward staff.

The 'object' discourse is based on the assumption that knowledge can be reified, affording organisations the opportunity to 'manage' the knowledge creation process [16]. This discourse encompasses a technocratic approach that primarily concentrates on the use of ICTs to connect people with people and people with information. Consequently, information communication technologies (ICTs) such as intranets, databases, discussion groups, and even decision-making support and e-learning software are dominant themes in discourse.

From the 'practice' discourse view, where knowledge is viewed as socially constructed, context-specific, and rooted in action, organisations are turning their attention to the 'management' of knowledge through people, utilising narrative techniques and community networking models, commonly known as Communities of Practice (CoPs). A CoP model consists of a community of individuals, working within a shared domain, who have a vested interest in working together to enhance their domain [17]. Consequently, the community model is hailed as the ideal platform to share tacit-made-explicit knowledge, utilise technical tacit knowledge, and construct shared identities, beliefs, and values that contribute to the right organisational culture. The 'structure' discourse is concerned with organizational networks, both invisible and visible. Teigland [18] distinguishes between 'emergent' (invisible social networks) and 'formal' or visible networks of practice, Formal, in this sense, differs from the definition of formal organisation structure that delineates positions of authority, function or geography depicted in the typical organisation chart. The distinction between emergent and formal networks is important, as visible networks can potentially be cultivated or managed. Some organisations, including the research organisation, take a more formal approach to CoP development. By bringing individuals together to bridge intra- and inter-organisation boundaries (formal networks), the hope is that patterns of relationships will mirror those naturally occurring networks (emergent) based on friendship and trust. Cultivating a CoP takes time and money, and typically an organisation that invests in CoPs will want to see or extract some benefit. Thus, it is plausible that people developing a CoP are bound by management to make CoPs 'work' and hence, tread a very fine line between fostering and managing a CoP. What is sometimes forgotten is that an organisation will include both types of structural forms, those that are mandated by the organisation chart and informal networks (both formal and emergent), and that tensions arise in the struggles for resources, authority and recognition between these two structures.

The five discourse elements have been used to analyse the field data gathered in the three case studies. As high level units of analysis, they provide a starting point for unraveling the often complicated struggles that characterize KM implementation, and gaining insight into patterns of participation. The discourse framework is by no means definitive, but it reflects the researcher's 'feel' as an insider for the research organisation. As we can see in the case study, the elements overlap – structure, value and practice converge in the case of CoPs.

4 The method

Yin [19] describes a case study as "one of several ways of doing social science research" (pg 1). He posits that the case study is a useful strategy when: "how" or "why" questions are posed; the researcher has little influence over events; or when studying contemporary phenomena in a real-life (organisational) context. Furthermore, a case study is, according to Creswell "an exploration of a 'bounded system' or a case (or multiple cases) over time through detailed, in-depth data collection involving multiple sources of information rich in context" [20 p. 61]. A case study has been chosen for a number of reasons. The researcher's workplace satisfies these criteria.

4.1 The position of the researcher

In qualitative research there are a number of roles researchers can assume in their quest to obtain data. These range from conducting research in complete secrecy to 'participant observation', where an employee might become a researcher [20]. Participant observation does not infer direct observation as the employee researcher can only be in a specific place at a specific time as and when the job demands this. Also, Czarniawska [21] points out that important events do not necessarily happen at the point of observation, but at other times and in different places. In addition, she states that researchers cannot determine that an event is significant when it takes place. Instead, important events are constructed post-hoc (ibid). Czarniawska introduces the term 'observant participant', a method whereby company employees were asked to note their observations, thus contributing to the research study [21 p. 785]. In this research endeavour, the term extends to what was gleaned in interaction with colleagues. Although there has been no conscious effort to ask them to record their observations, their observations are gathered as and when the research student is able to converse with them. These observations, recorded as field notes, are only one of the multiple sources of information collection; other data includes emails and documents. This assemblage constitutes an archive that is addressed in a genealogical analysis [7, 8].

The research organisation is sponsoring this research and the research student has made overt the fact that research is being conducted in the domain of KM and is concerned with the KM and its implementation in the organisation. The sponsor has not asked for specific details of how the research is being conducted and the data analysis methods have not been explicitly discussed. Sensing the research organisations' reluctance to allow invasive questioning, it was decided to assemble the data described above using unobtrusive methods. So field notes have been captured where possible and textual data such as emails and documents collected. An important consideration is to remain non-judgemental about specific individuals and groups.

The research student is not doing action research as she is not in a position to exert any great influence within the organisation at HQ level, local level or within the distributed knowledge network. This is primarily due to the fact that the researcher does not play a central role in decision-making or strategic planning in either of these locales. Decisions are either taken on collective basis or by management, and similarly the same individuals propose any interventions. In addition, the distributed nature of the knowledge network the research student is situated in limits opportunities for regular interaction. Although the designated KA role implies that the KA be a 'change agent' that diagnoses problems, suggests a solution, and helps implement the solution, this has not happened in practice. The role of the KA is supportive and though KAs may contribute in ways that ensure that certain problems or issues are resolved, this is not through not through personal diagnoses of the problem situation.

To say that this study does not involve action research is not to neutralize the presence of the researcher within the discourse , or knowledge network, that is explored. The researcher's role is inextricably coupled with the rhetorics and structures that condition activity in PSA, what Carter and Scarbrough describe as the 'structural repertoire' of the organization [16 p. 211]. (We return to this point inour later discussion of the Foucauldian subject). Following Foucault [8], who wrestled with the problem the ambivalent status of the researcher or 'archaeologist' as his methodological approach evolved, the researcher does not wish to clarify what KM is and should be, or whether knowledge can be managed and is managed correctly, but to embrace the ambiguities of KM to track their trajectory in an organisational setting. The study is not concerned with motivations or why certain individuals seek to dominate or their strategy for doing so. Rather, the focus is on ways in which discursive formations emerge, and this research endeavour is being promoted internally as an opportunity to discover how a discourse is formed within the organisation.

The case study that is presented below is concerned with patterns of participation as the knowledge management concept evolved, and thus with the political trajectory of a distributed knowledge network. In the organisation, Knowledge Management

(KM) and Knowledge Working (KW), have specific connotations and both terms are used in the study. In addition, there are a number of abbreviations in this draft case study and these are listed in Table 1 below.

Table1 Case Study Abbreviations

BT	Business Transformation
CoP	Community of Practice
HQ	Headquarters
KA	Knowledge Analyst
KM	Knowledge Management
KW	Knowledge Working
NDPB	Non-Departmental Public Body
QUANGO	Quasi-Autonomous Non-Governmental Organisation

5 The case study: constructing a knowledge infrastructure, 1999-2004

We start the story in April 1999, when the network approved a 'Knowledge Web' project. Initially this was a business re-engineering project, which later became a fully-fledged business transformation (BT) project. The BT project vision was "to help [the organisation] become a leading economic development agency, and more open, accessible and accountable through the use and communication of knowledge" (Briefing, Oct 1999). This project consisted of two main elements: firstly addressing the culture and behaviour in how knowledge is shared, learned, applied and interpreted; and secondly the processes and technology (ibid). Ten BT workstreams were identified to consider a change agenda, one of which included 'Knowledge' This mentioned the recruitment of 'Special-K People' who would have specialist knowledge skills to manage the core knowledge system; provide professional support, advice and training in managing knowledge; and finally, monitor and maintain best practice in KM. It was anticipated that these Special-K people would be able to assist, acquire and store knowledge. Exactly how these individuals would be deployed, and KM operationalised, was a matter for continuing debate.

At this stage, the K-discourses at work were primarily the 'psychology' and 'object' discourses. An example of the mapping of knowledge working principles and proposed activities to discourse views can be seen in Table 2 below. Table 2 sets out some examples from the HQ view of the future of knowledge working across the organization, as demonstrated in documentation collated (esp. Knowledge Architecture, Dec 2002), shown here in terms of the focus for a series of principles that were set out, the associated means of achieving them, and some implications for a future design stage. The fifth column in the table shows a mapping of these areas to discourse views, as outlined above, derived from a preliminary analysis of a data 'snapshot' for the 3-month period October to December 2002.

In June 2000 the role of 'Knowledge Analyst' was invented, and in July 2002 'Special-K People' or 'Knowledge Working Specialists' as they became known, were recruited into a new Knowledge Working (KW) team within the KM directorate (How KM is applied at XX, 2003). A 'future state operating model' or human resource allocation model was proposed in 2002, which dictated that each subsidiary had to recruit a Knowledge Analyst (KA). So what does this structure mean in practice? The headquarter KW team are formally depicted on HQ's organisational chart, whereas the KA's are a member of a team within the subsidiary. Typically, they are included in a team that deals with 'KM' activities such as strategy, finance, research and evaluation. As was mentioned previously, the term 'KM' has specific connotations in the organisation. It is associated primarily with a 'value' discourse, and with quantitative measures and targets including financial number crunching. Whilst the KW HQ team are responsible for developing and implementing tools and techniques ('object' discourse) for KW (How KM is applied, 2003), the KA's are responsible for identifying and interpreting the knowledge needs of staff ('psychology' discourse). Utilising a participation framework called the 'Knowledge Needs Route Map' (developed with the help of an IBM consultant between June and November 2003) and KW toolkit, KA's recommend and implement appropriate KW tools and solutions. The toolkit includes 'tacit' and 'explicit' tools. The primary 'tacit' tool is the community of practice, and the 'explicit' tool the intranet. Both are integral in breaking down organisational boundaries to encourage network communication and collaboration – 'practice, 'object' and 'psychology discourses converge here.

Towards the end of 2003 the KW team, KA's, their line managers, and other interested parties were taken through a two-day workshop and emerged as a 'CoP'. The KA's are an integral piece of the KW puzzle. Without them, HQ can't identify which local subsidiary priorities are important, recommend KW solutions, and apply them in the business. In isolation, the KW team and KA's operate in their own separate 'boxes'; the KW team at head office level, and each KA in their local subsidiary. As a KW CoP, the KW team and KA's operate both vertically (within HQ and subsidiary) and horizontally (across geographical boundaries). The KW CoP members are geographically distributed and operate in a virtual manner using technologies such as the intranet, telephone, and discussion groups. However, it is not pure 'virtual' entity as some members are co-located; others do meet on occasion and all members meet twice a year: a further discourse comes into play, 'structure'.

But the 'value' discourse retains its strength. Up until July 2005, on a yearly basis each subsidiary submitted a strategy to head office to procure funding to undertake economic development activities in their local area. Their measure of performance and subsequent funding is dependant on meeting a set of quantitative targets agreed by the government. The subsidiaries view these HQ imposed compulsory changes as detrimental; they erode their autonomy, represent a loss of innovation, and require the subsidiaries to achieve more with fewer resources. As the imposed KA post represents a potential loss of an operational member of staff, the subsidiaries were cautious in employing people whose role cannot demonstrate clear value-added benefits to their organisations. But, they were required to adhere to the new staffing structure imposed by HQ.

Because of the fluid nature of the KA job it was virtually impossible for KA's to identify a foreword schedule of work, and hence, articulate the potential benefit the organisation can derive from their interventions. Consequently, it was very difficult to attribute any direct value to KW and the reason why KW is perceived to be a 'pink and fluffy' concept by adherents of the 'value' discourse. In August 2003, ten months after the KA's were first introduced, a Change and Communications (C&C) Manager was brought in to provide strategic direction for the KA role (meeting, Aug 2003). In an attempt to paint a rosy picture to ensure the subsidiaries devote more time to KW, he classifies all the work the KA's do as KA work, and a very positive message is conveyed, but the reach and impact in the business is diminished. In June 2004, the KW CoP core group leader, also a KA, expressed reservations about the classification: "the role [the C&C Manager] created and sold or miss-sold is now our problem" (conversation, June 2004). Reservations are also evident in quotes from emails in June 2004 prior to a scheduled meeting with a Senior Director of Operations (SDO) nominated as the KW CoP sponsor.

6 Discussion

The Throughout the KA period (2000-2004) there is considerable tension between HQ "them" priorities and local subsidiary "us" priorities. This is articulated in conflicting and shifting K-discourses that are characteristic of a dialogic process at work. Some subsidiaries did not consider CoPs to be a local initiative or priority. CoPs may derive benefit for the organisation, but they were labour intensive, and only include a select few people in the local subsidiary. The time devoted to CoPs minimised time that could be spent on local issues, perhaps not even related to KW, which would have a far greater reach or impact on the business. Perhaps as a result of emphasising the importance of 'local demand' the KW Director, C&C Manager, and KA Co-ordinator mentioned that the KW strategy needed refreshing. The primary focus of these contests is the figure of the Knowledge Analyst, the organizational role occupied by the researcher, who can be seen as a Foucauldian subject – the product of a set of discourses formed round knowledge management. Because the KA role was initially directed from HQ, and KA's asked to undertake work without prior agreement with local line management, KAs are a material and bodily focus of organizational tensions. KA spirits were flagging as one KA attests: "Am just trying to get on with things and stay as positive as possible but continue to feel that being in a "network" post in [subsidiary] will never work (as demonstrated by my recent performance grading)." (email, June 2004). The KA's often questioned why they were not structured as a shared service team as they were promoted by some of their seniors as one.

6.1 The Knowledge Analyst as Foucauldian subject

The construction of the 'subject' of the Knowledge Analyst can be mapped in parallel with the tracking of different K-discourses. Just as the discourse of the clinic implicates a number of subjects (the figure or subject of the patient is an example whose treatment is contested in a dialogic process that sustains the domain), the discourse of KM in PSA has produced the figure of the KA, whose treatment is also contested, a contest that sustains the KM programme in the organization, as there is always something to be acted upon. The KAs questioned the KW network structure on many occasions. As a result of the BT project numerous network policies and procedures were being implemented across the board. More often than not HQ developed these with little input from the subsidiaries, the operations arm of the business. Many of the local problems faced involved an issue with a network directive that couldn't be solved locally but at a network level. As such, KA's found it difficult to intervene at a local level. Some KA's questioned whether local issues would be better addressed at a CoP level. This, it was felt, would be a better forum for KW interventions. But, as mentioned above, CoPs were not considered a local priority and the KA's were not perceived to be delivering locally if they focused on a network initiative. When the future-state operating model was first introduced, it was conceived that the KA's would operate as a shared service (discussion, July 2004). But, for some reason, when this operating model was drawn up a KA was to be situated in each subsidiary. It is possible, that at that stage, HQ thought that the subsidiaries wouldn't want another HQ team imposed on them. This was the reason given when discussing the group structure on numerous occasions. The KA Co-ordinator, a member of the BT workstream, mentioned that they were not consulted when HQ were considering this model. Six months later when HQ recruited for a KW team, it became apparent that the structure was an inhibitor and this was raised as a concern. However, political ramifications were cited as the reason why management would not, or could not, challenge this model. In May 2004, following a CoP meeting, the KW AQ Director capitulated and asked the C&C Manager and KA Co-Coordinator to investigate the structure and draft a management paper. But, it wasn't made clear to them what would happen to this paper, if anything. Yet another set of options were proposed at a KA meeting in August 2004. One, the structure remains as is and subsidiaries would be asked to devote more time to KW. Two, a central shared service team would be recruited with less KA's. Three, one KA would service two subsidiaries but would be managed locally. This would require network-wide consultation and a survey would be drafted and sent out to HQ Executive Board, HQ KW team; subsidiary CEO's, KA Director, KA Line Manager, and KA's.

7 Conclusion

To conclude, the research findings presented are preliminary, with analysis of data continuing, and with the researcher still participating in the organisation. At first glance the unraveling of the knowledge working trajectory demonstrates the complexity of attempts in this case to encourage e-participation in this public sector organization – a key aspect in the UK Government's attempts to 'modernise work'. However, the consideration of discourse views alerts us to the many ways in which this discourse can be interpreted. One of the features of this case is the way in which the HQ inspired of e-participation through knowledge working is to be implemented upon (*sic*) local, semi-autonomous, structural units. From what we see in this case study so far, this would appear to reflect a phenomenon noted elsewhere in public sector IT initiatives, namely discourse dissonance [22], consequences of which include elitism (and inertia), resistance, and speciation (where there are variants in practice). To this we may add contention as a possible consequence, where the discourse, in this instance relating to e-participation through knowledge working, becomes a locus for social actors [23] to contest the exercise of power. Thus, concentrating upon variations in the nature of discourse over time (for what will be several years for the organization reported upon in this case extract) at the HQ level as well as at the local 'business unit' level, should enable a detailed assessment of the life of the e-participation/knowledge working initiative. As part of this, developments in the views of what 'e-participation' and 'knowledge working' *are* become more visible, as do choices relating to the stimulating, fostering, encouraging, embracing, contesting, ignoring, and perhaps rejecting of this project. Such insights are important to our understanding of the influences upon e-governmental initiatives, an area of UK public spending that is littered with IT project failures [24].

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Table 2. The HQ view of the Future of Knowledge Working: A preliminary mapping to discourse views

Focus	Principles	Contribution (i.e. How?)	Implications for a future design phase	Discourse Views - Examples
In Supporting people as Knowledge Workers, Principles include:	- We will ensure people have the skills to be an effective knowledge worker - We will share knowledge not hoard it, and apply the lessons learned from both success and failure - We will recognise and reward knowledge working	Portal Values and Brand (Complete) Living the values Performance management and recognition General recruitment and retention	Develop and clearly communicate knowledge vision, strategy and benefits Design and communicate new ways of working & embed in management practices Ensure balanced scorecard communications further knowledge working agenda Build clear link with HR to ensure HR levers support knowledge working	Psychology discourse – e.g shaping behaviour; provide required skills to workers Object discourse – e.g. storing/hoarding Value discourse – e.g. manage through balanced scorecard communications
In supporting organisational groups, Principles include:	- We will empower communities of practice and other organisational groups to improve collaboration, - We will design organisational structure to ensure improved flow of knowledge to where it is needed in order to make high impact connections	Communities of Practice Project	Ensure detail of new operational model is aligned with the knowledge vision for group working and collaboration Ensure community consistency with organizational design Collaborative Tools – Understand how people should use them, how they fit together and skill requirements	Object discourse – e.g. knowledge will flow, and structure can be created to facilitate that flow Psychology discourse – e.g. forming quasi-informal communities Practice – e.g. knowledge working through CoPs
In supporting customers, Principles include:	- Our expertise, ideas and information will be the main value which we provide to customers; - We will facilitate knowledge sharing and the building of productive relationships	Portal will give access to knowledge Knowledge packs & products Knowledge Exchange Clusters & Business Networking	Ensure the knowledge is in place to support self-service approach to volume market Address issues of customers who want our money rather than our knowledge Identify implications of CR strategy and portal for org. design and headcount	Object discourse – ensure *the knowledge* is available for customers to 'take away' Psychology discourse – e.g. facilitating relationship building for knowledge sharing Structure discourse – e.g. new formal (& possibly informal) networks through clusters

Understanding the B2B E-Market in China

Jing Zhao, Frank Duserick, Wilfred V Huang
Jing Zhao:
Center for International Cooperation in E-Business
College of Management
China University of Geosciences
Wuhan 430074, P.R.China
yuzp@cug.edu.cn, zhao5563@yahoo.com.cn
Frank Duserick and Wilfred V Huang:
College of Business
Alfred University
Alfred, NY 14802, U.S.A.
{fduserick, fhuang} @alfred.edu

Abstract: This paper seeks to develop a conceptual model that is inherently suitable for analyzing the complexity of B2B e-market and transaction performance in China. The case study of CCEC.com provides an insight on how one excellent B2B e-market has executed a successful strategy utilizing the existing source within the current business climate of China. The data from the case research illustrate e-commerce strategies and crucial business activities. Further, the B2B E-Market Model is proposed for studying the critical strategy component of value creation in e-markets of China. The Model involves with two variables: the e-commerce process and the controlling complexity. Building on process insight, the e-commerce process can be modelled by separating main business activities into four phases designed to exploit value creation opportunity. Controlling complexity refers to supervising and controlling the transactional processes for security, trust and efficient transaction environment. The Model illustrates the relationship between the business components required to support the e-commerce processes with the value creation factor and the controlling complexity. Using the model in comparisons of B2B e-markets in USA and in China, we find unique characteristics in transactional processes - the information, negotiation, payment and delivery phases. It offers an effective approach to studying dynamic structure of transactional process and a high performance e-commerce strategy.

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1 Introduction

The application of Internet technologies to interfirm transactions has led to the amazing growth of Internet-based business-to-business (B2B) e-markets and on-line B2B sales. Worldwide, according to the Gartner Group, the value of B2B Internet commerce sales transactions surpassed $433 billion in 2000, a 189 percent increase over 1999 sales transactions [1]. B2B market assembles numerous buyers and sellers for on-line transaction. Both sides "know "each other through issuing and searching of business information, then negotiation and completing a contract over the Internet. It creates a new trade mechanism at a highly efficient and effective manner. As business-to-business transactions are increasing on the Internet, it is becoming critical for firms to rely on Web-based supply chains or e-supply chains in order to provide almost real-time response to market conditions [2, 3, 4, 5, 6, 7].

According to a research report from Deloitte Research, only about 400 of today's more than 1, 500 e-marketplaces are likely to succeed over the next three to four years [8]. Observing and experiencing the dramatic changes in the arena of B2B e-commerce, both academic researchers and Internet market makers are wondering what B2B business models will lead to lasting success in the digital economy [9].

The purpose of this paper is to fill a void in the research on B2B e-markets in China. We seek to develop a conceptual model that is inherently suitable for analyzing the complexity of B2B e-market and transaction performance. We have analyzed the development of Chinese e-markets and barriers when implementing e-commerce strategies, and identified unique characteristics in the transactional processes and market mechanisms. Building on the process insight, we studied the activities, strategies, and governance of transactional processes of B2B e-market using a case study approach. Furthermore, the paper proposes a B2B E-Market Model for the current limiting conditions of China. In the model, the whole transactional process can be viewed as the e-commerce process with four phases focusing on the controlling complexity and the value creation factors. This enables us to capture and study e-commerce strategies and primary e-commerce activities in each phase, which have a direct impact on value creation in the environment of China. We also discussed the e-markets in U.S.A and China using the B2B E-Market Model. We found many characteristics in common with the different maturity level in applying information technology on transactional processes. Our finding offers an efficient way of studying B2B e-market so as to explore e-commerce strategies and the adopted innovative market mechanisms directed towards the needs of customers.

2 Background

2.1 Literature Review

We review the academic literature on B2B e-market in management journals of China (i.e., *Management Review, Shanghai Management Science, Technoeconomics*

& Management Research) within the past three years. The literature on B2B e-market is limited, and main opinions are summarized as following:

Zhu [10] present that three modes of B2B market from a B2B market management perspective. They are: (1) E-Market controlled by sellers means that the suppliers create their webpage and products catalog by themselves to attract more buyers and reduce the transaction costs. (2) E-Market controlled by buyers means that the buyers create webpage and put their products on B2B e-Market by themselves to attract more suppliers and reduce the transaction costs. (3) E-Market controlled by intermediary means that E-Market play the role of digital intermediaries [11, 12]. For example, demand and supply information can be aggregated and disseminated, and buyers and sellers can be matched in E- markets, and to make transaction at the marketplace for increasing transaction efficiency and reducing transaction costs for both parts. He states that intermediary E-Market provides the platform for small and medium sized enterprises which can't establish their own company website, and for large enterprises which realize the integration of interior ERP/MRP/MIS with exterior exchange markets.

Wang et al. [13] proposed a neutral B2B E-Market model consisted of transaction opportunity, transaction verifying and transaction executing. The research presented the categories, content and construction of the model, which provide a useful reference for market markers in neutral B2B E-Market.

Jiang [14] proposed a framework of B2B E-procurement which is controlled by B2B intermediary. The greatest advantages of this model are improving efficiency, reducing transaction costs. The platform integrated the different suppliers and purchasers into the e- market, which has greatly facilitated finding products and the selection of suppliers who can more easily promote their products. This not only reduces the cost of sales, but also can handle inventory and make an inventory of assets.

Yan et al. [15] explored the mechanisms for building reliable transaction between sells and buyers under the environment of B2B E-market. A theoretical framework is proposed for reliable transaction system includes credit control, credit appraisal, credit obligation, credit feedback and cooperation criterion.

In summary of literature found, although prior work in this field has substantially contributed to our understanding of the role of e-market in China, we think existing works are scarce on case studies in choosing and implementing the best e-business strategy, and also on the process of practical transaction in an e-marketplace.

2.2 The Electronic Markets in China

The Chinese government has always been aware of the impelling effect of B2B e-business on the economy and the capabilities of the organization, and has been actively building a nationwide infrastructure of data communication network since 1993. Today, the existing network infrastructure reaches more than 2200 cities and towns. With the infrastructure in place, the government has built several advanced and unified public data and multimedia communication platforms that form a national Internet backbone network [16]. Entering 1998, government ministries and some forward-thinking IT firms spearheaded the e-commerce development by creating commercially oriented derivatives of the existing Internet backbone networks. The networks emerged as the B2B electronic markets. Their roles include aggregating suppliers and buyers, and providing trust and market information. For examples: [17]

- *China International e-Commerce Network* serves as a window through which businesses can get the latest information on foreign trade policy, management practices, government legislation and regulation, as well as general market environment.
- *China Materials Information Center* updates the availability of raw material, equipment and other inputs of production, so that businesses can derive economic benefit from otherwise idle resources.
- *China Crops Exchange Network* provides valuable information on the world crops market, and currently supports on-line trading in parts of China.
- *China National Commodity Exchange Center*, *China Economic Information Network*, *Chinamarket,* collectively form a virtual exchange, facilitating the flow of goods.
- *National Inventory Adjustment Network*, built by the Ministry of Interstate Commerce, has been effective in increasing inventory turnover and improving the utilization of capital.
- Others include *China Commercial Airlines Reservation System*, *China Securities and Investment Information Network*, *China Futures Information Network*, *China On-Line Banking System* in addition to *Beijing e-commerce Project* and *Shanghai Information Center*.

These networks form the basis for the early development of E-business in China. They relieve businesses of substantial initial investment, yet provide them opportunity to experiment with and understand e-commerce. As the forerunner of the transition to e-commerce, the entrepreneurs who were mostly small-and-medium-sized-enterprises (SME) have derived substantial profit from the use and exchange of information on the network. China is in the midst of industrialization, modernization and informationization. Various aspects of the consumer economy such as purchase habits, modes of exchange, and payment methods lag those of the developed countries. Information technology is not yet widely deployed in enterprises. It is expected that the development of full-scale e-commerce processes in B2B e-markets will encounter many obstacles [18]

First, there is a lack of solid understanding about e-commerce among managers. Business alliances and partnerships are dominated by longstanding personal "old-boy" connections. Moreover, the enterprise information system is under-utilized. A random sample of 1300 managers in 520 large state-owned enterprises and local backbone enterprises released by the National Council on Economics and Commerce in 2001 indicates that 69.1 percent of businesses host their own web sites, 21.6 percent of enterprises have a proposed e-commerce strategy, 4.1 percent of them completed procurement over the Internet and 3.4 percent of them engaged in Internet marketing [19].

Second, while the financial system in China is being modernized, electronic payment systems and the associated regulations are not yet in place. Some purchases for small-size enterprises are still made with cash. Many of the legal issues associated with e-commerce have not been addressed [20]. Third, inefficient transportation systems and the absence of professional distribution outsourcers are preventing businesses from going completely on-line since they must provide distribution capabilities on their own.

Under these limiting conditions, the development of electronic markets has unique characteristics in the transactional process, which relate largely to the current industry structure, financial infrastructure and organization structure.

3 A Case

The most prominent B2B e-market in China is China National Commodity Exchange Center (CCEC). Using the resources of the "Gold trade" project supported by government ministries, CCEC.com shows evidence of significant successes as an on-line B2B Exchange in China through its on-line transactional processes. So we are particularly interested in its development of the transactional process and the security and trust perceived by its buyers and sellers in the e-market.

3.1 Data collection:

In about 1999-2001, CCEC put its transaction volume for on-line sales and off-line sales over its website every day. So we often log on its website to get information. In addition data was gathered about transaction and sales volumes. Interviews with corporate executives and observation of transaction processing mechanisms were the bases for data collection. We get information from talking with one corporate executive at the conferences and through phone calls in 1999-2001. We also get materials about introduce to CCEC transaction processing from CD attached with a book written by Jiang, X.P. in 1999 [21]. Other sources were from corporate brochures at its website, newspapers/magazine report and public information websites like Juns.com [17]. Relative data were reported as following:
CCEC, an on-line B2B Exchange firm in China, initiatives its B2B e-commerce early in 1997. Its total registered members, both current and past, exceed five million. The B2B exchanges offer more than 500 classified products in all 26 industries for its members to look up and choose. It has the capability to not only collect and distribute extensive information about commodities and enterprises but also to provide various trade functions such as on-line negotiations, signing agreements, inviting tenders, bidding, purchasing and selling, settlement, and distribution. In the first two months of 2003, transaction volume for on-line sales reached 3.9 million dollars and off-line sales 30.7 million [22]. On-line sales transactions indicate that buyer and seller immediately complete the whole transactional processes through the CCEC's B2B Exchange e-commerce system,

including the processes of e-Procurement, payment, and delivery of digital products. The main characteristic of on-line transactions is that all the transactional processes are completed on-line. Off-line sales transactions signify that both sides sign contracts over a Web site but the payment and goods delivery are completed traditionally. Using the resources of the "Gold trade" project supported by government ministries, CCEC.com shows evidence of significant successes as an on-line B2B Exchange in China through on-line transactional processes.

3.2 CCEC's e-commerce activities and strategies

In China, security and trust are the most significant factors for successful e-market that attract buyers and sellers to make on-line trading. It is a complex and difficulty issue that will require cooperation of bank, transportation department and quality inspection department to establish a secure and reliable B2B e-market environment. Let's look CCEC how to do. Since CCEC is supported by the government, it has the ability of supervising and controlling all transactional processes. CCEC ensures the security of buyers' money and sellers' products using an application suite of normative bylaws, scientific management methods, and other comprehensive services. The advantage of CCEC, and also the key to its success, is that its integrated operation has enabled a complete solution to monitoring the credibility of both buyer and seller.

This study mainly explores CCEC's special transactional processes through two dimensions: the process and control. The process dimension divides e-commerce activities into several phases that provide a basis to develop a clear understanding of e-commerce activities at each phase and why and how e-market maker adopt an e-commerce strategy at each phase. The control dimension includes supervising and controlling of transactional process for Security and Trust for successful B2B e-market in China.

E-market can be modeled by classifying commerce activities into several phases. For instance, Selz and Schubert [23] refer to the four phases in their model as information, agreement, settlement, and communication. In this study, according to connected sequenced of the online transaction process, we divide CCEC's activities into four phases: information, negotiation, payment, and delivery that construct a completed transaction process. E-commerce activities are analyzed within the phase. The major concern is to carry out the contract deal safely and reliably in the transactation process. Using data from the CCEC.com web site, Table 1 illustrate CCEC.com's main e-commerce activities and strategies within the context of the four phases. The controlling complexity and the process dimension make us can pay attention to CCEC.com how to realize Security and Trust in the phase of transaction process. It provides an insight on the execution of this successful strategy in the current business climate of China. Let's analyze CCEC.com's e-commerce activities and strategies in each phase as following:

E-commerce Process	Controlling Complexity	CCEC.com's e-commerce activities	Strategy
Information	Low	500 classified products, 5 million registered members, Business Express, Sample House, Members' Office, Enable customers to manage and govern information and transaction.	Personalized and Customized Services
Negotiation	Medium	Various trade functions, signing agreement, inviting tenders and bidding. On-line catalogs, on-line "Negotiation Room" and "Sample House" services to match seller with buyer	Personalized and Customized Services
Payment	High	Support 5 payment methods based on entire payment processes integrating order, purchasing, warehouse and shipping information and emphasis on neutral supervisor role, and collaboration and information exchange	Structure and Control of the Payment Process
Delivery	High	Delivery networks consist of 200 branches in 40 provinces and cities of China. Shipping tracking system, Coexistence of market partners' alliance and government governance	Strategic partners network

Table 1 CCEC.com's e-commerce activities and strategies

1. CCEC.com Personalized and Customized Services

In the information and the negotiation phases, CCEC.com offers personalized and customized services to meet the unique needs of each customer. Because the number of registered members in CCEC.com has increased dramatically from 9000 to 5 million between 1999 and 2002, customers from different backgrounds (small or large size buying enterprises) expect much flexibility in choosing sellers and products, and much control in building and operating their own on-line transaction. In the information phase, CCEC.com offers a "Members' office", which enables customers to have their own office for managing and governing their business information. CCEC.com customers can control, revise, change, or dispose of their business information including registration, issuance, counter offers, partners' offers, contracts signed, and trade codes.

At the same time, in the negotiation phase the combination of on-line catalogues and on-line negotiation and "Sample House" services new opportunities are created, in less time and effort, to match sellers with buyers. This e-transaction benefits both customer and manager. It is worth noting that customers can play a critical role in value creation. They may work with the manager of B2B Exchange to manage and control information and transactions. The degree of participation of customers depends partially on the quality of personalized service provided in the Electronic markets.

- *CCEC.com Structure and Control of the Transactional Process*

In the payment and the delivery phases, CCEC.com's payment process is operated as a transactional process including financial settlement and delivery. It involves multiple players from transportation and storage providers to customs agents and banks. CCEC.com and its branches act as a neutral manager. Banks and transport companies are their partners along the payment channel.

The structure of the transactional process involves CCEC, bank, buyer, and seller as actors. After signing the contract, both buyer and seller pay a transaction fee and deposit to bank partner. CCEC.com initiates by notifying seller to deliver the goods. After the delivery, the seller sends a bill of lading to the local CCEC branch. CCEC.com then notifies the buyer to pay money to the bank. When payment is confirmed the bank informs CCEC.com. The local CCEC branch is then being notified and sends the bill of lading to the buyer to verify the goods. This involves the buyer to receive the goods and to confirm no discrepancy from the contract. The buyer then informs CCEC.com for settlement. In the last step, CCEC.com informs the bank and transacts settlement. The structure map of the payment process showed in Figure 1.

In the process, the B2B Exchange e-commerce system facilitates information flow between CCEC.com and all participants, and supports on-line transaction settlement. The structure of e-payment process, with emphasis on the neutral supervisor role, relies on collaboration and information exchange among participants. It provides a reliable, secure and efficient transaction environment under controlled conditions. In China this transactional process is especially useful because intentionally delayed shipments and payments occasionally occur.

- *CCEC.com strategic partners network*

Based upon the success of CCEC's B2B prototype, developed with the support of the "Gold Trade" project launched jointly by 13 ministries and commissions, CCEC.com now develops and guides affiliated branches that are managed by the provincial economic and trade councils. These branches form strategic alliances with banks, financial institutions and other trade fulfillment partners (quality assurance, insurance and delivery companies), and initiate joint-ventures with IT companies and local government agencies for special exchange markets, such as www.xhoi.com.cn, a web site of the Xin Hua Bookstore, and js.ccec.com, the crops exchange managed by government of Kirin Province. The appearance of a strategic network in which market and government governance mechanisms coexist has significantly expanded CCEC.com's market and customer bases. Moreover, CCEC.com's brand awareness and reputation are increasing rapidly.

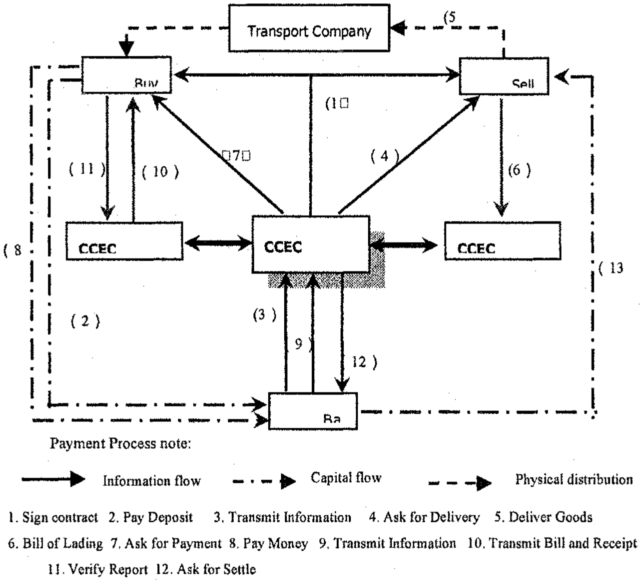

Fig. 1. CCEC Payment Process

4 The B2B E-Market Model

Previous research papers in B2B E-Market mostly are in terms of their roles and functions [9].A major objective of this paper is to identify and study the activities and strategies performed by B2B e-markets maker. It is through their activities and strategies that B2B e-markets provide a secure and reliable B2B transaction process for their customers and generate revenue for themselves. The B2B E-Market Model (Figure 2) was derived from the case study in CCEC. It can be used to study and characterize the activities and strategies of B2B e-markets in each phase of the process so as to explore significant factors for successful e-market.

The advantage of CCEC, and also the key to its success, is that it has the ability of supervising and controlling all transactional processes and has enabled a complete solution to monitoring the credibility of both buyer and seller. So the proposed B2B E-Market Model involves two variables: the e-commerce process and the controlling complexity. According to connected sequences of transaction process, the e-commerce process is divided into four phases: information, negotiation, payment, and delivery. It enables us to capture and study e-commerce activities and strategy in each phase, which has a direct impact on value creation. Controlling complexity refers to supervising and controlling transactional processes for a secure and reliable B2B transaction environment. The current electronic markets in China are beginning to emphasize the capabilities that aim to satisfy management transaction and reliable e-commerce processes needs. The whole process is designed with supervising and controlling features facilitated by the web technology, and the creation of a co-participation partners' network linking over the Internet for transaction process support. The controlling complexity degree varies among the four phases. The indication of the degree is from "low" to "high". For example, in the information phase, there is a low controlling complexity degree in facilitating this communication. Inexhaustible data about all sorts of buying and selling business is aggregated and disseminated. It is simple and straightforward to fulfill this function with Internet technology. All e-markets in China have this basic capability. The payment and delivery phases entail an end-to-end goods delivery and monetary transaction from the supplier to the buyer, and information and services among multiple players involved in the process. Shipment of bulk commodities involves multiple players from various transportation and storage providers, to freighter forwarders and surveyors, to customs agents and banks. The e-market has to coordinate all the players during the payment and shipping process so that the right information is delivered to the right person at the right time, and to supervise the execution of the transaction in a secure and reliable manner. This leads to greater flexibility and better control of information transmitting among buyer, supplier and partners by using the Web technology. It is necessary to create a partner network over the Internet to accomplish collaboration management, so there are high-controlling degrees of complexity in both phases. In e-commerce, payment and delivery processes must be exact to satisfy the seller-buyer relationship. Consequently, these two processes require intense scrutiny to ensure both parties are satisfied with the final exchange.

In the B2B E-Market Model (Figure2), the e-commerce process is divided into four phases at the horizontal axis. The vertical axis indicates the controlling complexity. The dual-axis interface plane signifies the value creation factor corresponding to each phase. The Model illustrates the relationship between the business components required to support the e-commerce processes with the value creation factor and controlling complexity. The Model aims at secured and reliable e-commerce processes that deliver significant business value, ranging from strategic challenges to operational efficiency and effectiveness issues. The Model offers a relevant perspective for exploring critical strategy components of value creation.

The value creation factors in the four phases along with the present business climate are outlined as follows:

2. *Information Phase: Providing high reach and richness of information*

   In the information phase, inexhaustible information about business transactions and collaboration can be aggregated and disseminated. The crucial duties for the e-market involve managing information content, providing the appropriate classified information, and helping buyers and sellers to issue and obtain information more quickly and easily.

- *Negotiation Phase: Matching buyers with sellers and creating exchange mechanisms*

  Electronic market managers integrate IT technologies such as on-line negotiations, agreement signing, inviting tenders, bidding, exchanging recorders, and helping to match buyers with sellers for making transactions. The principal challenges facing e-market are to lay down rules of exchange that are rooted in a neutral and effective process to create a fair and efficient negotiation experience for the customers.

E-Commerce Process / **Controlling Complexity**	Information	Negotiation	Payment	Delivery
Low	High reach and richness of information			
Medium		Matching buyers with sellers Creating exchange mechanisms		
High			Secure and reliable transactional process	Collaboration management

Fig. 2.: B2B E-Market Model

- *Payment Phase: Secure and reliable transactional process*
  In the payment phase, monetary transactions occur between the buyers and sellers. The transaction activity in the payment phase, with a strong emphasis on secure and reliable payment processes, relies on the facilities for settlement of on-line transaction as well as supporting a range of payment methods offered by various financial institutions. While the financial system in China is being modernized, the e-market needs to be creative in identifying alternative expedient consumer payment processes in order to build a competitive advantage. As a developing nation China does not yet possess an e-payment infrastructure common in developed countries.

- *Delivery Phase: Collaboration management*
  The delivery phase entails an end-to-end goods delivery from the supplier to the buyer. Together with payment phase, they form the transactional process. Thus shipment of bulk commodities involves multiple players from various transportation and storage providers to customs agents and banks. From the e-market manager's perspective, a critical issue is the lack of specialized nationwide delivery channels in China. As an emerging industrial economy, China does not yet have the supply chain

infrastructure to support on-line commerce in an effective and efficient manner. A critical challenge for managers has been the ability to ensure the smooth flow of information, products and services among multiple players involved in the delivery process and payment phases. Inherent in this challenge is the need to increase the speed, control, and reliability of the transactional process.

The value creation factors are complete with respect to certain aspects of business component found in the four phases, they are commensurate with the controlling complexity associated with the use of IT and partner network. The information phase and the negotiation phase are characterized by management of high reach and richness of information, and by a focus on matching buyers with sellers for making transactions and creating exchange mechanisms. The payment phase and the delivery phase are characterized by the management of new forms of collaboration among all the players during the transactional process. Both emphasize the processes that enable transaction and transaction governance. It is noticeable that the e-market value generation is associated with designing, building and managing e-commerce process.

With the unique nature of e-commerce of China the Model is the conceptual basis for analyzing and understanding the primary e-commerce activities and the innovative e-commerce strategies of electronic market in emerging markets.

5 Discussion

The B2B E-Market Model is used to analyze other electronic markets in the world, which managers can rely upon to enhance their understanding of future developments in this arena. First, let's characterize two of the e-markets in USA, e-Chemical and PlasticsNet, through the analytical lens of four phases of the B2B E-Market Model. Then, we will make comparisons of characteristics and regulations of e-markets in China and USA. It is found that (a) they have common characteristics, (b) they are concerned with the security and swiftness of the trade procedure, and (c) they focus on establishing partnership.

5.1 e-Chemical

e-Chemical (www.e-chemicals.com) is a chemical articles trade leading e-commerce company of U.S.A. It has greatly improved the security and reduced the time in purchasing, sales and deliveries. It was established by Alf Sherk, Lorne Darnell and Yossi Sheffi in the autumn of 1998, and the members must be the purchase traders and suppliers who obtained the qualification in the chemical trade. The creation of e-Chemical electronic market is to solve the challenge of purchasing in the chemical trade. The reason is mainly due to a widely scattered market causing poor efficiency and staggering prices in purchasing. The management group of e-Chemical electronic market, with more than 150 years of experience in the chemical trade organization, production and sales, put forward a set of comprehensive solutions to the trade and solve this supply-chain problem.

Information phase:

In the information phase of the B2B E-Market Model, e-Chemical has abundant of information. In the October of 1999, e-Chemical listed more than 1000 kinds of goods on the network, registered 600 buyers and 20 manufacturers and suppliers. Besides the general product information, e-Chemical offers the trade news and special reports to people every day, the contents of which are all closely related to chemical industry and e-commerce trade. There are feedback mechanisms on the website, allowing customers to ask questions. It keeps the website robust by adding service items constantly like environment, health, etc.

Negotiation Phase:

e-Chemical's website allows buyers to select, buy, inquire for price, order and consign. It has comprehended the connection between factories by allowing large volume purchasing on the web, therefore accelerating the course of purchase greatly.

Payment phase and delivery phase:

In the payment phase, it carries the payment for goods and settles account through the Sun Credit Bank. In the delivery phase, it has Yale Trucking Company to handle the stipulation. It's supervising and controlling transactional process is capable of managing and tracking the orders. Customers can examine the status of their orders on the web any time.

We summarize e-Chemical in the following three issues:

(i) Using Information technology: e-Chemical amalgamates the increasing number of suppliers, new trades and account settlements with the on-line trading. As a consequence, e-Chemical solves the poor efficiency problem in the supply chain of chemical trade.

(ii) Cooperative partnership: e-Chemical closely cooperates with chemical trade suppliers and retailers in making its e-commerce successful. It increases its marketability by establishing cooperative partnership with SOCMA and NACD. Furthermore, it joins alliance in technology and logistic services with IBM, Sun Credit Bank and Yale Trucking.

(iii) Confidential and neutral position: e-Chemical has gained good reputation for keeping confidential and neutral. Account users have to go through multi-tiered authentication to enter the highly secured website, and all transactional information are kept confidence along with the user registry.

5.2 PlasticsNet

PlasticsNet (www.plasticsnet.com) is the earliest electronic commercial center of the plastic trade in U.S.A. Since March of 1999, it has more than 30,000 registered on-line users, provides more than 90,0000 services monthly, and more than 165 suppliers in sales, marketing, advertising, etc. It has grown from a trading community and information center to a market with comprehensive e-commerce capability. PlasticsNet has gathered thousands of products form more than 200 suppliers. It serves as a hub of information and trade opportunities for both sellers and buyers in the plastic industry.

Information phase

In this information phase of the B2B E-Market Model, PlasticsNet offers abundant information and service including a search engine, websites of suppliers, the largest on-line classified advertisement database in the plastic industry, a education database, issuance of sales statistics, a technology forum and a technology catalogue of the plastic industry.

Negotiation Phase:

It offers different trade mechanisms depending on the category type of the merchandise. It also provides functions to manage account receivables for the on-line trade transactions. PlasticsNet also provides auction and reversed auction mainly for the surplus, the aged products, or the uncommon products.

Payment phase and delivery phase:

It offers back-end support services such as information tracking, billing, account receivables management, etc.

We summarize PlasticsNet in the following three issues:

(i) Using Information technology: PlasticsNet has designed an office system particularly for the buyers. This back end support service has revolutionized the traditional trade by automating the link between accounting and data storage system, thus allowing users to order goods from multiple sellers with a single form.

(ii) Cooperative partnership: PlasticsNet's partners include Heller Financial, JD Edwards, etc.

(iii) Confidential and neutral position: PlasticsNet uses customer codes for its registered members to protect the identity and confidentiality. It also allows a computerized price quoting system, where both parties are unaware of the other. Users can obtain the price and information from automatic briefing and classification.

There are commonalities and differences in the B2B electronic markets between the America and China. From the B2B E-Market Model perspective, we find that

The e-markets in both nations provide abundant of information, multiple trading functions and personalized services to satisfy customer's needs.

The e-markets in both nations focus on providing secure and reliable transactional processes. While Chinese e-market puts emphasis on supervising and controlling the transactional process to avoid intentionally delayed shipments and payments, American e-market stresses on the confidentiality of its members and the trades along with information tracking and inquiry systems.

Information technology is deployed in the American e-markets to respond to the poor efficiency in the supply chain. e-Chemical has integrated the increasing number of suppliers, new trades and account settlement together. PlasticsNet has a revolutionized computerized office system particularly for the buyers, which links the accounting and the data storage system allowing users to order goods from many sellers with a single form. American e-markets have combined the transactional processes with their enterprise information systems, thus improving the value chains of the enterprises. The Chinese e-markets are still only limited to managing and controlling of the transactional process to ensure the reliable execution of the contract.

The e-markets in both nations put efforts in establishing cooperative partnership network with banks and logistic parties. American e-markets are also creating alliances with others in their own industry to expand and strengthen the market share.

6 Conclusion

The evolving B2B e-market in China defines a new challenging field for research within e-commerce. To facilitate the development, we have attempted to approach the strategic value creation of B2B e-market in real-life context, and to describe and analyze them in the relevant perspectives. Four points are made about the research on B2B e-markets in China.

First, after introducing the e-market development in China a case study of a successful on-line B2B e-market is presented. It illustrates the performance of e-business strategy in the transactional processes of e-markets. The critical strategy components emerge from the analysis of e-commerce process. They are personalized and customized services, the structure and control of transactional process, and strategic network. Both payment and delivery are important business activities that reflect the effectiveness of the business strategies.

Second, we analyze different types of e-commerce activities and illustrate the value creation factors corresponding to the strategies. The B2B E-Market Model based on the e-commerce process is proposed to study e-commerce activities and strategy focus within the context of the four phases: information, negotiation, payment, and delivery. It enables us to identify and characterize the critical strategy and activities rooted in the e-commerce process. The controlling complexity and the process dimension are used to examine and study CCEC.com's transaction process for Security and Trust in B2B e-market.

Third, we apply the B2B E-Market Model to e-markets in U.S.A. and found common characteristics. The common characteristics are the support of abundant information on products and services to satisfy customer's needs. It is a place that gathers all information and provides multi-functions in trading. It focuses on the security, reliability and speed of the transactional process. It accentuates the development of the partners relationship and partners information network to support the transactional process. The difference is the application of the network and information technology for the transactional process. In U.S.A. the e-markets are to resolve the inefficiency of the supply chain, while in China they are only for monitoring and controlling.

Overall, the present analysis indicates that B2B e-markets in China are still in their formative stages. It is noticeable that the e-market value generation is associated with designing, building and managing transaction process.

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Personalization Beyond Recommender Systems

An Application-Oriented Overview of Personalization Functions

Petra Schubert, Leimstoll Uwe, Daniel Risch
University of Applied Sciences Northwestern Switzerland FHNW
School of Business
Competence Center E-Business Basel
Peter Merian-Strasse 86, CH-4002 Basel, Switzerland
[petra.schubert] [uwe.leimstoll] [daniel.risch]@fhnw.ch

Abstract. Personalization is an interdisciplinary topic that has been discussed in the literature of marketing and information systems as well as in other research areas. In this paper we present findings from a longitudinal research project on personalization of e-commerce systems. The findings were taken from interviews and software development projects with company partners (action research). The main contribution described in this paper is the Personalization Map. The map provides an extensive overview on personalization functions that can be used to individualize and improve human-computer-interaction both in B2C and B2B e-commerce environments. In a first step, the functions are classified according to their order of appearance in the buying process. In a second step they are grouped into subcategories. There is no single strategy for selecting successful personalization functions as the suitability varies depending on the industry and the goods sold. Most definitions of personalization are closely connected to the recommendation of items based on user preferences. The Personalization Map shows that recommender systems are an interesting but rather small part of the universe of personalization functions.

1 Introduction

Personalization is about the interaction between a company and a customer on a one-to-one basis in order to match user needs. As a result personalization is intended to maximize the customer value (for the vendor) and the benefit (for the customer) at the same time. Due to the interactive characteristics of Web-based applications –

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compared to other media such as newspapers, television, or radio – the Web is particularly suited for personalized services.

Personalization is an interdisciplinary topic that has been discussed in the literature of marketing and information systems as well as in other research areas. Most definitions of personalization implicitly point to individualized recommendations of items. This paper takes a broad view on personalization introducing an application-oriented framework for personalization functions which includes but is not limited to recommender systems. We will provide a well-structured view of personalization functions in B2C as well as in B2B e-commerce environments by means of a so called „Personalization Map". To the best of our knowledge no such overview has been provided up to now.

The Personalization Map contributes to existing literature by classifying personalization functions according to their order of appearance in the purchasing process. In this context, we choose a broad definition for the term personalization referring to any adaptation of a Web site or e-commerce application based on previously stored user data (customer profiles) [28]. The provided framework is a valuable means for personalization projects with the aim of identifying suitable personalization functions as well as classifying new or previously unknown functions.

In chapter 0 we provide some common definitions and discuss related work in the field of personalization. In chapter 0 we describe the research methodology that we used in this project. Chapter 0 contains the basic concepts of personalization followed by the introduction of the Personalization Map (our basic framework of personalization functions). Having discussed the results in chapter 0 we summarize the results and provide an outlook into future research.

1.1 Background and Related Work

Deitel et al. [8] define personalization as using „information from tracking, mining and data analysis to customize a person's interaction with a company's products, services, web site and employees". Mulvenna et al. [13] understand personalization as „the provision to the individual of tailored products, service, information or information relating to products or services. This broad area also covers recommender systems, customization, and adaptive web sites". Adomavicius/Tuzhilin [2] summarize in that „personalization tailors certain offerings (such as content, services, product recommendations, communications, and e-commerce interactions) by providers (such as e-commerce Web sites) to consumers (such as customers and visitors) based on knowledge about them, with certain goal(s) in mind." These definitions imply a close relationship between personalization and the recommendation of items. Even if recommender systems are undoubtedly an interesting part of personalization there are many other personalization functionalities that are geared at an improved customer loyalty. Examples for such functions are personal shopping lists, customer-specific assortments or extensive checkout support (cf. section 0). Therefore we decided to follow the broader definition of personalization provided by Riecken [17]: „personalization is about building customer loyalty by building meaningful one-to-one relationships; by understanding the needs of each individual and helping satisfy a goal that efficiently and knowledgeably addresses each individual's need in a given context." The possibilities of personalizing the user interface were pointed out by Peppers/Rogers [15] as well as Allen et al. [4].

Personalization uses information about customers. The general term for stored customer information is „user profile" or in the context of electronic shopping „customer profile". There are various ways how e-shop operators can cultivate customer profiles e.g. „historically" by storing (1) interaction with the Web site (click stream), or (2) purchase transactions, or „explicitly" by asking (3) for preferences, or (4) ratings, or (5) by recording contextual information (e.g. time, date, place). What formerly seemed to be possible only for the corner shop whose storekeeper knew all her clients personally, reaches a new potential in the online medium where every client leaves traces and thus „teaches" the system how to treat him in a different way than other customers. This form of personalization becomes feasible with the use of predefined rules which can be built into e-commerce environments. These automatic personalized Web sites do not achieve the high quality of corner shops but they help to establish a personal dialogue with the customers tying them closer to the electronic offer. Additionally, the time spent by the client to „teach" the system is assumed to lead to increased switching cost.

Over the past years there has been a lot of research in the broad field of personalization focusing on recommender systems [19, 3, 10], privacy concerns [1, 16, 18], human-computer interfaces (HCI) [27, 5, 9] and personalization as a marketing approach [15, 14, 22].

In its most common form, a personalization function can be defined as the combination of profile data with personalization techniques to ease and support human-computer interaction. In this paper we focus on personalization functions.

1.2 Research Methodology

For the generation of findings portrayed in this paper, a combination of literature review, individual interviews with company representatives, company workshops, and case studies was chosen. The research group at the Competence Center E-Business Basel which compiled the findings of this paper has been involved in a longitudinal, publicly funded research project about „personalization of e-commerce applications" since the year 2000. The project involved three different universities and ten companies that jointly worked on the development of personalization issues.

The research method that we used for the development of the Personalization Map is *action research* (as e.g. described by Cunningham [7]; Baskerville/Wood-Harper [6]; Kock et al. [11]; Lau [12]). There are two essential aims common to all literature on action research: to improve and involve. Our research project on personalization was targeted at the improvement of current e-shop processes and design (*improve*). The employees of the partner companies were intensely involved in the design process (*involve*). The first version of the personalization map was developed in a series of workshops with the first project partner in the year 2001. It was then repeatedly used and refined over the years with other partner companies. The process was thus cyclic, participative, qualitative, and reflective. As is typical for action research, we aimed at the following three areas: (1) improvement of practice, (2) improvement of understanding of practice by its practitioners, and (3) improvement of the situation in which practice takes place.

The research resulted in a number of publications, for example a handbook on personalization [24], an empirical study on personalization [25], as well as papers on legal issues of personalized Web sites [23]. Beyond these publications, the output also comprises the implemented e-shops with their personalization functions, a checklist for legal requirements, and several case studies describing the results of the sub-projects.

Throughout the last six years, we added more than 100 personalization functions to the framework but it is probable that the map is still incomplete as new personalization functions are emerging over time. Due to the size restrictions we had to limit our discussion to one half of the Personalization Map.

2 A Framework for Personalization Functions

There is no single strategy for a successful personalization feature: each company needs to find its own unique selling proposition.

2.1 Figure and Concept of the Framework

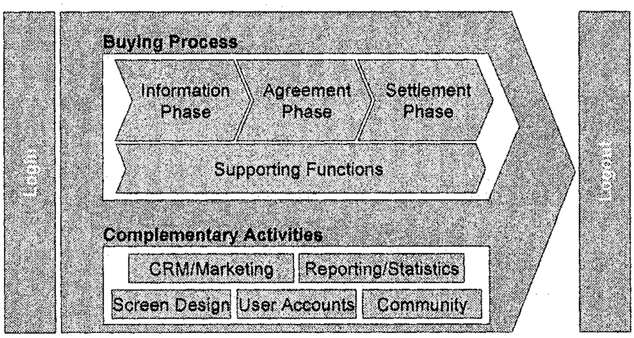

Fig. 4. Personalization Framework

The personalization functions in the Personalization Map either belong to the *buying process/supporting functions* or are part of *complementary activities* (Fig. 4).

The buying process is divided into the following three phases [20, 26] (1) information, (2) agreement, and (3) settlement, and enhanced with overlapping supporting functions. Another conceptual framework for classifying personalization that we used as guidance was developed by Wu et al. [28].

In the information phase customers collect information about products and services. The agreement phase is geared at setting up a contract, fixing details like product specifications, price, delivery, method of payment, general terms, etc. The (physical/virtual) delivery of the product takes place in the settlement phase. The involved parties fulfill their obligations as agreed upon in the contract. For this reason it is also called fulfillment phase [21]. The "supporting functions" refer to functions that support the entire buying process. The functions that belong to the complementary activities may support the human-computer-interaction between the customer and the interface but are not directly related to the buying process. The login and logout bars on the left and on the right point to the fact that personalization should start after a customer has identified himself (login) and should end with the user leaving the store.

2.2 Methodology for Personalization Projects and the Personalization Map

The first step of each personalization project is the identification of the personalization features that need to be implemented for an individual online merchant or e-service provider. In order to facilitate the process and to structure the discussion, we developed a Personalization Map (Fig. 5). This mind map contains a structured view of the world of personalization functions. The following paragraphs describe the branches of the mind map and their specific contents.

As shown in the personalization framework, on the top level, we distinguish between functions for the „order process" (left hand side) and functions for „complementary activities" (right hand side). The two parts contain 9 different branches. Due to space limitations we confine ourselves to only describe the functions related to the order process (left hand side of the Map).

Search functions can be pre-configured to the individual needs of a user (ready to click on e.g. „show required air and water filters for Jonathan Archer High School in Washington").

Customer specific assortments save selection time and make the buying process easier and faster for non-frequent buyers. Limited assortments that are optimized for a company reflect the choices and defaults of the central purchasing department. Often they are the result of negotiations (master agreement) and were implemented into the e-shop by the supplier. An important personalization function is the assortment for current equipment. In general, limiting the amount of displayed products from an existing vast choice of products is a first step to save time in the selection process. Existing equipment (e.g. printers, filter, and installations) can be either pre-defined with sales agents during the initial customer meeting or can be automatically recorded during the purchase process (in case the same supplier offers equipment and accessories in the same e-shop). Once the equipment is known, the shop can limit the product choices to products related to this equipment (e.g. printer-toner type).

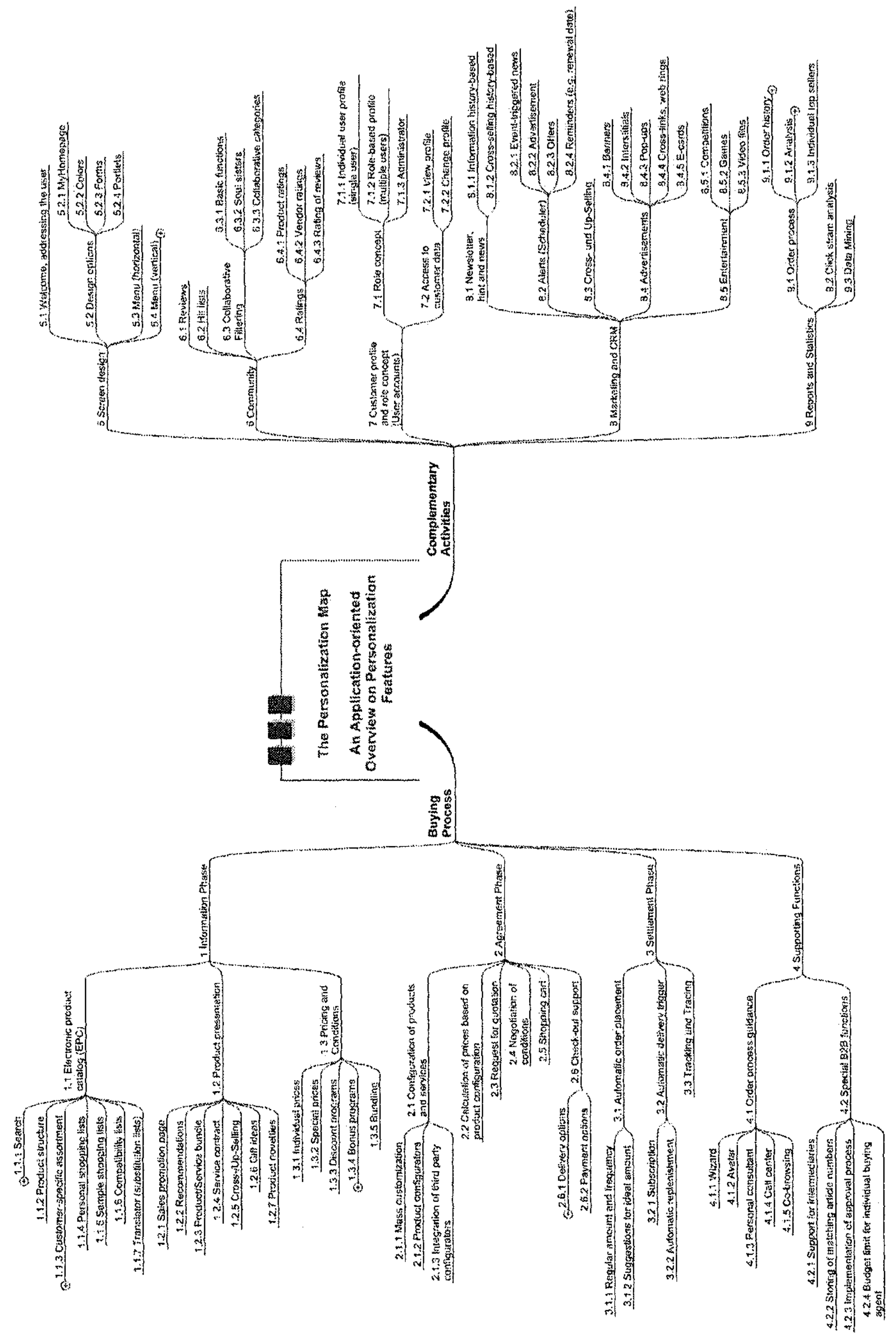

Fig. 5. The Personalization Map

Pre-defined product lists (favorites) help inexperienced employees (they only get a selection of the „right" products for their company). Personal shopping lists facilitate recurrent buys and can be named according to their purpose (e.g. quarterly_toner_purchase_for_marketing_department). They can be created by the users themselves whereas sample shopping lists are pre-defined by the administrator – usually a person from the purchasing department.

Table 2. Information phase

1 Information phase	
1.1 Electronic product catalog (EPC)	**1.2 Product presentation**
1.1.1 Search	1.2.1 Sales promotion page
1.1.1.1 Pre-configured search	1.2.2 Recommendations
1.1.1.2 Criteria-based search	1.2.3 Product/Service bundle
1.1.1.3 Full-text search	1.2.4 Service contract
1.1.1.4 Structured search	1.2.5 Cross-/Up-Selling
1.1.2 Product structure	1.2.6 Gift ideas
1.1.3 Customer-specific assortment	1.2.7 Product novelties
1.1.3.1 Limited (optimized) assortment	
1.1.3.2 Assortment for current equipment	**1.3 Pricing and Conditions**
1.1.3.3 Pre-defined products (favorites)	1.3.1 Individual prices
1.1.4 Personal shopping lists	1.3.2 Special prices
1.1.5 Sample shopping list	1.3.3 Discount programs
1.1.6 Compatibility lists	1.3.4 Bonus programs
1.1.7 Translator (substitution lists)	1.3.4.1 Bonus points
	1.3.4.2 Coupons
	1.3.5 Bundling

Similar to the specific assortment for existing equipment, compatibility lists show complementary articles for items that the buying agent selected in a previous purchase. A translator function can hint at possible substitutes for products which an employee is about to buy – e.g. in case they are currently out of stock or there is a temporary special price available. This can be used as a marketing means for trials or leftovers.

The products and services presented in the e-shop are specifically targeted at a single customer. In order to generate personalized product presentations, certain knowledge about the user is required. These functions are dependent on the provision of significant (implicit or explicit) customer profiles. The first Web page after a successful login should contain personalized product offers. A dedicated sales promotion page should also be embedded in the general navigation menu of this user. Recommendations for products and services are generated on the basis of the user's preference categories. The most common sources of preference categories are transaction profiles (previous purchases) or the user's interaction profiles (click stream). Product/service bundles comprise different (user-adequate) components that – after combining them – appear to be a monolithic good (e.g. a luxury car including a mobility guarantee). The components can be provided by different vendors. Service contracts can be customized for customers according to their special needs (e.g. frequency, duration, extent of service). Cross-selling refers to the current context (status of the order process). Depending on products that the user has looked at or placed in the shopping cart other (alternative or complementary) products are offered on the screen. Up-selling refers to the display of more expensive, higher class products whereas cross-selling implies supplemental or matching products. Amazon even offers corresponding second hand goods sold by customers (down-selling). Customer profiles can also be used to generate gift ideas provided that the customer is willing to share his or her wishes with other users (grant access rights). When buying presents for a known friend (who is a customer at the same e-shop) the system can perform a check on the products already owned by the presentee. The user can be informed about product novelties according to his taste (e.g. e new book in a series of books that he already owns).

Pricing is one of the most common forms of personalization. Usually, prices vary according to the status of the customer (amount of purchases per year, long-term customer, etc.). Special prices are granted to companies which have a master agreement with the supplier (B2B). Discount prices are granted for placing large amounts during a certain period or for ordering at a specific time (e.g. when stocks are to be cleared). Bonus programs are a well-known marketing measure in B2C e-commerce where customers can either collect bonus points (as a kind of currency) or receive special coupons based on their buying behavior. They are often rooted in a physical customer (value) card (e.g. Migros Cumulus Card, Coop Supercard). The bundling of products (guided by the user profile) can lead to discount prices (e.g. "buy two for the price of one").

Table 3. Agreement phase

2 Agreement phase	
2.1 Configuration of products and services	**2.6 Check-out support**
2.1.1 Mass customization	2.6.1 Delivery options
2.1.2 Product configurators	2.6.1.1 Wrapping
2.1.3 Integration of third party configurators	2.6.2.2 Dispatch type
2.2 Calculation of prices based on product configuration	2.6.2.3 Shipping date
2.3 Request for quotation	2.6.2.4 Shipping address
2.4 Negotiation of conditions	2.6.2.5 Billing address
2.5 Shopping cart	2.6.2 Payment options
	2.6.2.1 Advance payment
	2.6.2.2 Debit card
	2.6.2.3 Invoice/debit direct
	2.6.2.4 Pay-by-call
	2.6.2.5 Internet payment system
	2.6.2.6 Credit card
	2.6.2.7 Purchasing card
	2.6.2.8 Financing/leasing

The configuration of products and services allows the customer to choose from a given set of components and services. In this step, the customer composes the final product/service. The Web site guides the customer through this process. Mass customization sites allow the selection of attributes (e.g. color, size) for mass products (e.g. Lego bricks). Product configurators support the assembly of complicated products. Their underlying databases contain information about components including structural design and interoperability. Personalized configurators remember and recall settings for specific users (e.g. "my company only buys IBM PCs") and learn from past purchases (e.g. the store knows the shoe size after the first purchase). In the end, each customer receives an individually customized product based on individual tastes and needs (e.g. price, functionality, etc.). Just like the customized assortments, configurators reduce the burden of choice and are thus a valuable aid for non-frequent or non-sophisticated buyers.

Special software modules for prize calculation help the user to identify the right product for her (e.g. a personal life insurance). They can also help in finding the ideal amount and frequency of items ordered (e.g. depending on delivery costs and discounts). Personalized calculators make use of profile information (existing contract, fixed prices, budget, etc.).

The software modules for the "requests for quotations", the "negotiation of conditions", and "the filling of the shopping cart" make use of the current customer profile. Valuable aids in this context are suggestions (e.g. pre-defined delivery address can be selected for the correct calculation of delivery cost in the quotation), auto-completion of fields (budget limits, individual prices), and pre-defined options ("same conditions as for last purchase").

There are various possibilities of helping the customer in the last step before placing an order (check-out support). As a rule, a customer should never make a selection or indication twice. After choosing wrapping, dispatch type, shipping date, shipping address, billing address once, the system should come up with default settings/suggestions the next time the user is about to proceed to the checkout. These suggestions can then be changed and the changes should be added to the database. The same applies to payment options. This is an area where B2B and B2C transactions are quite different. Whereas options for private end consumers are usually credit card, advance payment, debit card, invoice/debit direct, pay-by-call, or Internet payment systems (such as PayPal, FirstGate, Click2Pay, or others), the most frequent way of payment settlement in Swiss B2B e-commerce is the invoice. A useful extension of the B2C credit card is the so-called purchasing card (allows certain limitations for the purchase of product categories, e.g. alcohol).

Table 4. Settlement phase

3 Settlement phase

3.1 Automatic compilation of an order
- 3.1.1 Regular amount and frequency
- 3.1.2 Suggestion for ideal amount

3.2 Automatic delivery trigger
- 3.2.1 Subscription
- 3.2.2 Automatic replenishment

3.3 Tracking and tracing

The automatic compilation of an order is a typical personalization feature. The frequency and amount of orders are often constant over time. This allows the customer to set conditions for orders which then only have to be accepted in the moment of placing the order. Over time, the e-shop can come up with suggestions regarding amount and frequency of future orders.

It is even possible to go one step further, allowing the e-shop to automatically trigger the delivery of products. In the case of a regular "subscription", orders are generated for a constant amount in a regular frequency. Today, we also encounter "automatic replenishment" based on dynamic customer requirements. The ultimate integration between supplier and customer is called Efficient Consumer Response (ECR) – a term commonly used for a tight EDI integration between two or more partners of the value chain.

Tracking allows the customer to check the delivery status of a *current* delivery. Tracing, on the other hand, enables an *ex-post* analysis of the path of delivery. These services are usually supplied by third parties (DHL, FedEx, Postal Services, and others).

Table 5. Supporting functions

4 Supporting functions	
4.1 Order process guidance	**4.2 Special B2B functions**
4.1.1 Wizard	4.2.1 Support for intermediaries
4.1.2 Avatar	4.2.2 Storing of matching article numbers
4.1.3 Personal consultant	4.2.3 Implementation of approval process
4.1.4 Call center	4.2.4 Budget limit for individual buying agents
4.1.5 Co-browsing	

Supporting functions are not related to *one specific* phase but can rather be found in all phases of an electronic purchase transaction. There are multiple ways for offering guidance to the user. Wizards are written instructions that guide the user through different steps of the order process usually by asking questions like "do you want to perform the following action?". Avatars are virtual representations of sales clerks that may appear as moderators, consultants, or entertainers. They can automatically appear in certain situations or be manually invoked for consultation. They are intended to provide a human-like interaction with the computer. Personal consultants help the customer to find a specific product or service. The customer can interact with the consultant by posing questions. The words are interpreted by the server and pre-defined answers are given. On some Web sites there are buttons that open a telephone connection to a person in a call center. In a co-browsing session, an employee takes the customer virtually "by the hand" by sharing the screen (they both see the same things) and controlling his keyboard and mouse. This way the employee can teach the customer how to effectively navigate the system.

B2B e-commerce has a further potential for specific personalization features. Online merchants are increasingly integrating business partners into their e-shop environments. They also offer e-shop functionality to re-sellers (shop-in-shop concept). Products are ordered in the e-shop of one company and are actually delivered by another company without the awareness of the customer. For this reason, the selling company needs to define its "appearance" on the Web site (e.g. stationary, logo, address, invoice information, etc.). In order to facilitate procurement matching article numbers can be stored on the sell-side server giving the buying agent the possibility to use the internal article numbers for placing orders (they usually know them by heart). The customer's approval process can also be implemented into the e-shop. Once the order has been entered into the system the supervisor will be asked to confirm the release of the order (e.g. by sending an e-mail with the link to the order information). The same applies for the limitation of budgets or product categories for certain employees. Once they have e.g. reached a monthly limit the automatic processing of orders is stopped.

3 Discussion

The Personalization Map presented in the previous sections provides a convenient overview of personalization functions. All functions shown in Fig. 5 support the human-computer interaction in a shopping environment. Although we are aware that the Personalization Map will never be complete in the sense that it will contain *all* possible personalization functions, it stimulates a general idea of what is possible and of what could be appropriate for a specific e-commerce application. There will never be an implementation of all functions into one single e-shop. A personalization endeavor is a selective process in which each company needs to find the appropriate functions for its given context.

As can be seen from the overview in section 0, the recommendation of items (1.2.2 in the Personalization Map) does only take place in the information phase and is only one of many other functions. Nevertheless, recommender systems are most often discussed in the literature of personalization. Their attraction for researchers can be explained in that they show impressive results for individually tailored products based on sophisticated algorithms which are valid candidates for analysis and improvement. Many functions listed in our Personalization Map are useful but rather simple as they only provide stored information (e.g. delivery or payment options).

With the help of our personalization projects we could show that it is not the most sophisticated but the most purposeful function that has the greatest impact on customer satisfaction.

4 Summary and Further Research

In this paper, we presented and discussed an application-oriented classification for personalization functions that can be used to identify personalization functions in a personalization project. The trigger for coming up with this personalization overview was the need for a common understanding of all possible personalization functions at the beginning of the personalization projects mentioned above. The most important findings regarding the Personalization Map are:

- There is no standard procedure for the selection of personalization functions in a given context. Every company has to identify the most appropriate personalization functions for its own e-commerce environment.

- The concept of personalization goes far beyond recommender systems. Every measure that supports the customer in interacting with a user interface based on previously stored, user-specific data is part of personalization.

The Personalization Map in its current form contains a (still incomplete) picture of the universe of personalization functions. We will continue to enhance this overview adding new functions that emerge. Future research will be used to validate the classification framework. We have recently started five new projects with company partners in which the Personalization Map will be applied and validated.

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Multidisciplinary models and guidelines for eProcurement projects: the eReadiness phase

C. Batini, F Cabitza, G. Cammarota, D. Ciriaci, M. Corsi, A. Maurino, R. Russo, S. Scipioni. M. Telaro

DISCO, Università di Milano Bicocca
{batini,cabitza,maurino,telaro}@disco.unimib.it
LUISS Guido Carli Roma
{gcammarota,mcorsi,dciriaci} @luiss.it
DIS, Università di Roma "La Sapienza"
{ruggero.russo,sirio.scipioni} @dis.uniroma1.it

Abstract. This paper presents a multidisciplinary methodology for developing public eProcurement (eProc.) projects in countries whose economy are either emerging, developing or in transition. The focus is on the first part of the methodology, namely eReadiness. Our aim is to bring out a number of issues, which are currently challenging many eGovernment projects through an integrated approach by encompassing sociological, economic, organizational, legal and technological factors.

1 Introduction

eProcurement (eProc.) has been considered as a relevant area in eGovernment since the Green Paper issued by European Union [1] and has been confirmed in the strategy defined at the Lisbon EU summit in 2000 and in the 2005 action plan [3]. A number of directives have been outlined concerning eProc. Due to the interdisciplinary nature of the area, goals and objectives for eProc. pertain to a wide range of research issues, i.e. social, economic, organizational, juridical, and technological research issues. In Figure 1 the inter-relationships among such issues are outlined, as compared with the traditional "technology centred" approach.

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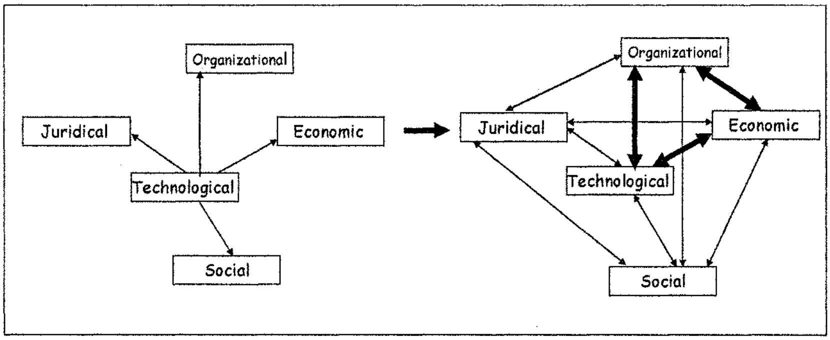

Fig. 1. The technology centered vision and the multidisciplinary one

Concerning first the specific areas:

- Sociological issues provide an improved understanding of the interactions between citizens and users at large, the business sector and public administration, and prevent or buffer possible conflicts between the uses of different modes of interaction and the various established cultures.
- Economic and organizational researches provide predictions and evaluation of impact of the effects of eGovernment projects on economic growth. Furthermore, they allow identifying the implications of socio-technical processes and effects for citizens, businesses and institutions.
- Juridical aspects are crucial in every project involving Public Administrations (PAs), since the organization of PA and the administrative processes are deeply influenced by the general legal framework and by the specific laws and rules enacted for the new initiatives to be undertaken.

This paper presents guidelines to steer the sustainable and effective development of eProcurement systems for the PA, especially in the context of the Mediterranean area, by using a multidisciplinary approach, considering the social, economic, organizational, legal, technological dimensions. For the sake of brevity we focus mainly on the relationship among economic, organizational and technological issues; with regard to technologies, we are specifically concerned with service oriented computing and information management, which are usually seen as relevant issues in innovative eGovernment projects. Guidelines concern two macro-phases of the eProc. design activity, namely a. eReadiness, and b. Design of the eProcurement solution. In this paper, for reasons of space, we focus on the eReadiness macro-phase. The reader interested in the second macro-phase can refer to [2].

The paper is organized as follows. In Section 2 we present technological, economic, organizational eProc. models used in our guidelines; in Section 3 a short description of the whole methodology is provided. Section 4 focuses on the first sub-phase of the process, Context reconstruction; Section 5 describes the second phase, eReadiness, which provides the name to the whole macro-phase. Section 6 presents related works and, finally, Section 7 draws conclusion and future research.

2 eProcurement models

According to the graph of influences introduced in Figure 1, the organizational structure of the eProc. process should be coherent with the technological infrastructure, and, at the same time, should be chosen considering mainly the impact of the eProc. process in the economy of the country. In order to show how technologies can become an enabling factor in eProc. projects, we (shortly) present the technological, organizational, and economic models adopted in our proposal.

In an eProc. system a new technological architecture is needed, to coordinate information exchanges among the information systems of the several companies and the Public Authorities involved in an eProc. process, trying, at the same time, to preserve the autonomy of each involved subject. The achievement of this target requires cooperation among the various administrations to develop the ICT process, also taking into account the constraints and the differences among organizations [4].

In the traditional client/server transactions (see Figure 2.a) if a citizen or a business receives a service whose supplying requires the interoperation of several PAs, it has to interact separately with the different PAs involved. This result is an increase of the time for the supply of the service and in its worse quality, for the absence of an automatic process managing the operations and for problems related to the fragmentation of responsibilities, possible interruptions of services inside each agency, and for the heterogeneity of their systems. In Figure 2.b a possible technological architecture proposed to implement the improved interaction is shown.

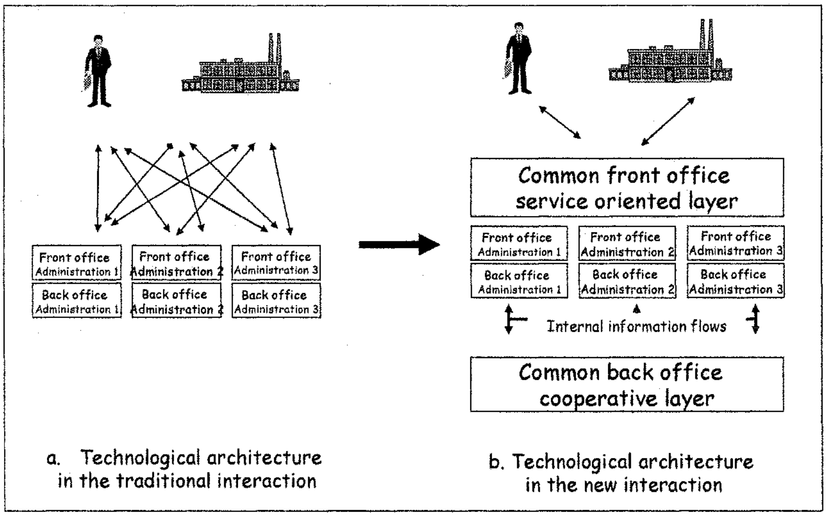

Fig. 2 Technological architectures for G2B, G2C relationships

The front-office layer allows a more efficient and automatic communication with the clients through the use of web based technologies (e.g. web portals), while the back office layer is introduced to improve the communication among the different cooperating organizations. Focusing on the back-office side, through the service oriented technologies [5], organizations implicated in a specific eProc. process can cooperate using common interfaces which allow the interoperable communication among them even if their internal systems are implemented with different technologies.

With regard to organizational issues, eProc. can be realized in different forms which are referable to two models, the Indirect Procurement System (IPS), and the Direct Procurement System (DPS). Such models can be described on the basis of two key-concepts: the Contracting unit, namely the public administration which purchases goods and services and bears the relative costs, and the Ordering subject, which manages the purchasing phase of the eProc. process.

In the IPS model, the Contracting unit makes the demand estimation, the budget definition and the need notification. The sourcing activity is handled by a different subject, which does not coincide with the Ordering subject. In the IPS model (for example, in Italy [6] and in Lebanon [7,8] the Ordering subject can be a corporate body, which can be either public or private. The other phases of the eProc. process are managed by the Contracting unit. Differently, in the DPS model (adopted, for example, in Morocco [9]), the Contracting unit coincides with the Ordering subject. Here the public administration which purchases good or services manages the purchasing procedure.

Regardless the eProc. model chosen, the use of ICT in the procurement process may lead to benefits; for example, the costs and time reductions for managing information, and the enhanced integration, comparability and quick update of data coming from different sources. Moreover, ICT investments can induce, as a direct effect, an increase in labour productivity (more capital per worker and reorganization of the back-office procedures) and as indirect effect, through the well-known accelerator/multiplier effect, GDP growth. Clearly, there exist economic and social barriers to the achievements of these targets, and the possibility of achieving them is correlated with the model of eProc. chosen by a government. In fact, the IPS model allows i) better inventory coordination and cost control, namely, economic rationality, ii) more simplification, due to the high procedural management uniformity, and iii) improved accountability, due to the reduced decision maker units and to standardized decision making. The IPS model may lead to less competitive markets because not every enterprise may be able to supply all the goods and services ordered by the central administration to cover all the needs identified. In particular, there may be a stronger loss of competition if both central and local public administrations are obliged to purchase through a single subject (as in the IPS). The DPS model, instead, allows the achievement of an high autonomy of the single administrations and enables the access of new suppliers, even of the smallest and local ones. However, the DPS induces a loss of control due to the improved number of decision maker units. Finally, among the barriers to the introduction of an eProc. system and to the achievement of the economic goals stressed above, there is the low level of economic development, the existence of poor private competitors services (as stressed before), and a low literacy level.

3 The guidelines at a glance

Due to the many factors involved in the implementation of an eProc. system, in order to manage the complexity, we propose a set of guidelines which are drawn from a multidisciplinary corpus of models, lessons learned and best practices. As described in the introduction, two are the main macro-phases of an eProc. development project: eReadiness, and Design of the eProc. solution. The first macro-phase (see Figure 3, where inputs and outputs of the process are described) is in charge of collecting, organizing and evaluating the existing eProc. solution according to a multidisciplinary approach. The result of this macro-phase is a quali/quantitative evaluation of the actual system.

The second macro-phase is in charge of defining objectives, strategic and detail plans for the design (or re-design) and development of the eProc. system. Even in this macro-phase, multidisciplinary models and tools help the designer to understand and choose the best instruments to use in order to obtain an effective project. eReadiness includes the Context Reconstruction and Context Assessment phases while the Design of the eProc. solution includes the eProc. process reengineering and eProc. Design phases.

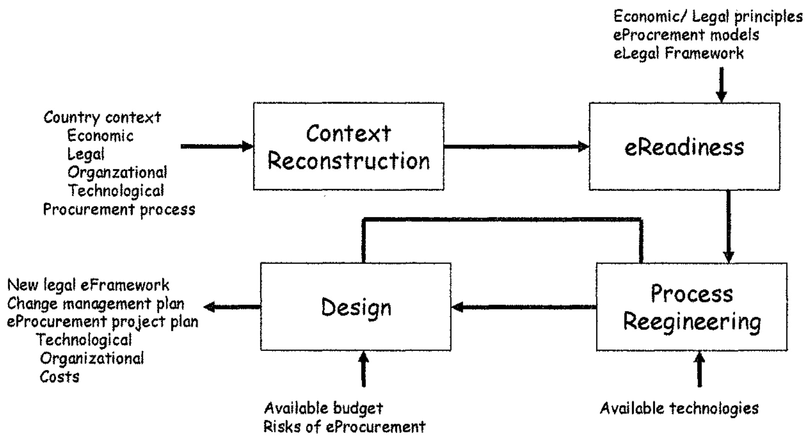

Fig. 3 Methodological framework for eProc. projects

The guidelines proposed in the following can be seen as a methodological framework within which the policy maker for an eProc. system in her country can find general directions and specific indications for the choice of the best path of intervention.

4 Context Reconstruction

The goal of the first phase is to provide a clear understanding of the organizational-economic-technological framework of public procurement of goods and services in the considered country and, more specifically, a more detailed picture for some good and service typologies aimed at detecting specific organizational networks of stakeholders.

This phase is performed through two different steps: *Data collection*, where a wide acquisition of knowledge is performed, and *State reconstruction,* where the relationships among the dimensions previously found are defined. In fact, each procurement activity, from demand estimation to accounting, involves several actors, which is both the organization units of the public administration, and the service and goods suppliers and any other juridical entity which has a share or an interest at any level in the overall procurement process. They can be seen as bound together by thick (social and organizational) networks of relationships; such relationships correlate the existing policies and practices to the roles and functions which apply them and to the (often implicit) interests which move their actions. Notice that this phase can be optionally skipped in the case in which the results of the phase are already available or the production of such data is too much expensive with respect to the global cost of the project.

In the Data collection step we gather data from heterogeneous sources; such data came from two different types of sources: primary or secondary sources. In the former case the data are directly acquired by the source; for example, the set of laws regulating the eProc. process can be taken by legal office of public administration. In the case of the latter source type the data was already elaborated by third part elements. For example, the GDP of a country can be acquired by the national statistical bureau. The choice of which type of data source to consider is related to a number of factors such as: cost for producing data, reliability of the data source, time needed to produce data. Examples of data which has to be collected for an eProc. project are:

- economic dimension: GDP, effect of eProc. cost with respect to the public budget;
- legal dimension: legal framework for eProc.;
- social dimension: corruption rate;
- organizational dimension: general organization chart of PA, most relevant procurement stakeholders, current workflow of procurement process;
- technological dimension: technologies used in PA.

In the State reconstruction step, correlations between the elements found in the previous analysis are found, according to the relationships presented in Figure 1. In particular we characterize the main organizational networks involved in the current procurement process and correlate: i) organizational units (organizational dimension), ii) the roles they cover in each procurement subprocess (legal), iii) the data sets they manage and use in the processes they are involved in (technological), iv) the ownership and accountability they have with respect to the different data sets (economic/ legal dimension), and v) the functions such data have in the subprocess (technological).

Moreover, it is important to correlate procurement subprocesses with the rules regulating them, both general laws (e.g., state laws concerning privacy) and lower level rules (e.g., department procedures and business rules).

To organize such information and to explicit the above mentioned correlations, we propose to use tables as effective instruments. With regard to the correlations between technological dimension and the organizational one, we propose to conceive and populate some matrixes:

- an Actor/ Data set matrix, where each cell specifies whether an organizational unit either creates (i.e., owns) or just consumes (i.e., uses) a set of data such as good orders, contracts, tenders.
- a Process / Actor matrix, where each cell specifies whether an Actor either leads or participates in the procurement subprocesses (e.g. order collection, tendering, contracting) and hence assigns the responsibilities for the digitization activities proposed in the following methodological phases.
- a Process / Data set matrix, where each cell represents the relationship, in terms of inputs and outputs, between information and internal processes which use and possibly transform it according to organizational requirements.
- an Actor / Technology matrix describing technologies presently used by each organization involved in the eProc. process. Such a matrix will be used to make an evaluation of the technological advance of the organizations involved, in order to plan effectively the most suitable modules for the overall architecture. The presence of legacy systems, for example, requires the implementation of suitable wrappers to support the communication among the different organizations.

In Table 1 we report an example of Actor/Data set matrix, applied to the Italian Procurement system. The Chambers of Commerce provides the complete list of business actors (the Business registry) to the ordering subject, which publishes a Request for Quotations about the tender to suppliers.

Table 6 Example of the Actor/Data set matrix

Actors/ Data Sets	Business registry	RFQs	Product quotations
Ordering Subject	Uses	Creates	Uses
Suppliers		Uses	Creates
Chambers of Commerce	Creates		

5 eReadiness

eReadiness refers to the extent an organizational and social network is ready to accept the ICT enabled innovation of processes it is involved in and, above all, how ready it is to take advantage from digitization. This phase determines how existing policies and practices and the institutional framework favor the implementation of a sustainable eProc. system. In order to get such an evaluation, the phase encompasses: i) a qualitative assessment aiming at identifying the main problems and the corresponding critical areas, i.e., both the processes (or activities) and the related networks of the stakeholders, users and customers of those processes, and ii) a quantitative assessment identifying a reliable measurement of the main factors to base the following phases on.

As regard eReadiness, a number of proposal exist to assess eReadiness at country level (see Section 6); we adapt them to provide a comprehensive and synthetic indicator of the extent an organizational unit (and the network of partners involved) is ready to gain the benefits offered by ICT in terms of policy, infrastructure and ground-level initiatives.

With regard to qualitative aspects, the major problems related with the procurement services are detected by involving the key stakeholders of the current procurement process through interviews, questionnaires and participative observations. For example, assume that questionnaires return these problems: (1) requests for quotations take a long time to reach suppliers (and so replies); (2) some requests are lost or misdelivered; (3) prices are still too high. These are quite heterogeneous in scope and nature and relate to different critical areas. Notwithstanding that, those indications give us precious elements to identify problems to involved areas so as to identify critical areas and correlated processes and stakeholders. The problems reported by users can be related, respectively, to the use of regular mail, to incomplete/inaccurate address data and to the awarding process (e.g., sealed bid vs reverse auction).

Quantitative analysis takes into account finding the most relevant indicators to measure and then assigning them correct values according to the state reconstruction phase. In the following we focus on economic and technological issues, providing several examples of indicators.

In our view, an eReadiness assessment with reference to socio-economic indicators should assess first the macroeconomic environment and the availability of ICT capacity and training (literacy level, enrolment in secondary and tertiary education institutions, % of schools equipped with computers, % of internet-connected computers of university students, number of IT specialists, engineers and programmers, number of managers and officers). Such information is important in order to evaluate whether there exist the general economic and legal preconditions for implementing an eGovernment system.

Secondly, it should focus on the legal/regulatory environment (interconnectivity and interoperability, use of systems of advanced electronic signature, use of systems of certified e-mail, use of secure electronic payment systems), it should evaluate the diffusion of ICT use in business and in the public administrations involved, and its affordability. That is to say, the access to and use of ICT among businesses (% of companies which have at least one computer; % of companies with internet access), the local businesses with websites (% of companies which have a web presence), the use of ICT by small and medium-sized enterprise (% of SMEs using ICT for procurement), the level of eCommerce (% of growth of eCommerce; % of firms selling products online). At the same time, to evaluate the "internal" impact of eProc. and whether an administration is eReady or not to implement and use an eProc. system, the assessment should evaluate the skill level of the public servants, the diffusion of computers in public administration, (% of connected computers in the PAs involved, number of IT specialists, engineers, managers and officers). Furthermore, it should assess the communication costs (cost of telephone services, cost of mobile phone), the cost of internet access and use (ISP and telephone use charge, price of modems, price of PCs), the mobile phone penetration, the organizational costs (costs of consultancy and training in Public Sector), the cost of Public Sector staff (average salary), the cost of hardware and software (amount of public sector investments in hardware and software) and the total amount of procurement. Such information is important to evaluate whether eProc. may act as an enabler of ICT diffusion in private business, to evaluate the potential impact of eCommerce on competition among firms (in particular on SMEs), and to evaluate the cost of investments in training, hardware, software etc. needed to implement it.

Technological issues concern, in our approach, the area of cooperative architectures, including service oriented computing, and the area of information quality. With reference to architectures, examples of indicators concern:

1. the diffusion and obsolescence of legacy systems in PAs and private enterprises. Such information is important as it influences the strategy for the development of the architecture (use of wrappers or redevelopment of the information systems of the organizations);
2. the diffusion of middleware software (e.g. message queues, Service oriented computing, remote method invocation) to interconnect servers, measured e.g., through the % of servers connected to a middleware.

With reference to information quality, indicators concern:

1. the presence in the information processing activity of control activities, which guarantee a better level of accuracy in data;
2. the % of data exchanged in electronic format, that do not have to be imputed with error prone procedures;
3. the level of currency in updates, that guarantees usage of the last copy of data;
4. the completeness of data in representing phenomena of interest, e.g., the completeness of registries of businesses involved in tenders;
5. costs due to low quality, critical areas and administrative processes responsible of low quality.

From the matrixes proposed in Section 4, we identify relevant information quality dimensions and metrics for each data set and flow, and measure them so that critical areas can be identified to focus on in the reengineering phase. For instance, we can detect that the business registry is updated every three months and errors in updated data have an average rate of 3%; consequently, accuracy and completeness of the business registry is, respectively, 97% and 95%.

At the end of this step we may calculate an eReadiness Global Index, plus a set of recommendations to be considered in the design phase. E.g., the low number of IT specialists and officers may lead to outsource system development and management, while a learning plan can be set up for managers to avoid the externalization of strategies.

6 Related work

The literature on eProc. [13] recognizes the necessity of an integrated effort of bringing knowledge related activities together, because public procurement is an extremely complicated function of government and requires interdisciplinary skills and knowledge including economics, political sciences, public administration, accounting, marketing, law, and engineering. Among the examples of critical issues for the successful implementation of any IT-system, Kawalek et al. [14] stress the importance of top management support, organizational adaptation, and training of employees. Besides, Oliveira and Amorin [15] consider an extra set of factors such as financial risk, risk of building a portal, and legislative issues necessary for the implementation of an eProc. system. In fact, procurement is a bilateral process, and the issue of whether public eProc. is adopted depends on the technological capabilities of public institutions and their willingness to adopt the system: whether efficiency gains are realized depends on whether potential adaptors are willing to sacrifice political independency for an increase in the overall public procurement system [16] However, the public procurement system's ability to accomplish goals or policies is influenced by its environment and, at the same time, influences its environment [13]

Our approach tends to stress that the use of ICT in a procurement process may lead to increased productivity of labour in the public sector because it results in a reorganization of the back-office procedures. If an effective relationship between ICTs and economic growth exists, it can be reasonable to wonder which are the preconditions which make it ready, and whether a country is more or less ready to benefit from it.

The main e-Readiness assessment tools comparison reports [10,11,17] basically categorize e-Readiness tools with respect to what they measure and how they do it. eReadiness assessment tools and models can be divided into two main categories: those which measure readiness for business or economic growth (*e-economy assessments*) e.g., [18,19], and those which focus on the broader possibility of the overall society to exploit ICT and benefit from it (*e-society assessments*), see [12,20].

As regards the measurement methodology, most of e-readiness assessment tools comparison reports categorize tools in: statistical or questionnaire based [21,22] country case studies (e.g., the USAID ICT Assessment reports); interview and survey based third party reports [23].

In our view, an eReadiness assessment should support public decision makers' choice of how to introduce eProc., hence it has a strong practical and specific aim and it must predict impacts on i) the efficiency level, namely the economic return of the investment in eProc. on the involved public administrations, and ii) the effectiveness level, i.e. the gain in productivity of those public administrations involved in eProc. implementation with reference to traditional public procurement, and growth and private sector productivity.

With regard to technological issues, examples of methodologies for the choice of dimensions and measures and for the qualitative vs quantitative evaluation are proposed by Lee et al. [24], Kahn et al. [25] Pipino et al. [26], De Amicis et al. [27].

The distinctive aspect of our approach is to consider costs due to low quality, and relate them to administrative processes.

Several paradigms and technologies are proposed to cope with the problem of the development of distributed cooperative systems, the most important approaches are:

- service-oriented systems [28], based on the Web service technology which allows greater interoperability (through the service composition), and reuse of software and services;
- data integration in cooperative systems which allows to achieve the transparency of data with regard to the technological heterogeneity of the systems involved [29];
- intelligent agents systems, agent-based methodologies [30].

In our approach an original contribution is proposed with regard to the automatic and distributed orchestration of eProc. process among organizations. In the presented approach, in fact, orchestration is seen as a methodology to automatize the workflow of the cooperative process among organizations involved in eProc., thus simplifying the process and providing better and faster services for the private sector.

7 Conclusions and future research

In this paper we propose a set of methodological guidelines for the eReadiness phase, for building eProc. systems in public administrations. The key element of the methodology is its multidisciplinary approach that considers economic, organizational, technological issues and their relationships in the design of eProc. projects. We are now interested to practically apply the methodology in real life contexts. In fact, we are on the point to apply the whole process in public administrations of some countries such as Morocco and Lebanon. The experimentation will provide useful indications in order to better define the right balance among the theory and practical approaches.

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The Adoption of RFID-based Self-Check-Out-Systems at the Point-of-Sale

An empirical investigation

Christian Tellkamp, Thomas Wiechert, Frédéric Thiesse, and Elgar Fleisch
Christian Tellkamp:
Arvato Services Benelux B.V., Amsterdamsestraatweg 26, 1391 AB Abcoude, The Netherlands,
christian.tellkamp@arvatoservices.nl
http:// www.arvatoservices.nl
Thomas Wiechert, Frédéric Thiesse and Elgar Fleisch:
University of St. Gallen, Institute of Technology Management, Dufourstrasse 40a, 9000 St. Gallen, Switzerland,
{frederic.thiesse, thomas.wiechert} @unisg.ch
http://www.item.unisg.ch
Elgar Fleisch:
ETH Zurich, Department of Management, Technology, and Economics, Kreuzplatz 5, 8032 Zurich, Switzerland,
elgar.fleisch@unisg.ch
http://www.im.ethz.ch

Abstract. It is the aim of this paper to identify the most important factors that influence a retail company's expectations and motivations regarding RFID implementation at the point-of-sale based on empirical data. The data for our research was gathered by means of a questionnaire and analysed using a structural equation model. The results suggest that retailers which expect a high potential from RFID use intend to adopt early compared to the industry average. Interestingly, the current level of RFID capabilities does not seem to influence the expected timing of adopting RFID-based check-outs. However, our results show that companies which expect high potential benefits have significantly higher levels of RFID knowledge. Customer waiting time seems to be a main driver for companies to examine new technologies such as RFID-based check-out terminals. Retailers that recognize customer waiting time in front of the POS terminal as a problem expect higher benefits from RFID and are more innovative with regard to POS technology. Contrary to our expectations, pressure to save personnel costs did not have a significant impact on the assessment of expected benefits from RFID. This indicates that

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the main driver for companies to consider RFID for automating the check-out process is customer service rather than cost savings.

1 Introduction

The technology of Radio Frequency Identification (RFID) and its applications are currently the subject of enormous interest on the part of the retail industry and beyond. Retailers such as Wal-Mart, Tesco and Metro are particularly hoping for gains in operational efficiency in their logistics processes. Until now, RFID roll-outs are limited to case and pallet level tracking, and focus on the upstream supply chain from manufacturers up to the retail shelf. The ultimate goal, however, is item-level tagging which is expected to improve product availability, increase labour efficiency, reduce theft, provide easy access to product information, enable interactive marketing applications, automate the check-out process, etc. [1, 2, 3, 4, 5].

One important field of application for RFID technology on items is point-of-sale (POS) automation. RFID technology makes the bulk identification of objects without line-of-sight possible. This has two fundamental advantages: First, it can reduce personnel costs, and second, it can improve customer satisfaction by reducing waiting lines and putting customers in control of the check-out process. Furthermore, self check-out terminals require significantly less space on the sales floor compared to traditional POS installations.

Retailers that improve the check-out process may achieve an increase in customer service and satisfaction. According to a survey by IBM and the National Retail Foundation (NRF), 76% of customers stated that the check-out process is very important when it comes to improving the shopping experience [6]. These results made the check-out process the most important step in the shopping process in this respect, ahead of product search, purchase decision, after-sales service, and pre-store information. Similar surveys by Capgemini, Intel, Cisco Systems, and Microsoft [7] and KPMG and Indiana University [8] support these findings.

There are, however, some challenges to overcome before the vision of an RFID based check-out becomes reality. Obstacles include the cost of RFID tags, RFID read rates, integration of tags into packaging, and privacy concerns. Furthermore, in order to be practicable, a critical mass of products may need to be equipped with RFID tags before retailers are likely to install RFID-based check-outs. The same phenomenon was observed during the introduction of the bar code when the sales of scanners did not take off before a minimum of 85 percent of all products were equipped with the code. This number was reached in the late 70's, i.e. more than six years after its invention [9].

Against this background, this paper presents an empirical study of factors that influence the timing regarding the introduction of RFID technology for self check-out systems at the POS. The remainder of this paper is structured as follows: First, the paper discusses the use of RFID in the retail industry with a focus on the benefits of POS automation. In the second part, our research model is presented. Then, we briefly describe the data sample, followed by research results and a discussion of important key findings. The paper closes with a summary and an outlook on future research opportunities.

2 Background

2.1 RFID in the retail industry

RFID technology facilitates the automatic identification of physical objects by radio such as industrial containers, pallets for cargo and freight, drink cans and even people. The identification procedure operates through a transponder label that can be detected without contact or line-of-sight through a reading device equipped with an antenna. In contrast to goods identification by the standard bar code, RFID is characterised by (a) bulk read capability, (b) identification without line-of-sight, (c) unique identification of a single object, (d) data storage on the object, and (e) robustness against environmental impacts and destruction [10, 11].

RFID technology has already been in use for many years in a broad range of applications such as animal identification and asset management, i.e. typical closed-loop applications with high-value goods. In recent years, however, the focus was increasingly shifted to open-loop applications such as fast moving consumer goods (FMCG) and retail scenarios. These applications can be roughly divided into the following classes [12, 13]:

- *Supply chain execution.* Despite the introduction of the bar code and related technologies many years ago as well as industry initiatives such as Efficient Consumer Response (ECR), the retail industry has not managed to eliminate several issues, e.g. shrinkage throughout the entire supply chain and inventory inaccuracy [14]. Automatic identification technologies such as RFID are expected to further improve physical process efficiency and to positively address some of the primary causes that lie beyond the above-mentioned issues.
- *In-store operations.* A second field of application is the optimisation of processes within stores, e.g. in order to reduce out-of-stock (OOS) situations [15]. In the retail sector, 5–10% of required products are not available [16]; in the case of specially promoted products the figure is 15% [17]. For these reasons, retailers such as Wal-Mart and Metro seek to improve the replenishment-from-the-backroom process by placing RFID readers at the gate between backroom and store floor. The readers record the movement of cases between the two locations and thus deliver RFID data that allows for distinguishing between shop floor and backroom inventory [18].
- *Consumer experience.* Socio-demographic changes such as increased number of dual-income, single-parent and technology-familiar households, have significantly altered shoppers' expectations, demands and spending patterns during their traditional shopping experience [19]. Traditional factors of

competition, e.g. price level, selection and location, although still important, are no longer sufficient in order to achieve competitive differentiation. As a result, retailers concentrate on enhancing the end-to-end shopping experience aiming to win customer loyalty by inventing innovative ways of satisfying the new consumer needs [3]. In this context, examples for RFID-based scenarios are product information kiosks and self check-out systems that address the needs of the 'self-service consumer'.

2.2 RFID-enabled Self-Check-Out

In the retail environment, the POS is the place where the actual business and financial transactions take place. This is not to be confounded with the point-of-purchase, which in today's stores has moved to the shelves where customers pick their goods and put them in a shopping trolley. Usually, the POS is the check-out area where customers put all goods that they have placed in their shopping trolley onto a counter or a conveyor belt. The cashier then picks up each of the products, locates their bar code and scans each product code manually. The customer then puts all products back into the trolley or into shopping bags. At last, the payment concludes the transaction.

Modern POS systems have nothing in common with the classic cash register anymore: They contain full fledged personal computers integrated into the retailer's warehouse and supply chain management systems. Nevertheless, today's check-out areas and activities leave an enormous potential for improvements [20]. The above-mentioned sequence of activities obliges consumers to spend more time in the store than they actually wish to, by slowing down the check-out process and accumulating waiting lines. In addition to being uncomfortable for the customer, today's check-out process is labour-intensive and thus expensive for retailers. German retailers' general expenses, for example, constituted 24.1% of revenues in 2003; 41% of these costs were labour costs. Since the average retailer's operating margin has sunk to -4.2% of revenue, the need to cut down on expenses is evident [21].

Self-service solutions have been implemented for years in other industries. Prominent examples are automated teller machines in banks, self check-ins at airports and self-service payment systems at gas stations. Some self check-out systems have also been implemented in the retail industry, e.g. by Metro in Germany and Delhaize in Belgium. In Metro's so-called 'Future Store', for instance, customers may choose between traditional check-outs and bar-code-based self-scanning stations. According to a report by Metro and BCG, the acceptance of self check-outs has increased from 28% in 2003 to 54% in 2005 [22].

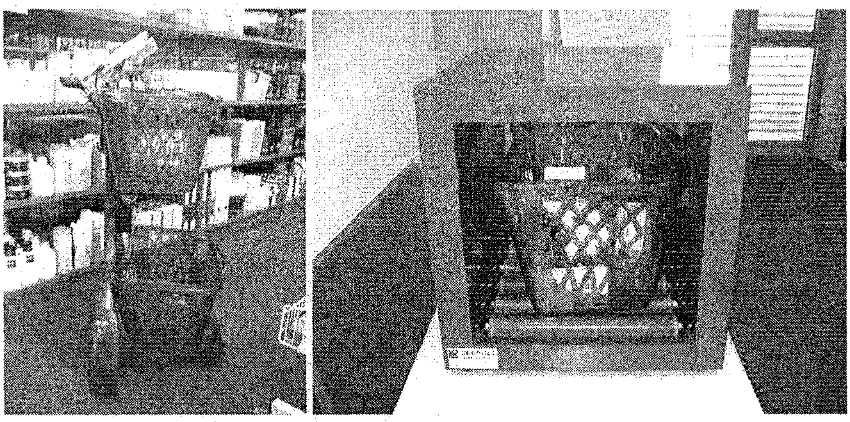

Fig. 1. Shopping trolley and tunnel reader in the Migros Smart Store

RFID-based self check-outs offer various additional advantages over bar code scanning. Most notably the customer does not have to scan each single item any more. RFID readers at the POS rather process the contents of an entire shopping basket within a single scan operation. A prototype of an RFID-enabled check-out solution is depicted in Figure 1. In this example from Migros, Switzerland's largest retail company, plastic baskets are scanned in an RFID tunnel reader at the POS.

3 Empirical Study

Against the background of the current interest in RFID and its use at the point-of-sale on the part of the retail industry, we wanted to get a better understanding of the drivers and influences on this specific case of technology adoption. For this purpose, we conducted an empirical study with executives from retailers in the German-speaking part of Switzerland and used the data as a foundation for our analysis. The following sections describe our approach and the main findings that could be derived from the results.

3.1 Research Model

The goal of our investigation was to analyse the most important factors that influence a company's expectations and motivations regarding RFID implementation in its own operations. Since we already had some ideas of the causal relations based on several industry projects, expert interviews, and a review of related literature, we decided to use structural equation modelling (SEM) as a methodology that is adequate to confirm an explanatory model with data that we would acquire from a questionnaire-based inquiry. SEM is an extension of the general statistical linear model that simultaneously estimates relationships between multiple independent, dependent and latent variables. It allows the modeller to explicitly capture unreliability of measurement in the model, in theory allowing the structural relations between latent variables to be accurately modelled.

Our experiences indicated that companies consider better customer service, resulting from a quicker check-out and reduced personnel costs as the main benefits of RFID-based check-out systems. Therefore, we decided to ask companies how they rate the current situation with regard to personnel costs and waiting time. Our implicit assumption was that the higher the personnel cost and waiting time pressure, the higher a company would rate the potential benefit of RFID-based POS terminals. The perceived benefit, which was assumed to reflect a company's motivation, would affect the timing decision, i.e. when to invest in RFID. Of course, this assessment would also be strongly influenced by the company's expectation regarding the availability of a solution. Furthermore, we expected that the current level of knowledge, as a proxy for a company's technological capabilities, would influence the timing decision. Finally, the level of knowledge was expected to differ between companies, depending on a company's attitude towards POS innovations and its size.

The complete research model is depicted in Figure 2; constructs and hypotheses are summarised in Table 1.

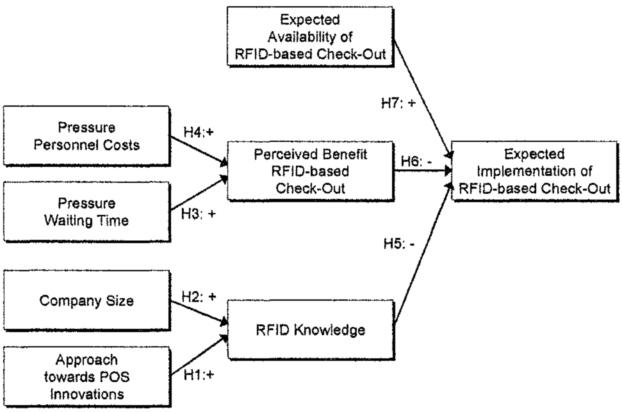

Fig. 2. Implicit a priori research model

Table 7. Description of constructs and hypotheses used in the research model

Construct	Explanation and derived hypotheses
Approach towards POS Innovations	Describes the company's innovation culture regarding POS-related innovations. A company that generally drives innovations in the field of POS should be more likely to drive the innovative RFID self check-out approach. → *H1: A positive approach towards POS Innovations is positively correlated with a large amount of RFID knowledge within the company.*
Company Size	Describes the company's number of affiliates and the number of installed POS systems. A large company with a higher number of POS systems should be more likely to be willing to drive RFID based check-out systems because more resources are necessary to do so.

	→ *H2: Large company size is positively correlated with a large amount of RFID knowledge within the company.*
Pressure Waiting Time	Describes the degree to which waiting lines in front of the POS are considered a problem for the company. A company that regards waiting lines as a serious problem should perceive a higher benefit in a technology that may help it to reduce these lines. Therefore such a company should be more likely to investigate such innovations and drive an early adoption. → *H3: High pressure regarding waiting time is positively correlated with a company's perception regarding the benefit of RFID-based check-outs.*
Pressure Personnel Costs	Describes the degree to which a company considers its personnel costs as a problem to its competitiveness. A company that regards personnel costs as a serious problem will perceive a higher benefit in a technology that may help it to reduce these costs through automation. Therefore such a company should be more likely to investigate such innovations and drive an early adoption. → *H4: High pressure in personnel costs is positively correlated with a company's perception regarding benefits of RFID-based check-outs.*
RFID Knowledge	Describes the amount of knowledge in the field of RFID that a company has accumulated in theory and practice. The amount of RFID knowledge a company accumulates itself is dependant on the constructs 'Approach towards POS Innovation' and 'Company Size'. Furthermore the amount of RFID knowledge accumulated influences the likelihood of an early RFID adoption, because the knowledge necessary for adoption is more likely to be available inside the company. → *H5: Extensive RFID knowledge accumulated within a company is negatively correlated with the expected implementation of RFID-based check-outs within the company.*
Perceived Benefit RFID-based Check-Out	Describes the benefit that a company expects from the adoption of RFID-based check-outs. This perceived benefit depends on the constructs 'Pressure Personal Costs' and 'Pressure Waiting Time'. Moreover, perceived benefit influences the likelihood of early RFID adoption, because a company that perceives a high benefit in the adoption of a technology should be more likely to drive adoption. → *H6: A high perceived benefit is negatively correlated with the expected implementation of RFID-based check-outs within the company.*
Expected Availability of RFID-based Check-Out	Describes the point in time at which companies expect RFID-based check-out solutions to become available. The earlier companies think that RFID solutions will be available the more likely they will drive an early adoption. → *H7: An early availability of RFID-based POS solutions is positively correlated with the expected implementation of RFID-based check-outs within the own company.*
Expected Implementation of	Describes the point in time at which companies expect an RFID check-out solution to be implemented in their own company.

RFID-based Check-Outs

3.2 Data Collection

The data for our analysis was gathered by means of a questionnaire in summer 2005. For the conception of this questionnaire the above-mentioned constructs had to be operationalised. For this reason, they were broken down into several easy to answer questions. The answers to the questions on company profile, expectation of availability, and expectation of implementation were defined as categorical variables. Depending on the question there were 3 to 9 answering options. All other questions had to be answered on a 5-point-Likert-type scale ranging from '1: strongly disagree' to '5: strongly agree'.

The questionnaire was sent by mail to 500 executives (owners, CEOs, as well as marketing, finance, IT and logistics managers) of Swiss retail chains in the German-speaking part of Switzerland. The contact details were taken from a professional address database. Overall, 148 questionnaires were returned. This equals a return ratio of 29.6%. Of these 8 contained double answers so that 140 (28%) were usable. Due to missing data, some questionnaires had to be eliminated and 117 (23.4%) were used for the analysis.

The following basic data on respondents, company profiles and RFID knowledge provides an overview of our study sample (see Figure 3):

- 16% operate a maximum of 10 branches, while 24% operate more than 100.
- 66% sell non-food, 11% food and 23% both food and non-food products.
- 56% of respondents regard themselves as specialty shop.
- 59% of respondents claim to possess a medium to high theoretical knowledge on RFID, while 71% had little practical experience with the technology.
- 60% of respondents expect that RFID-based check-outs will become available within the next 7 years, and 36% expect that their company will implement the technology within this time period.

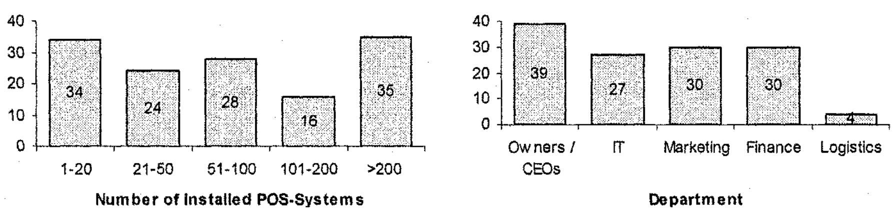

Fig. 3. Respondents separated by Number of POS systems and department affiliation

3.3 Results

After the measurement model was established, the explorative phase using structural equation modelling began. The implicit a priori research model was taken as a starting point. We used the software toolkit AMOS Version 5.0.1 for factorial analyses and structural equation modelling. The following indices and thresholds were used to test the overall model fit: chi-square/df (≤ 2.0), Tucker & Lewis index (TLI, ≥ 0.9), comparative fit index (CFI, ≥ 0.9), and Steiger's root mean square of approximation (RMSEA, ≤ 0.08).

Our a priori research model already showed acceptable overall fit measures (Chi-square/df = 1.416, TLI = 0.902, CFI = 0.914, RMSEA = 0.060), and all expected regression weights had the expected plus and minus sign. However, not all relationships proved significant at a level of at least 0.05. Specifically, 'Pressure on Personnel Costs' did not seem to have a significant effect on the expected benefits of RFID-based check-out systems, and 'RFID Knowledge' did not seem to influence the company's timing decision. Furthermore, 'Company Size' had no significant effect on 'RFID Knowledge'.

The covariances between the constructs, as estimated in the measurement model, indicated how to improve the fit of the model. Therefore, 'Pressure Waiting Time' and 'Approach towards POS Innovations', as well as 'Approach towards POS Innovations' and 'Company Size' were allowed to covary, which further improved the above-mentioned indices.

The emphasis was to make as few changes as possible to the initial model in order to keep it parsimony and not to extensively respecify the model based on sample data. One relationship was added: Rather than being independent from each other, the empirical findings suggested that, in this case, the motivation to introduce a novel technology influenced the acquisition of technical capabilities. Specifically, 'Perceived Benefit RFID-based Check-Out' seemed to positively influence 'RFID Knowledge'. Running the model with this additional relationship improved the overall fit of the model, and the relationship proved to be significant at p = 0.05. The removal of 'Company Size' from the model further improved the fit. The final model is depicted in Figure 4, including standardised parameter estimates, significance levels and fit measures.

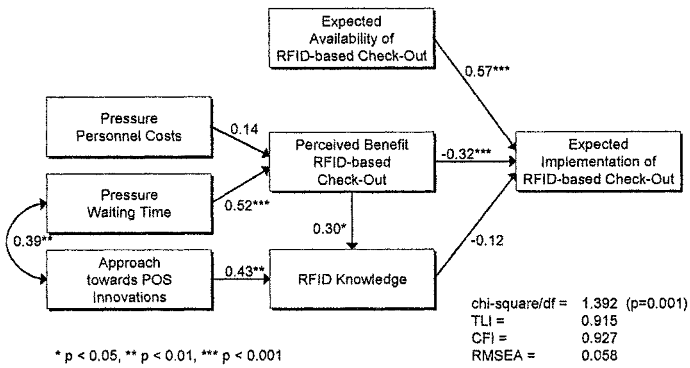

Fig. 4. Final Research Model

As can be seen in Figure 4, our hypotheses H1, H3, H6 and H7 could be confirmed, i.e. a company's innovation culture has an influence on the acquisition of RFID knowledge, the pressure in waiting time does have an influence in a company's perceived benefit of RFID, the perceived benefit correlates with the expected implementation of RFID, and finally the expected availability of a solution influences the expected implementation as well. In addition to these findings, our research revealed that the perceived benefit influences the acquisition of knowledge and that there is a correlation between waiting time pressure and innovation culture.

However, we were not able to confirm our hypotheses H4 and H5. Surprisingly, we could not find a correlation between personnel cost pressure and the perceived benefit of RFID-based check-out solutions. Furthermore, we could not find a significant influence of current RFID knowledge on the expected time of implementation. As mentioned before, H2 was removed from our model in favour of a better overall model fit.

3.4 Discussion

The findings we feel to be most interesting and worthy of discussion are those we could not prove to be consistent with our a priori expectations. The first question we wanted to answer was the lack of correlation between personnel cost pressure and the perceived benefit of RFID-based check-outs. We suppose that the explanation could be the following: RFID-based check-outs will not reduce the number of POS, but rather shorten the waiting lines in front of them. The above-mentioned project at Delhaize in Belgium supports this assumption. In this case example, traditional POS installations were not removed, but rather complemented by automatic check-outs for self-service customers, which are now able to enjoy shorter waiting times. Delhaize's project has not led to a cut in personnel cost but to an increase in customer service and a parallel increase in revenues [23].

The next finding that we found intriguing was that the presence of RFID knowledge within a company does not seem to have an influence on the expected implementation time. An explanation for this might be that the accumulated knowledge itself has no meaning to the company if the corresponding products are not technically mature, unavailable, or still too expensive to allow for a positive ROI.

Analogous to that, we might probably also explain why the perceived benefit does have an influence on the accumulation of knowledge, but the relationship could not be proved the other way around. While a perceived benefit constitutes the necessary motivation for the acquisition of knowledge, this knowledge in itself is not sufficient for an early implementation.

4 Summary

The results of our research indicate that retailers which see a high potential in the adoption of RFID technology intend to adopt relatively early. These retailers already prepare for the future by gathering experiences with the technology today. Interestingly, the current level of RFID capabilities that was acquired because of the perceived benefits does not influence the expected timing of adopting RFID-based check-outs. This may be due to the fact that the technology is still at an early stage and that the possession of the knowledge by itself is not sufficient for the implementation.

However, although the actual level of knowledge does not influence the timing decision, the model shows that companies which expect high potential benefits have significantly higher levels of RFID knowledge. This indicates that those companies actively engage in exploring the potentials of the technology.

Customer waiting time seems to be the main driver for companies to examine new technologies such as RFID-based check-out terminals. Retailers that recognize customer waiting time in front of the POS terminal as a problem expect higher benefits from RFID and are more innovative with regard to POS technology.

Contrary to our expectations, pressure to save personnel cost did not have a significant impact on the assessment of expected benefits from RFID. This indicates that the main driver for companies to consider RFID for automating the check-out process is customer service rather than cost savings.

In our opinion, the results should be considered as a starting point for further research in various directions:

- Additional empirical research will be needed in order to get a better understanding of the consumer perspective and their expectations regarding POS automation. It would also be interesting to conduct research on the effect of shorter lines on the customers' shopping behaviour. Delhaize, for example, states that customers spend more time actually shopping and leave more money in the stores, when they know they won't have to waste time waiting in line [23].
- Conceptual research will be necessary to improve the design of current self check-out solutions and the services that can be offered at the POS, e.g. through demonstrators and prototypes.
- Not least, our findings should also be considered in the context of the consumer's technology acceptance and risk perception. RFID-enabled services that increase customer convenience might be the key to outweigh the widespread perception of RFID technology as a risk to privacy and health [24].

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Application of Text Mining into Auto Answering System and Improvement of Mining Performance

Koudai Aman, Fukuya Ishino
Graduate School of Information, Production System Waseda University,
Ishino Laboratory. 2-7 Hibikino, Wakamatsuku, Kitakyushu-city,
Fukuoka, 808-0135 JAPAN
Kodai-aman@asagi.waseda.jp
Ishino@waseda.jp

Abstract. Most CRM systems include the text base response function through the Web, which apply the text mining technology. However, there is the critical problem of bad performance of the mining system; low hit rate of expected answers at the beginning stage. The problem is caused by limited knowledge in the system due to the lack of corpus and documents accumulated. Another cause is that the vocabulary is sometimes poor in the customer's short questionnaire. The main purpose of this study is to improve the performance of mining systems by tuning from the user's standpoint, not from the system provider. We experimented with a mining system. We populated corpus to the system and put some questions into the system repeatedly while changing corpus quantity and the effect of keywords. The results suggest that when the corpus quantity is not large enough, the system can be improved by repeating to input the same corpus several times.

1 Introduction

Today's CRM systems have the auto response function (**Fig. 1**) which deal with customer's questions or complaint sentences online instead of call center operators, in order to reduce the human resource costs. Another merit of the system is that they automatically keep records of all customers' questions and complaints making it easier for management to supervise the quality of service and to plan new products. Fig. 1 shows the automatic answering system [1, 2].

Please use the following format when citing this chapter:

Aman, K., Ishino, F., 2006, in IFIP International Federation for Information Processing, Volume 226, Project E-Society: Building Bricks, eds. R. Suomi, Cabral, R., Hampe, J. Felix, Heikkilä, A., Järveläinen, J., Koskivaara, E., (Boston: Springer), pp. 166–175.

A customer asks a question or makes a complaint to the company through its homepage on the web (1). Next, the system selects some candidate Q&As that seem to be similar to the customer's question from a Q&A database of previously asked questions and its answer. The system presents the Q&A candidates to the customer. At this time, if the customer finds a Q&A candidate which matches his or her intention, he/she selects that Q&A candidate (2). If he/she can not find a suitable Q&A candidate in the list, the company's experts respond to the customer's question afterwards (3). The new question and its answer are added to the Q&A database (4). Moreover, the company may analyze this Q&A data by using text mining technology for management purposes. Text mining technology is applied to the system' search function. However, there is the critical problem of bad performance of the mining system. The problem is caused by limited knowledge in the system due to the lack of corpus and documents. Another cause is that the vocabulary is sometimes poor in the customer's question. Moreover, it is not easy for nonprofessionals to operate for the good performance.

The main purpose of this study is to improve the performance of mining systems from the user's standpoint not from the system provider and to propose how to tune the mining system for the nonprofessionals. We experimented with off-the-shelf text mining system. We populated documents corpus to the system and put some questions into the system repeatedly while changing document quantity and the effect of keywords. We measured ranks of target documents. The higher the ranks of the target documents are, the better the system performance is. And put some questions into the system repeatedly while changing document quantity and the effect of keywords. We measured ranks of target documents. The higher the ranks of the target documents are, the better the system performance is.

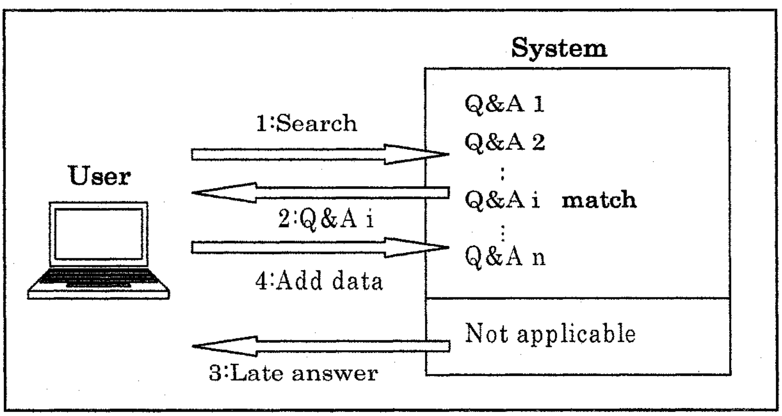

Fig. 1. Auto response function used in most CRM

2 Ming system learning algorithm

The mining system has a concept base. Concept vectors are semantic word expressions which are derived from co-occurrence patterns of words. A set of concept vectors is called a concept base [3, 4]. The system converts words into vectors in a multidimensional space. The system first extracts 20,000 words from documents in descending order of the occurrence number, and then counts the co-occurrence number among the words [1]. The system has a feature of discarding unavailable words, words which appear only once in its documents database. These words do not take part in creating the concept base. The co-occurrence relation is described as a co-occurrence matrix.

	W_1	W_2	W_3	…	W_n
W_1	c_{11}	c_{12}	c_{13}	…	c_{1n}
W_2	c_{21}	⋱			…
W_3	c_{31}		⋱		⋮
…	⋮			⋱	…
W_n	c_{n1}	…	…	…	W_{nn}

W_n (n=1~20000) ; words in documents
c ; co-occurrence frequency

The system converts the co-occurrence matrix by using principal component analysis to stochastically set main axis in the vector space (**Fig. 2**)

	P_1	P_2	P_3	…	P_{100}
W_1	s_{11}	s_{12}	s_{13}	…	s_{1100}
W_2	s_{21}	⋱			…
W_3	s_{31}		⋱		…
⋮	…			⋱	⋮
W_n	s_{n1}	…	…	…	s_{n100}

$P_{1\sim100}$; principal component (PC)
s ; PC score

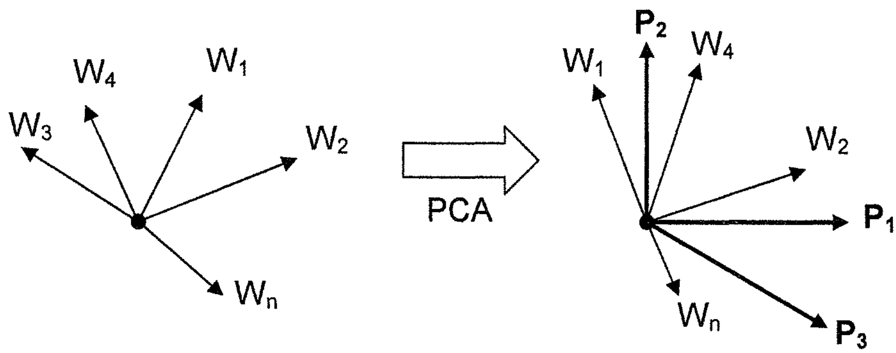

Fig. 2. Compression of co-occurrence matrix by principal component analysis

The vector of a word W_1 is $V_1 = [s_{11}\ s_{12}\ s_{13}\ \ldots\ s_{1100}]$.
The system then calculates similarities among the words from the word vectors. The similarities are the cosine between two word vectors.

The similarity

$$Sim(W_1 \cdot W_2) = \cos\theta = \frac{V_1 \cdot V_2}{|V_1||V_2|}$$

Moreover, a sentence vector is the mean value of all the word vectors included in the sentence.

3 Experiments

The higher the ranks of the target documents are, the better the system performance is.

We first prepared abstracts of 8,000 pocketbooks. These abstracts are the equivalent of the Q&A database which the auto response function owns. We secondly divided these abstracts into 10 folders having 800 abstracts each, and then made the system learn these abstract folders.

The system which holds i books is expressed in S_i (i=800~8,000).

We then randomly selected 100 abstracts from one of the folders. These abstracts were targeted. Before doing a search of the 100 abstracts, we had learned what was written in the abstracts and then made questions for them. We finally put the questions into the system to measure the ranks of the target abstracts. We prepared two types of questions.

Type A

We assumed that customer's questions have no keywords included in the target documents.

Then, we prepared 100 questions Q_{nk}, which have no keywords.

Type B

We assumed that customer's questions have some keywords included in the target documents.

Then, we prepared 100 questions Q_k, which have some keywords.

3.1 Setting co-occurrence range /Edit document data

Co-occurrence ranges among the words are a base element of the concept base. Therefore, the system performances should vary when the ranges are expanded. The ranges are between periods, that is, the ranges are one sentence. Therefore, the system users can expand the ranges by deleting the periods. In this study, we prepared three types of co-occurrence ranges.

Number one is one sentence. Number two is a single document. Number three contains all of the documents.

3.2 Learning common sense

The system does not have a basic knowledge database. The system creates the concept base only by learning documents. Subsequently, the system performance should decrease if the document quantity is not large enough. Therefore, we made the system learn a dictionary.

A set of vectors which created from the abstracts is expressed V_{object}, and a set of vectors from the dictionary is expressed V_{system}. In conclusion, the overall concept vector of system is

$$V_{system} = w \times V_{object} + V_{common}$$

Where, w is a weight of V_{object}.

The system performances vary when the weight w varies. The weight w can be changed by making the system learn copies of the abstracts. We controlled the system to learn copies of the abstracts. For example, if the system learns the same abstracts two times, the weight is w =2.

4 Results and discussion

We evaluated the system performance by measuring the ranks of the target abstracts. When internet users carry out searches on the Internet, they don't check all of the pages. Most users review only up to ten of the top pages. If they do not find suitable documents in the top ten pages, they input a new search request. In this paper, we evaluated the system performance by measuring the rate R_{10}, a ranking of no more than 10, in the 100 abstracts. **Fig. 3** shows the results of increasing the number of abstracts in the system. When the questions had some keywords, the rate R_{10} was about 36% in the S_{800}, 50% in the S_{8000}. When the abstracts were increased to 8,000 from 800, the rate was 14% better for Q_{nk}. When Q_k was entered to S_{800}, the rate was 75%. We found out that when the questions have some keywords, the rate R_{10} doubles.

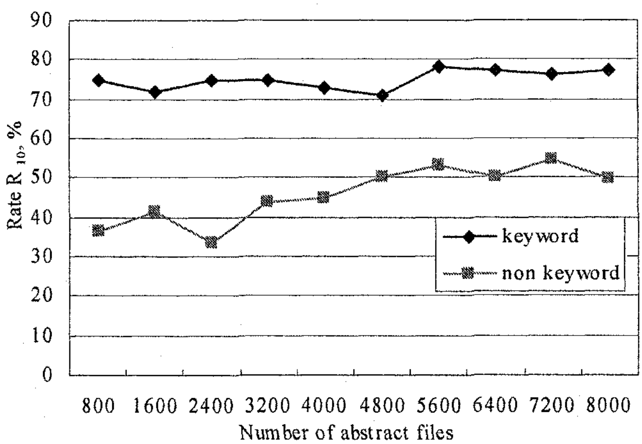

Fig. 3. Effect of keywords contained in questions

Next, **Fig. 4** shows the results of changing the co-occurrence range. The rate R_{10} increased and the system performance improved by expanding the range from one sentence to a single document, because the co-occurrence frequency increased and greater co-occurrence variations were created. However, the system performance didn't improve when the ranges were expanded to include multiple documents. The system users should set the single document ranges by deleting the periods.

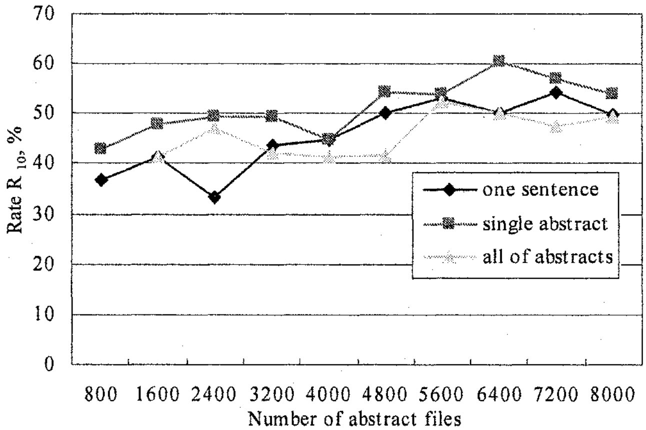

Fig. 4. Relation between system performance and co-occurrence range pattern

Fig. 5 shows the results of learning common sense, the dictionary. In S_{8000}, the rate R_{10} was about 60 % and higher by 5 % thanks to having the dictionary. However, the rate decreased a little in $S_{800\sim3200}$, because the system has and uses more common sense than knowledge created from the abstracts. The number of bytes in the 800 abstracts was 0.7MB, and the number of bytes in the dictionary was 35MB. The system users should tune the ratio of the dictionary to the object documents to balance them.

Next, we measured the rates while changing the ratio by making the system learn the same abstracts repeatedly. The results are showed in **Fig. 6**. The concept vector in the system is a composition of the dictionary vectors V_{common} and the abstract vectors Vo_{bject}. The overall concept vector V_{system} varies by tuning the ratio of the dictionary to the size of abstracts (**Fig. 7**). Therefore, the system performance varies. In this paper, the system learning the same 800 abstracts w times is expressed in $S_{800\text{-}w}$. The rate R_{10} was 38% in $S_{800\text{-}1}$, and 56% in $S_{800\text{-}8}$. The rate was 16% higher by making the system learn the same 800 abstracts 8 times. In $S_{800\sim3,200}$, the performance improved by the repeated learning, the system had more common sense than knowledge learned from the abstracts. The effect of the repeated learning is reduced in $S_{4800\sim8,000}$.

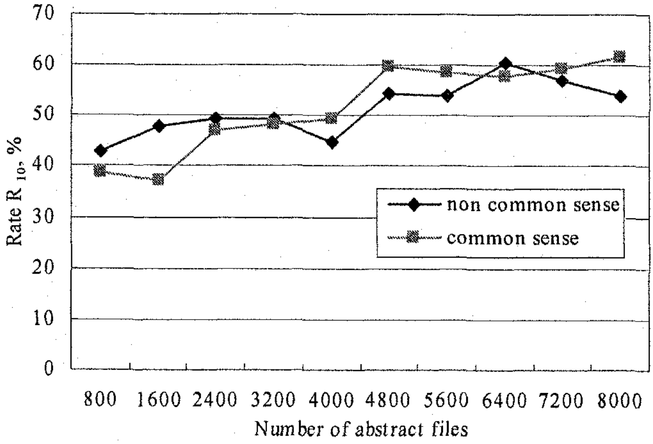

Fig. 5. Effect of learning common sense

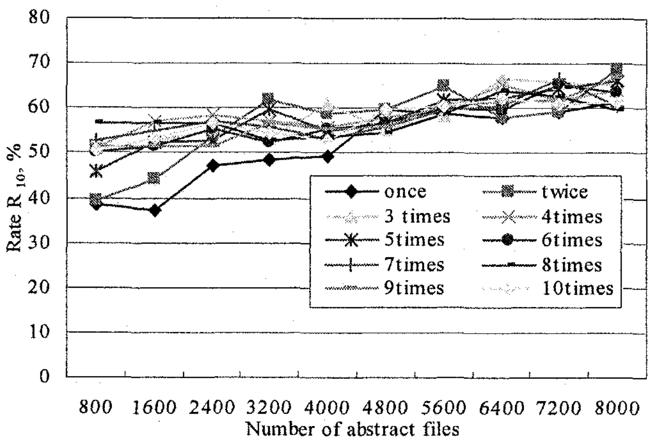

Fig. 6. Effect of repeated learning same documents

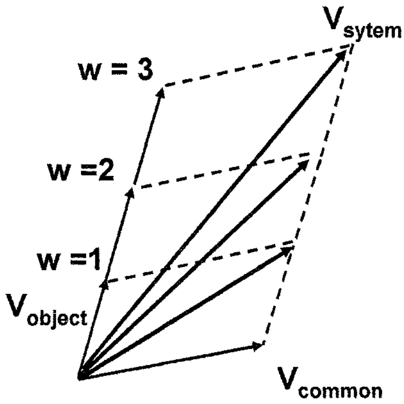

Fig. 7. Concept base variation by tuning the ratio

The experiment results show that when the co-occurrence range is a single document and $S_{8000\text{-}2}$ learns the dictionary, the system performs best. The rate R_{10} was 68 %. The rate is 33 % higher than S_{800} not tuned.

In order to obtain peak performance, the system should be operated in the best condition.

The system users can achieve better performance by trying the results and the measuring methods presented in this study.

5 Conclusion

The performance of text mining systems used in today's CRM systems does not meet user's expectations. This is specially true when the questions that the users input do not contain keywords. Through this study we discovered that the performance could be considerably improved and the rate R_{10} of about 70% was obtained by applying the following techniques.

- The co-occurrence ranges among words should be kept to a single document.
- The common sense of the system can be improved by inputting a dictionary.
- The ratio of the dictionary to the targeted documents should be balanced. The users should tune this ratio as necessary.

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Who should take care of the personalization?

Jarogniew Rykowski
The Poznan University of Economics, Department of Information Technology
Mansfelda 4, 60-854 Poznan, Poland
rykowski@kti.ae.poznan.pl

Abstract. In this paper, a new approach is proposed for the personalization of the access to different information sources (servers, Web pages, services, etc.) distributed across the Internet. In contrast to the traditional approaches, with personalization software owned and controlled by the owner of the information source, we propose to use the software that is prepared and controlled directly by the end-users. Our approach is based on software agent technology and imperative programming of agent code. The main goal of using personalization agents is twofold. First, such agents act as information brokers, adjusting both contents and format of the information to individual user requirements, restrictions imposed by the end-user hardware and communication means, current situation, etc. Second, the agents are used as autonomous monitors, individually informing agent owners about "important" (from the particular owner point of view) information changes. The fact of using source-independent personalization agents makes it possible to personalize access to such traditionally closed and fixed (i.e., unmanageable from the end-user point of view) information sources and systems, as e-banks, public Web portals and information servers, etc. Due to the fact the agents are prepared by (or at least for) particular users, the expenses related with the development of the agent code are in the major part incurred by these users.

1 Introduction

Rapid development of new information and communication technologies (ICT) introduced a new market of information services. Such a service is usually realized in a client-server mode, with information hosted at a certain location, and remotely operated clients. Recently, particular stress is put on mobile clients, i.e., clients with radio-connected devices of different type, purpose, and possibilities.

Mass introduction of new ICT services emphasized certain problems, mainly related with the well-known conflict between mass usage of these services, and

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individual requirements and expectations of different service users. On one hand, a service is optimized from the point of view of the service owner, with a clear business goal – reducing service costs with keeping maximum efficiency, throughput, etc. On the other hand, each service client is different and obviously prefers his/her own, individual access mode to the information, taking into account not only human-related interests and habits, but also such user-independent factors, as communication costs, technical restrictions of end-user devices, current situation, geographical position, etc. So far, it looks like these are the service owners who are winning in the above-presented conflict, imposing several access conditions on the service clients. As a consequence, service personalization is usually quite restricted, as this is not a primary business goal for the service owner.

A question arises – what should be undertaken by a typical client in order to achieve a reasonable level of personalization? The response is twofold. Obviously, the client needs an efficient access to the information; however, these are the service owners who control such access, and such control cannot be passed by. On the other hand, certain information processing is needed, according to individual user requirements. This implies some user-related software, to be executed over service-related data. Here, the second question arises: where to execute such personalization software and who is in charge to start such execution? There are three basic possibilities. First, server-side execution – theoretically it looks like the optimum choice, however, service owners are not usually interested in providing such functionality. Second, client-side processing – the main restriction lies in the fact that end-user devices, especially mobile devices such as phones and palmtops, are not powerful enough to deal with complex data processing. Moreover, client-side processing requires certain communication bandwidth, usually costly and resource-consuming (note at least battery consumption, as well as a need for continuous on-line network access). And finally, the personalization software may be executed somewhere in the network, at a selected host. However, in this case we deal with the problem of a generic, distributed software environment for user-defined programs, to not say about certain security risks and the loss of privacy.

To solve the above problems, in this paper we propose a new strategy of user-defined personalization, both theoretical model, and the practical implementation. The strategy is based on imperatively programmed software agents, and a specialized application of the Agent Computing Environment (ACE) framework. Within this framework, the users are able to execute their own agents, choosing not only their own algorithm of the information processing, but also the execution place and time. Our approach makes it possible to personalize access to information sources of different type, purpose, characterized by different access methods and interfaces.

The remaining of the paper is organized as follows. First, in Section 2, we discuss main limitations of the current approaches to server-side and client-side personalization, especially those related with the software agent technology. In Section 3, a generic architecture of our agent-based personalization framework is described. In Section 4, we discuss some implementation issues, mainly security and privacy aspects, and basic methods for defining and executing user-owned personalization software. Finally, in Section 5 we provide some final conclusions, and we point out some directions for the future work.

2 Current approaches to mass personalization

So far, software agents have not been widely used for mass personalization of the access to distributed information sources. Due to this fact, we are able to provide here only a limited state-of-the-art description related with sub-functionality of some agent-based and traditional distributed systems, the following features included: (1) personalization of distributed systems and information servers, (2) different strategies for monitoring and alerting, (3) human-to-agent communication methods, and (4) different programming methods for user-defined agents.

Usually, *personalization in distributed* systems, servers, and services is based on user-related data only – mainly client-side cookies and server-side user profiles. User profiles are either statically declared by the user (e.g., Yahoo and similar systems), or determined dynamically, taking into account current user activities (e.g., Click-stream Analysis, Web Usage Mining Systems, Collaborative Filtering). Some profiles may be fixed by analyzing individual usage of cookies [3]. There are three main disadvantages of such profile-based personalization: (1) personalization algorithm is fixed by the server owner, and thus it cannot be adapted to the specificity of the end-users, (2) profiles operate with limited number of parameters, usually quite restricted in type and scope, and (3) number of profiles is usually limited, to simplify profile management. However, higher is the level of profile generalization, lower is the satisfaction level of the end-users [7].

Recently, some attempts were proposed to provide user-defined personalization algorithms. For example, designers of the Web Services Experience Language WSXL introduced user description of service interfaces. Another proposal, XUL, a part of the Mozilla project [5], makes it possible to mix XML, CSS, RDF, and JavaScript technologies to personalize contents and formatting of Web pages. However, the above-mentioned personalization frameworks are still at the scientific-prototype stage, and their functionality is usually restricted to providing personalized Web pages being entry points to real Web pages and servers. What we propose is to use active, autonomous software agents rather than passive Web pages, to enable unrestricted personalization of any information source.

Monitoring and alerting (e.g., sending a message once something happens) by the use of software agents has been implemented in many systems, such as BargainFinder, NewsPage, and PumaTech's Mind-It [14]. Basic functionality of such systems is to facilitate e-shopping and searching for news (sport, stocks, weather forecast, etc.). There are two basic approaches to implement a monitoring system: client-side software, installed by the end-users and periodically polling specific Web servers and/or pages, and server-side agents, being internal parts of specialized information servers. In both cases, as the agents are prepared by software companies rather than the end-users, it is not possible to re-program detailed agent behavior, change parameter list (including the number and types of monitoring data sources), update execution schedule, etc. In the case of software-side monitoring agents, service owners are not interested in individualization of agent behavior, due to pure economical reasons. Moreover, as one cannot foresee all the possible expectations of all the possible users, it is not feasible to provide generic monitoring software. As a consequence, types and locations of the monitored information sources are usually fixed, e.g., a sport-news agent informs users about sporting events; however, it is not possible to use this agent to distribute political news, even if the monitoring and alerting algorithms are quite similar in both cases.

In the case of client-side agents, periodical polling for information changes requires certain network bandwidth that maybe costly or even impossible to achieve in some cases (e.g., mobile phones). Note also, that even if the monitoring software is installed at the client-side, the end-users have limited possibilities to individualize the behavior of this software. Moreover, the monitoring process may be easily reversed, to monitor user and/or user software activities (e.g., spyware, however, some more useful functions as well, such as automatic updates). Software agent technology, being the core of our approach, is much better suitable for both server- and client-side monitoring, mainly due to the fact that these are the users who are responsible for preparation, and further management and execution of their agents.

Recently, some systems have been proposed using agents as brokers to Web Services, e.g., SEMOA [13] platform, and our Virtual Web Services [15]. Note, however, that Web Services are usually equipped with a stable, well defined interface and service ontology, while the case of a distributed system with heterogonous, dynamically evolving information sources is much more general. Thus, the personalization agents must be more flexible and user-oriented, forcing agent code and execution place/time to be defined directly by the end-users.

So far, standard WWW interface was preferred as a basic method *of human-to-machine communication*. We think that more stress should be put to natural-language interfaces via telecommunication means, such as SMS/MMS, e-mail, voice gateways, and Push-To-Talk PTT messaging, traditionally related with mobile phones and human-to-human communication [6]. Taking into account hardware/software limitations of the mobile phones, we think that the chatterbot conversation [10] looks like a good candidate for a primary agent interface [18]. So far, chatterbot interfaces were not widely used, especially in the context of the software agent technology. Such prototype systems as AMASE [2] and Microsoft Agent applications use only standard, pre-programmed communication chatterbots, with fixed set of keywords and possible actions, making the personalization practically impossible. What we propose is to extend the chatterbot interface by the possibility of applying user-defined agents with individual conversation algorithms, keywords, given information sources, etc.

As for the latter above-mentioned feature – programming method for remotely executed software agents, we may choose between a skeleton-based approach, declarative approach, and imperative programming. *Skeleton-based approach* is based on some predefined pieces of code being "patterns" for automatic creation of the agents to be executed in the name of the agent owners [1]. This approach maybe used in the case the overall system security is much more important than user privacy and code individualization. Usually, the agent "owner" is in the power to choose the place and time of execution of the software only, while the software functionality is determined in advance by system designers. Even if this approach is widely used for such closed and fixed application areas as internet shops and marketplaces (e.g., Concordia agents), we think that it cannot be applied for user-defined personalization activities and ad-hoc cooperation.

The second above-mentioned programming technique – declarative programming – is usually based on a specialized programming language [8], originated from logical programming (Shoham's Agent0 programming language), artificial intelligence, goal-oriented programming (e.g., database programming languages) [4], etc. Even if declarative programming is much more flexible than using program skeletons, we think that it still cannot be applied for unrestricted user-defined personalization activities. First, similar to the skeleton-based technique, all the possible declarations (and thus total system functionality) must be known in advance. Each user has a choice of using or not certain declarations, however, he/she is not able to fully program details of the agent behavior [17]. Second, providing run-time "compilation" of a declaratively-programmed agent limits overall efficiency, both from the system (less throughput, more resources consumed – memory, CPU, etc.) and the agent owner (slow execution time) points of view.

Another approach to define software agents consists in the use of a classical, imperative programming language, such as Java. AMASE [2] is an agent-based system with java agents working in different mobile environments. Voyager is another example of usage of Java-based agents, with many successful e-commerce and e-business applications. Recently introduced Cougaar system uses agents composed by users with agent parts chosen from a set of well-defined, stable plugins encoded by system designers.

The most important problem of the Java-based agents is to achieve reasonable level of global system safety. Executing external Java code means, from a local system point of view, executing alien code, unknown and potentially dangerous. Even if the level of security provided by Java is considered as to be high, and several additional mechanisms are used – ciphering, digital signatures, anti-virus checkers – one cannot be sure the just executed code behaves well. Maybe in several cases this is more psychological than real menace; however, Java-based agents usually used in closed, mutually trusted environments. Moreover, in most of the cases, the users are not directly allowed to prepare the Java code. Instead, system-defined code is used as a set of "black boxes" (e.g., Voyager applications and Cougaar plugins).

3 Architecture of the APE personalization framework

To solve all the problems mentioned in Section 2, we propose to use one single technology – software agents. In our approach, called Agent-Based Personalization Environment (APE) we define software agents in the classical way, as presented in [9, 20]. A software agent is a program, executed at a given place, characterized by: (1) autonomy – agents process their work independently without the need for human management, (2) communication – agents are able to communicate with one another, as well as with humans, and (3) learning – agents are able to learn as they react with their environment and other agents or humans. As follows from the above definition, an agent may be programmed by its owner, thus allowing unrestricted personalization of behavior of this agent [19]. Agents may be executed in different places [11], according to owners' needs and possibilities of the end-user hardware [12]. In particular, agents may continuously monitor given information sources and inform about detected information changes [16].

APE agents are individually programmed by (or at least for) selected users. Agent functionality, i.e., personalization scope, is under exclusive control of the agent owner. This is up to the user to decide about amount of work (and costs) for agent preparation, distribution, and execution. The user is able to determine the personalization algorithm (i.e., the agent code), distribution and execution strategy (time, place, and conditions for running the agents), and finally – human-to-agent communication interface. As the agents are prepared individually for given users, there is no need for global agent management, a global schema, a uniform communication protocol, user groups, profiles, etc. Instead, users are free to define the most adequate (for them) agent behavior and variables.

APE agents may be distributed across the network. In particular, agents may be executed in user private environment (home PC, a notebook, a portable, or even a mobile phone), at server-side near the information sources, and at a selected host (so called network-side). Agent distribution may relieve the system of huge data transfer, traditionally related with client-server operating mode, by shifting the agents close to the information sources. Moreover, agent mobility makes it possible to take profits of the personalization in the case the user is not equipped with a powerful end-user device, e.g., in a mobile environment.

In contrast to traditional approach of accessing information sources, APE agents are able to access the source in two modes: synchronously and asynchronously. In the *synchronous mode* (being a counterpart of a classical access), this is the agent owner who sends a request to the information source/service, using his/her agents as brokers. The agent is responsible for contacting the information source(s) and collecting the response. The just-collected information is prepared (contents) and formatted (both a form and a layout) according to user needs, hardware/software environment, and communication means (a bandwidth, costs, speed, etc.). Thus, APE agents act as information brokers, hiding some details related with access methods to the information sources, and personalizing the information obtained. In the *asynchronous mode*, APE agents act as autonomous monitors, operating in a selected network host, and informing their owners about "interesting" information changes. What is "interesting" is programmed by the user in the code of his/her agent(s). The main advantage of the asynchronous mode is the fact that the agent owner is bother by really important alerts, however, important only for him/her. As long as there is nothing "interesting" related with the information observed, there is no need for additional polling, verification, etc. Note that the alerts may be sent to non-advances devices, such as mobile phones (SMS/MMS messaging), or even to a traditional phone via a voice gateway (speech synthesis).

Beside the monitoring and formatting functionality, APE agents may be used for bonding originally independent information sources and services into one single, consistent (from the agent owner point of view, however) conglomerate. Such operation, so called "orchestration" of servers/services, needs no permission of the information/service owner. As the orchestration is performed for a single user, user privacy is preserved. However, if needed, the above process may be related with a group of users and common agents, including ad-hoc, informal cooperation (e.g., tourist groups, people at certain geographical locations, etc.).

APE agents, to some extent, are able to provide a personification of the information sources/servers/devices they are related with. The agent owner, accessing his/her agents via a standard communication channel (e.g., a voice gateway, SMS/MMS messaging, e-mail) in a semi-natural language (cf. Section 2.4) has an impression of interacting with another human [18]. For example, we may consider an agent for an intelligent building. Agent owner, stuck in a traffic jam, may call the agent and ask to record a TV show. The agent searches for the show details in the Internet schedule, and starts recording with the VCR/DVD device. Note the agent owner contacts the system exactly in the same way as the family members, with all the technical details completely hidden. Note also, that the recording device does not have to be "intelligent", unless the agent is equipped with such "intelligence" to start/stop the device. However, such agent "intelligence" is quite simple (chatterbot conversation, a connection with an Internet search engine, a remote-control hardware link to the device, e.g., IrDA-operated), and may be realized with limited efforts.

Once developed and registered by an agent owner, the APE agents may be located and further executed at a selected place of the APE network of hosts. We assume that there are three basic classes of the hosts an APE agent may be sent to and executed: private hosts, generic network hosts, and server-side hosts. According to these host classes, we distinguish three basic agent pools: client-side pool, composed of the hosts controlled by the agent owners (i.e., ordinary end-users), middle-side pool, composed by some general-usage hosts, and source-side pool, composed by the hosts controlled by the service owners (i.e., the users offering some services and access to the information). The pools are characterized by different methods for migrating, storing, searching for, and executing the agents. Below, a general characteristic is given of each pool, together with a description of purpose and functionality of sample agents belonging to these pools.

A functionality of a host from the *source-side pool* is optimized towards reliable and efficient access to selected data sources, from the point of view of the information owner. Agents operating in source-side hosts are usually owned by the information owner. For security reasons, storing and executing "alien" agents belonging to the end-users is substantially limited. A typical source-side host is reduced to a set of gateways, able to standardize an access to the data source(s) connected, with limited support for public telecommunication facilities (WWW access, SMS/MMS/e-mail asynchronous messaging, etc.). The gateways are equipped with several mechanisms supporting efficient, parallel, multi-user access to the data sources, for example cache memories, proxies, synchronizers, locks, query optimizers and serializers, etc.

Accessing agents from source-side hosts is similar to accessing public Web servers and services. The difference is the agents provide some additional communication, wrapping and brokering functionality, requested by the users, as well as some uniformity of the external access to several information sources. However, nevertheless the end-users have limited control over source-side agents –

usually such agents are used as "black boxes", with limited possibilities of individualization of their behavior as well as the mode of operation.

Hosts from the *middle-side pool* are located in arbitrary chosen parts of the global network. In contrast to the source-side pool, middle-side hosts store and execute agents belonging to different users. A typical task list for the user agents covers: brokering among source-side and private agents, wrapping and formatting messages exchanged by the population of agents, providing access via different telecommunication means and protocols, etc. A stress is put on efficient access to the agents by the humans, using popular telecommunication channels and standards (WWW/WAP, SMS/MMS, e-mail, etc.). Agents from the middle-side pool are usually devoted to the tasks related with network-side monitoring – detecting information changes that are "interesting" for the agent owners. As already stated, what is "interesting" is programmed by the agent owner in the agent code.

Architecture and usage of a host from the *client-side pool* strongly depends on technical and communicational possibilities of an end-user hardware/software the agent owner posses at the moment. Private agents may be executed for example in the scope of a stationary PC, mobile equipment (a PDA, a notebook, or even an intelligent mobile phone). It is up to the agent owner to locate his/her agents either in a host from the middle-side pool, or in the private (i.e., client-side) host. In the first case, the network traffic may be substantially reduced, however, remotely executed user agents are less secured (from the user point of view) and less efficient (mainly because of additional security checks, cf. Section 4). In the second case, all the user agents are executed in a trusted (still, only from the agent owner point of view) environment, however, a lot of data must be transferred among distributed hosts.

For the agents executed at a portable/mobile device, a stress is put on fast and user-friendly human-to-agent communication. The technical capabilities of the device strongly limit the possibilities of executing the agents (small memory, limited battery time, difficult management, etc.). Thus, usually only a few private agents are located in a mobile host capable of performing some simple tasks, e.g., formatting of an alert message, filtering incoming messages, generating sound alerts, etc.

APE framework provides a possibility of defining and using several specialized agents called input/output gateways, able to communicate with the external world (including both software and humans) via communication channels of different type and purpose. Number and types of the gateways used (including some specific parameters, as a phone number for an SMS center, an address for a SMTP/POP3 server, etc.) is local-administrator dependent. Note that the gateways are implemented as agents, thus one may easily extend the framework by some specific communication channels, for example a dedicated application for contacting and programming agents, file system/NFS gateway able to exchange information via common files, etc.

In general, two basic types of communication channels are available: textual and Web-based. A *textual channel* is able to exchange flat (unformatted) text messages, usually among humans and agents. Physically, textual channels may use such media as an e-mail SMPT/POP3 connection, SMS (Short Message System)/MMS connection with a telecommunication network, a voice gateway, etc. Once sent by a textual message, an agent acts as a chatterbot, analyzing the message via keyword extraction and analysis. The semi-natural access to an agent in a chatterbot manner is especially useful for non-advanced users, as well as for users temporary handicapped due to limited hardware possibilities and communication costs. For example, an SMS message may be used to check the most important information during a journey, once a stationary PC is further used to get the complex information while the user is back home. *Web-based channels* are used to access an agent via a WWW/WAP page, and from specialized applications. These channels use personal, semi-automatic formatting of both contexts and presentation of the data to be sent. To this goal, XSL-T technology was adapted with XSL transformations defined in a personal manner and stored in private agent variables. In a case of a conversation with a human, automatic detection of end-user device may be used, thus restricting the communication. For example, a small textual message is sent to a mobile phone using WAP connection, similar message with the same contents however some additional formatting is sent to a PDA device, and full text&graphic message is sent to a stationary PC.

4 Implementation issues

The APE idea was implemented using the Agent Computing Environment ACE, the framework originally developed by us for supporting owners of mobile phones in accessing the Internet servers [16]. The framework is based on a set of distributed Agent Servers [17], each of them capable of storing and executing software agents. The agents are imperatively programmed by the use of certain programming languages, both standard and dedicated only for ACE framework. The agents may be moved among Agent Servers. Agent Servers may be located in both stationary and mobile devices. In case of stationary equipment, multi-user, multi-agent, mass-usage Agent Servers may be used. In case of mobile devices, characterized by limited hardware and software possibilities and high communication costs, personal, single-agent, light-weight Agent Servers may be used. Depending on hardware and communication restrictions, and current situation, a user has a choice in determining a place of execution of agents.

Due to the restrictions of the skeleton-based and declarative programming techniques (cf. Section 2.3), we propose to use imperative programming for setting up agent behavior, directly by the agent owners. In order to provide reasonable level of portability (migration) of the agent, and reasonable level of overall system security, we propose to apply two primary programming techniques: interpretation connected with run-time code inspection for "untrusted" agents, and compilation for the "trusted" ones.

The main problem related with unrestricted usage of imperative code concerns limited system security. Remotely executed, imperatively programmed agents are treated as the "alien" code, potentially dangerous for the local environment. Such anxiety may be justified by insufficient level of code verification, or simply by pure psychological reaction of local system administrators. Even if from the "technical" point of view several security mechanisms are applied for the external code verification (i.e., code encryption and signing by digital certificates, built-in security verification for the compilers and kernels of the operating systems, etc.), the psychological fear maybe a serious obstacle for wide acceptance of user-defined, not-known in advance agents. However, similar problem has been already successfully resolved in the domain of the operating systems, by introducing two basic programming techniques: a shell language, used for example for preparing batch programs and desktop icons, and different programming languages, used for design of the application programs, further compiled to "executables". Shell scripts are usually simple programs, in contrast to application programs – usually quite complicated and compiled (installed) prior to the execution. Compiled "executables" are used by the ordinary users as "black boxes", with limited parameterization and no possibility of re-programming internal functionality. Most operating-system users are entitled only to manipulate shell scripts, and only some (usually system administrators) are able to install and control executables.

Applying this approach to the APE agents, we propose two basic techniques of setting up safe and secured activity behavior: the dedicated shell language, and full compilation. The shell language is used for programming mobile, remotely executed, user-defined activities. The language is based on the XML standard, and its syntax computational power is similar to the widely known shell programming languages. Note that we were not able to adapt any existing XML query language, as well as any generic XML transformation language, as these languages are specialized for node processing, generating a set of XML nodes as a result of processing of queries/other nodes. Instead, we adopted typical shell syntax, adjusting it to the framework of the XML documents. In the proposed agent-shell programming language, the following shell-language statements may be used: *variable statement* (variable definition), *procedure definition* (similar to procedure/method definition in most of the imperative programming languages), *if-then-else* choice and *while* loops with conditional statements, and procedure *call* with *return* statement.

Due to the fact that the XML-programmed agents are treated as an "alien" code (from the point of view of the owner/administration of the agent execution environment), we introduce additional run-time checking: verification of the maximum agent execution time, and maximum space (quota) for temporal variables. Such checking is performed prior to the execution of each program line (XML node), by a comparison of granted and consumed amount of resources (mainly total CPU time and memory load). Badly-behaving agents are detected and their execution is stopped. As a result, it is not possible for an agent to loop (intentionally or not) forever and to consume too much memory/disk space, slowing down or even blocking other agents. To our best knowledge, there is no similar run-time verification for any shell-like programming language.

On the contrary, agents prepared by "trusted" (still, from the local environment point of view) users are written in Java, being an efficient and portable programming language. There is no additional run-time checking for such agents, except for standard security procedures built-in into the local Java Virtual Machine (memory consumption and quota, verification of the access rights, especially those related with accessing external software, digital signing and verification of the program code, etc.). Note that, even if the Java-based agents cannot be developed by ordinary users, such agents may be used as "black boxes", similar to the applications of a typical operating system. Note also that the Java-based agents may be used as brokers to external resources and software, including non-standard communication means (public SMS/MMS/e-mail channels, WWW-based access via individualized pages, etc.) [16].

Typically, we assume that most of the complex tasks are realized as Java-based agents, with the code prepared by system designers. The shell-based agents are used for the personalization purposes: linking, formatting, and presenting information obtained from different places and in different form, monitoring and alerting, adjusting the results to the individual requirements of the agent owner, as well as to hardware/software/communication limitations, etc. This is in turn similar to a typical operating system, with shell scripts and desktop icons personalizing the usage of the system-controlled applications. The local environment (and other agents) is secured enough, and, as the majority of the complex and resource-consuming tasks is realized by Java-based agents, the whole system is fast, both from the agent owner (small response time), and from the system point of view (large throughput).

5 Conclusions

In contrast to current solutions, the proposed personalization strategy is characterized by several advantages. First, the costs related with the preparation and the execution of the personalization software are incurred by the end-users. Each user is able to define his/her individual personalization scope and possible expenses. Second, it is possible to personalize access to traditionally closed and fixed (from the user point of view) information sources, such as e-banks and public Web portals. Third, it is up to the user to choose the information source(s), data processing algorithm, information scope, date and time of software execution, etc. Fourth, personalized access may be enriched by individual monitoring of "important" information changes and asynchronous alerting if "something interesting" happens with the monitored information. What is "interesting" for a particular user is defined by him/her in his/her personalization software. And fifth, it is possible to utilize several communication channels of different type, purpose, bandwidth, costs, etc., even those not necessary related with the information source, such as SMS/MMS/e-mail messaging for Web servers.

The system is flexible and open for new services, communication standards, users, etc. Due to the brokerage of public agents, the new services and protocols may be added in an invisible (for an ordinary user) way. Existing applications and distributed systems may profit from using software agents as monitors and personalizers [18]. Mobile agents and APE/ACE applications, apart from personalization of an access to distributed resources, are able to take some benefits of modern communication channels, such as WAP/WML, SMS/MMS, and PTT (Push-To-Talk)/voice access. To our best knowledge, there is not a single proposal up to now to use imperative, mobile, user-defined software agents for personalization of a distributed environment that is directly comparable with our approach.

Potential application areas of the APE/ACE framework are the following: advanced and individual controlling of database access, personal monitoring, asynchronous notification for changes, personalization of closed systems, mobile access to databases, enabling access for non-advanced and handicapped users, mobile applications, etc.

The APE/ACE framework was implemented and tested as two industrial applications: a universal information system for users of mobile phones, and as personal monitoring software for an internet bank. Due to the lack of space, we are not able to provide here detailed results of the measurement of the system efficiency. We mention only that we measured average system response time and agent execution time for a population of up to 100000 of agents, created artificially as multiply clones of agents developed and used by a hundred of real human users. The obtained results – system response time counted in parts of a second for SMS, e-mail and WWW-based gateways, average agent execution time up to 80 ms, and system throughput up to 30 agent executions per second under maximum load for 1000 hours (more than a month) of continuous test – proved the whole system is fast and efficient, especially for "handicapped" owners of mobile phones during an access to distributed Internet information sources.

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Methodology for IT Governance Assessment and Design

Sérgio Clementi, Tereza Cristina M. B. Carvalho

Fundação Santo André
sergio.clementi@fsa.br
Laboratory of Computer Architecture and Networks – Escola Politécnica

University of São Paulo

carvalho@larc.usp.br

Abstract. IT Governance has become an increasingly important process in delivering business value from IT. A number of IT governance frameworks have been proposed as the MIT – CISR framework and COBIT. However, there is no proposal of a systematic methodology for IT Governance assessment and design, considering the possibility of joint usage of multiple frameworks. This paper presents a systematic methodology for IT governance assessment and design, specified through different phases, their activities and outcomes. This methodology is applied in a real case showing the practical benefit from its usage.

1 Introduction

IT Governance has become an increasingly important topic for most of the enterprises. In North America and Western Europe the increasing investments in IT (around 4.2 % of the annual revenues) have focused attention on ensuring that IT delivers value [2]. Similar trends have been observed in Brazil, where, according to FGV-EAESP [10], the average investments in IT have also increased: in 1988, it was 1.3% of the net revenue, while in 2003 it went up to 4.9% of the net revenue.

Nowadays, IT is completely embedded in the enterprises and it is expected that new IT technologies would bring new business opportunities to the enterprises. According to [2], firms with **focused strategies** and good **IT governance** have more than **20% higher profits** than other firms following the same strategies.

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In this sense, IT governance is an important process in delivering business value from IT and mitigating IT risks. This paper presents a systematic methodology for IT governance assessment and design, specified through different phases, their activities and outcomes. Applying this methodology, the business objectives are mapped onto IT business role; and the decisions to be taken, the archetypes for making IT decisions, and the mechanisms for implementing and assessing IT Governance are defined. So, the main research contribution of this paper is the theoretical and practical sides of a methodology for IT governance assessment and design.

This paper has 6 sections in addition to this introductory one. The second section discusses some basic concepts about which is considered IT Governance. The third section presents an overview of the MIT-CISR IT Governance framework that is taken as basis for the development of the methodology proposed in this paper. The fourth section describes the proposed methodology for IT Governance design and assessment composed of different phases, detailing, for each phase, their activities and the expected outcomes. In the fifth section, it is discussed the validation of this methodology considering some scientific checking criteria and its practical application. In the last section, some conclusions and final discussions are presented.

2 IT Governance Concept

But what is IT Governance? For Peterson [4], IT Governance is the system by which an organization's **IT portfolio** is **directed** and **controlled**. IT Governance describes: the distribution of IT **decision-making rights** and responsibilities among different stakeholders in the organization; and the rules and procedures for **making and monitoring** decisions on IT strategy.

Weill and Ross [2] state "Governance is about systematically determining **who makes each type of decision** (a decision right), who has **input to a decision** (an input right) and how these people (or groups) are held **accountable for their role**". In this case, IT Governance is responsible for specifying the **decision rights** and **accountability** framework to encourage **desirable behavior** in the use of IT.

COBIT considers IT Governance as being a structure of **relationships** and **processes** to direct and control the enterprise, achieving the enterprise's goals by **adding value** while balancing **risk versus return** over IT and its processes [1][5].

From these definitions, it can be said that IT Governance is focused on [3][8]:

- **Creation of business value** (strategic alignment).
- **Preservation of business value** (risk management).

3 Overview of the MIT-CISR Framework

The MIT-CISR framework is built up over six components (see in Figure 1)[2]:

- **Enterprise strategy and organization:** provide the direction for IT structure and desirable behaviors motivating governance.

- **IT governance arrangements:** assign decision rights to different IT archetypes for key decisions aiming to achieve business performance goals.
- **Business performance goals.**
- **IT organization and desirable behaviors** are aligned and harmonized with the enterprise strategy and organization.
- **IT metrics and accountabilities** define how IT will contribute to the enterprise performance goals and provide means for assessing the IT effectiveness.
- **IT governance mechanisms**: provide tools for implementing and supporting the IT governance decisions. They cover decision-making organizational structures; alignment processes (e.g., SLA) and communication approaches.

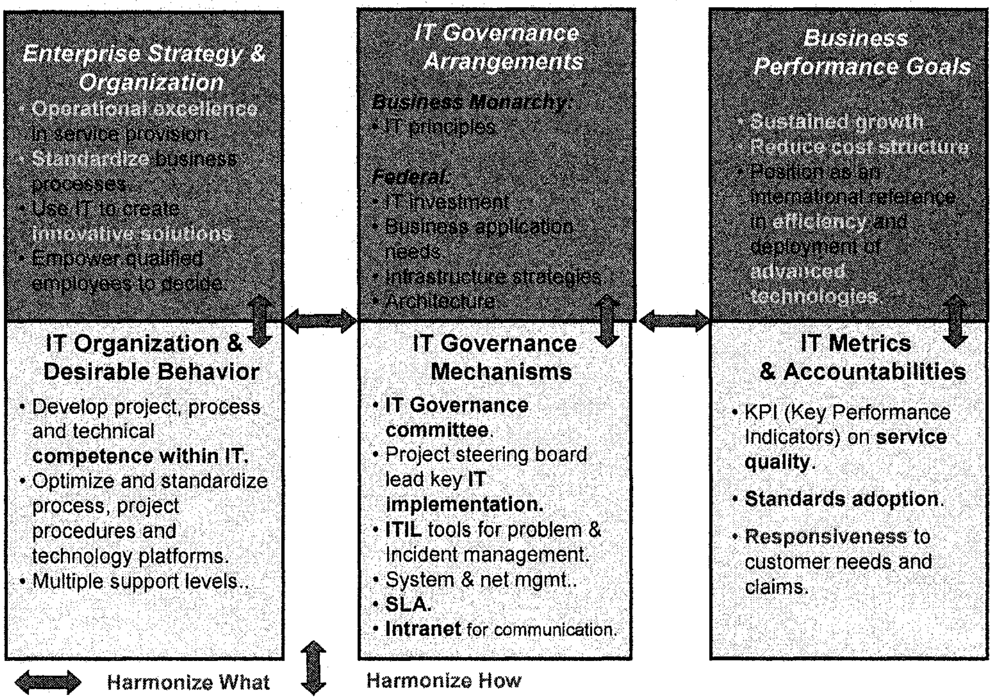

Fig. 1. Example of the Governance Design Framework

In addition, this framework defines **IT decision** types and **IT archetypes**. The defined **IT decision** types are: IT principles (IT business role); IT architecture; IT infrastructure; business application and IT investment. The IT archetypes specify who is responsible for IT decisions and include: business monarchy (top managers); IT monarchy (IT specialists); Feudal (BU - Business Units); Federal (corporate members, BUs and, optionally, IT people); IT duopoly (IT group and another group) and Anarchy (not well defined) [2]. The IT archetypes and decisions are used to develop the Governance Arrangements Matrix (Figure 2 shows a Governance Matrix example). In this matrix, it is presented which archetypes contribute **(input)** to the decision-making processes and which ones **(decision)** really take the decisions.

4 IT Governance Methodology

The proposed methodology presents a systematic way to design the IT Governance for an enterprise:

- It is described in terms of different phases and their relationship.
- It specifies the inputs, the procedures and the expected results for each phase.

It takes as basis the Governance Arrangements Matrix and the Governance Design Framework proposed by Weil and Ross in [2], described in Section 3.

Governance Archetype	Decision Domain: IT Principles		IT Architecture		IT Infrastructure		Business Application Needs		IT Investment	
	Input	Decision	Input	Decision	Input	Decision	Input	Decision	Input	Decision
Business Monarchy		X								
IT Monarchy										
Feudal			X		X					
Federal	X			X		X	X	X	X	X
Duopoly										
Anarchy										

Fig.2. Example - IT Computer Center Governance Arrangements Matrix

The phases of this methodology are (Figure 3):

- **Phase 1 – Enterprise Setting Information:** its purpose is to acquire basic knowledge about the company and the IT Governance status.
- **Phase 2 – Assessment of IT Governance Performance**: in this phase, it is identified the IT decision makers and contributors, the adopted IT Governance mechanisms and how the IT Governance results are evaluated in terms of financial metrics and effective use of the IT resources.
- **Phase 3 – Redesign of IT Governance.** Based on the analysis of the previous phases, the IT governance is reviewed taking into account the decision makers, the effectiveness of the IT governance mechanisms and the business performance goals versus IT Governance metrics and accountabilities.
- **Phase 4 – Implementation of the New IT Governance.** In this phase, it is planned how a New IT Governance will be implemented considering the activities

to be developed, the necessary human resources and the time for their execution. The IT Governance implementation plan is executed and continuously evaluated.

- **Phase 5 – Assessment and Management of IT Governance.** Based on the metrics and accountability indicators previously specified, the IT governance effectiveness is evaluated. If some problems are detected, the IT mechanisms and behaviors are analyzed and reviewed.

4.1 Phase 1 - IT Governance Settings

Before deciding for one IT Governance Framework or another, it is important to assess the enterprise settings. The enterprise settings capture the industry, the basic strategy, the size, the number of Business Units and the relationship among them.

First of all, it should be understood which basic strategy guides the enterprise. As basis, the following three value disciplines can be considered [9]:

- **Operational Excellence**: emphasizes efficiency and reliability, leads the industry in price and convenience, minimizes overhead costs and streamlines supply chain.
- **Customer Intimacy:** focuses on customer relationships, lifetime, service, responsiveness and customization based on its deep knowledge.
- **Product (Service) Leadership:** prioritizes continuous product innovation, embracing new ideas and solutions with rapid commercialization.

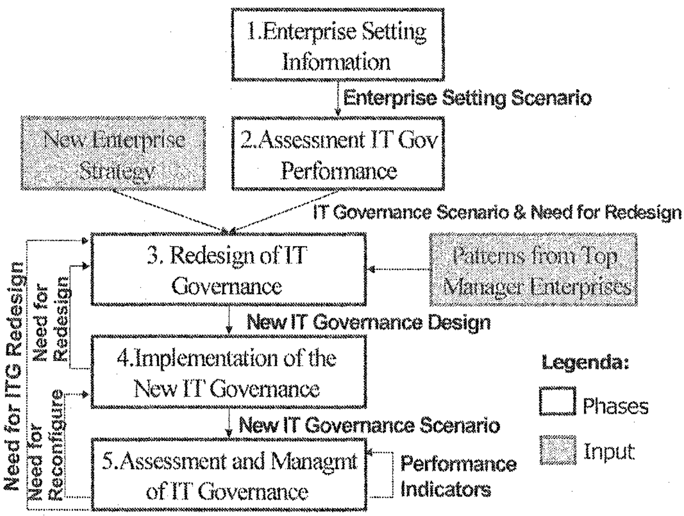

Fig. 3. General Overview of the Methodology

In addition, it is considered the organizational design that reflects the firm size (number of BUs) and the synergy level between these BUs - centralized management (high BU synergy) or distributed management (BU autonomy) structures. Other important aspects include the environment stability and the performance goals, as: profit (ROI or ROE); asset utilization (ROA); and revenue growth.

This phase will result in the description of the **Enterprise Setting Scenario.**

4.2 Phase 2 - Assessment of IT Governance

In this phase, the IT decision makers and contributors, the adopted IT Governance mechanisms and how the IT Governance results are evaluated in terms of financial metrics and effective use of the IT resources are identified. For this purpose, the following activities are performed (Figure 4):

- Map the enterprise's current governance onto the Governance Arrangements Matrix and the Governance Design Framework.
- Audit the current IT Governance mechanisms.
  - Identify the types of IT Governance mechanisms (decision-making, alignment and communication mechanisms), how they are defined, how they are applied, their objectives, their expected desirable behaviors, their effectiveness and how this effectiveness is evaluated.
  - Evaluate the IT Governance awareness and engagement.
  - Audit IT Governance Metrics and Accountabilities.

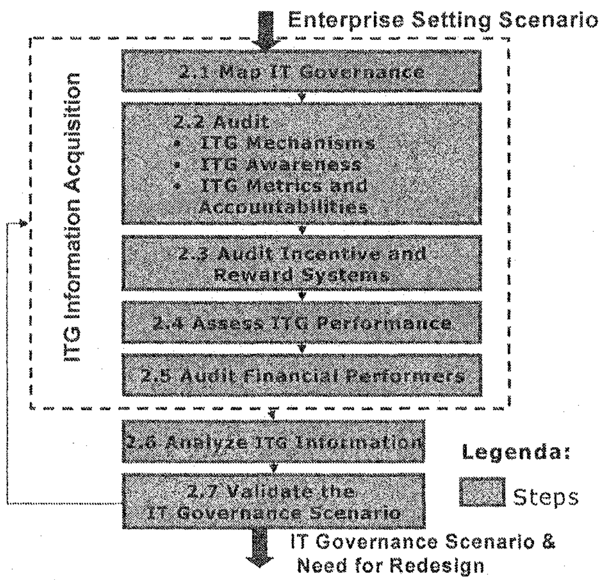

Fig. 4. Phase 2 – Assessment of IT Governance

- Audit incentive and reward systems, verifying if they are aligned with the organizational goals.
- Assess the IT Governance performance in terms of the importance of its outcomes, the impact on the business and in which enterprise areas it works best

and worst. The effective use of IT for cost control, growth, asset utilization and business flexibility is evaluated.

- Audit Financial Performance considering the business goals (e.g., profit – ROE, ROI, percent margin, asset utilization, growth – percentage change in revenue).

The acquired data is analyzed identifying the enterprise's strategy, which kind of IT decisions has been taken under IT Governance, who are the decision makers, how the decisions are made and monitored, how the performance goals have been achieved. As result, it is obtained the current IT Governance scenario. The current IT Governance scenario is presented to the enterprise's board for validation. It should foster discussions about the IT Governance status related to current positive outcomes, inefficiencies and improvement goals, defining which key performance indicators should be prioritized. As result of this phase, the **IT Governance scenario** is described and some specific **needs for redesign** are identified.

4.3 Phase 3 - Redesign of IT Governance

Based on the analysis of the previous phases, the IT governance is reviewed considering the decision makers, the IT governance mechanisms effectiveness and the business performance goals versus IT Governance metrics and accountabilities (Figure 5). Thus, the Governance Design Framework is reviewed through:

- Redefinition of the strategy mission, making clear the strategy intent through a clear, concise statement;
- Identification of new desirable behaviors in harmony with the strategic direction (e.g., process optimization in harmony with the operational excellence strategy).
- Review of the IT Governance arrangements (decision makers and contributors versus types of decisions to be taken (Section 3) and identification of the actions to be taken to improve its harmonization with enterprise strategy and organization.
- Review of the business performance goals (e.g., ROI or profits), stating clearer business objectives (e.g., cost reduction, the customer retention improvement) for IT Governance and a benchmark for assessing the success of governance efforts.
- Identification of the need for new IT Governance mechanisms or the reduction of their number (well-designed mechanisms reinforce and encourage desirable behaviors and lead to outcomes specified in the IT metrics and accountabilities).
- Review of the IT Governance Metrics and Accountabilities, verifying if they are harmonized with the business performance goals.
- Review of the IT Governance communication approaches.

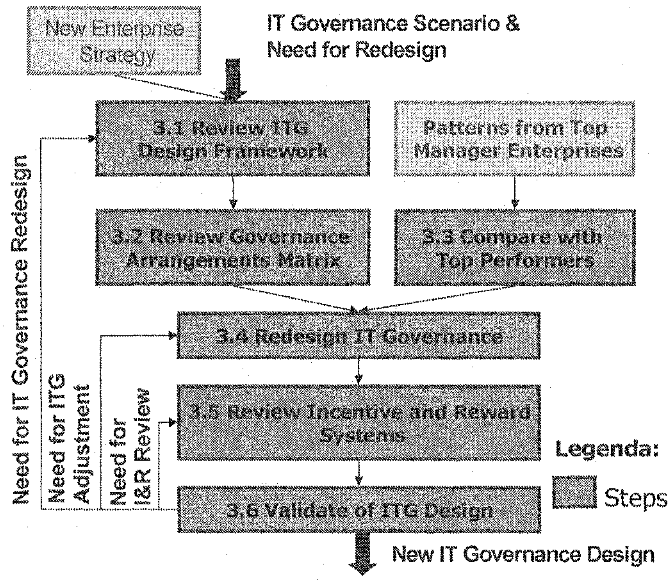

Fig. 5. Phase 3 - Redesign of IT Governance

Based on the new resulting Governance Design Framework, the Governance Arrangements Matrix is also reviewed. Then, the Governance Design Framework and the Governance Arrangements Matrix are compared with those ones of similar top performer enterprises in terms of culture, structure, strategy and business goals. It can be taken as reference the research results published in [12]. The differences are identified and evaluated, verifying the need for IT Governance redefinition.

The redesign of the IT Governance is completed, identifying the changes to be made in the Governance Design Framework, the Governance Matrix Arrangements, the IT Governance mechanisms, the IT Governance metrics and accountabilities. In addition, the Incentive and Reward Systems is reviewed to assure that they are aligned with the organizational goals.

The new IT Governance design is presented and discussed with the enterprise's leaders (e.g., senior managers) and/or with the person or group of people responsible for the IT Governance implementation. As result, it can be necessary to do some adjustments and reviews in the IT Governance design or even redesign it.

The main outcome of this phase is the **New Design of the IT Governance.**

4.4 Phase 4 - Implementation of The New IT Governance

In this phase, the IT Governance implementation plan is detailed, executed and continuously evaluated (see Figure 6). The plan for the implementation of the new IT Governance is detailed, describing the activities of each phase of implementation, the necessary resources and time for its execution besides its expected outcomes. This IT

Governance implementation plan is presented and discussed with the IT and/or BU's leaders. Once the plan has been approved, its execution can start.

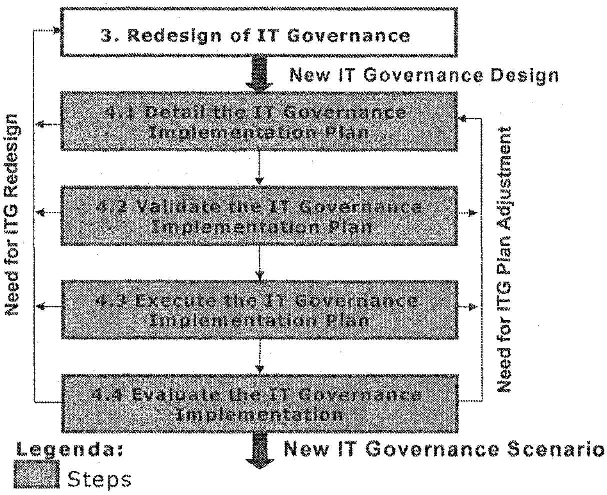

Fig. 6. Phase 4 - Implementation of The New IT Governance

At this point, the enterprise can decide for its implementation internally or by a third party company. In the first case, it should proceed allocating the necessary resources and the team responsible for different IT Governance activities and, programming the necessary training and launching its start. The execution of the IT Governance implementation and its milestones should be constantly evaluated as well the employees reaction to the undergoing changes. However, if the enterprise has decided for outsourcing the IT Governance implementation, at first it has to define how the outsourced company will be selected considering previous experience, team qualification, cost and time to deliver the IT Governance implementation, among other relevant features for the enterprise. Once the outsourced company has been selected, the other activities to be performed are basically the same as in the case of internal implementation. The firm's employees will be involved in a lower degree but they will have to work together with the outsourced company's team to guarantee the IT Governance implementation success.

At this phase end, a new **IT Governance scenario** will have been implemented.

4.5 Phase 5 – Assessment and Management of IT Governance

Based on the metrics and accountability indicators specified previously, the IT Governance effectiveness is evaluated. If some problems are detected, the IT mechanisms and behaviors are analyzed and reviewed (see Figure 7).

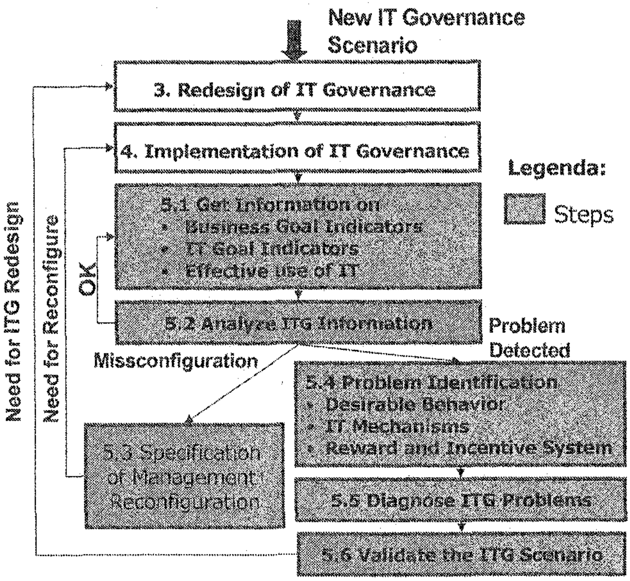

Fig. 7. Assessment and Management of IT Governance

In this phase, at first it is collected information about the financial performers, the customer perspective in relation to the enterprise, the employee performance, product and service innovation capability, need for new business indicators, the evaluation of the IT efficiency and reliability taking as reference the predefined IT metrics, the need for IT metrics, the evaluation of the effective use of IT related to cost control, asset utilization and business alignment, among other specific issues important for each business.

As result of this information analysis, it can be decided for the system management reconfiguration, introducing new IT metrics and/or business indicators or even modifying the target values for such metrics and indicators. This analysis allows identifying problems with the IT desirable behaviors, the IT mechanisms efficiency, and the Incentive and Reward Systems impact on the IT governance goals.

This analysis serves as basis for the IT Governance diagnose to be discussed with the IT and business leaders. As consequence, it can be decided for IT Governance adjustment or redesign.

In Figure 3, it can be verified that these phases are not necessarily executed in sequence. The transition from the current phase to any other will depend on the outcomes got from the current phase. For instance, the assessment of IT Governance in Phase 5 can result in its redesign (Phase 3) or reconfiguration (Phase 4).

5 Methodology Validation

As it was already mentioned the proposed methodology took as basis the MIT-CISR framework for IT Governance design and assessment and its IT Governance research carried out in around 250 enterprises. The basis of this research allows us to assure the practical benefit from the application of the proposed methodology in the IT Governance design and assessment of the nowadays enterprise.

Methodology Effectiveness

According to [11], an effective methodology must fulfill the following requirements:

- **Formal description** – A methodology must consist of a set of operations or activities specified in a written, graphical or algorithm forms or any combination of these forms as long as it meets the need for no ambiguity.
- **Definable activities** – The activities must be capable of definition.
- **Complete transformation** – The transformation must be essentially complete, i.é, no additional activity must be necessary in order to produce a usable result.
- **Implementable actions** – all activities must be capable of implementation.

The proposed methodology for IT Governance design and assessment satisfies the criteria defined in [11]. The methodology is described in a systematic manner, detailing its phases and the activities of each phase. These activities are defined allowing the use of the proposed methodology by any enterprise that wants to design or assess its IT Governance. The complete transformation is achieved; being described the input and the outcomes of each phase. All the specified activities are capable of implementation as it is shown in the case study described in the next item.

Additionally, the proposed methodology supports the fulfillment of the critical success factors of the IT Governance, identified as [2]:

- **Transparency:** More transparency in the process of IT Governance implementation normally results in more confidence from the enterprise employees (e.g., communication approaches as IT Governance mechanism).
- **Engagement and education**: the managers should be educated and engaged in this process (e.g., usage of communication approaches and different archetypes for different types of decision).
- **Ownership:** it should be ensured that IT governance is owned and has metrics and incentives (e.g., use of the Governance Arrangements Matrix and IT metrics and accountabilities).
- **Alignment between incentives and metrics:** Unaligned incentives and metrics governance destroy governance (e.g., requirement of alignment between desirable behavior and enterprise strategy & organization).
- **Governance Design:** the IT Governance should be designed at enterprise and BU levels. It should be known when it has to be redesigned (e.g., usage of the Governance Arrangements Matrix and the IT Governance Design Framework for IT Governance assessment and design).

Case Study

A case study was developed aiming to validate the proposed methodology. It was considered the IT center of a large public university, whose mission is to provide IT services to the university community such as: networking, data content hosting, IT security and management, equipment maintenance and IT usage support. Nowadays, this community is composed of 60,000 students (undergraduate and graduate), 5,000 faculty members and 15,000 staff people. This IT center is organized in 5 divisions (networking, datacenter, multimedia services, maintenance and HR).

Following the proposed methodology, initially it was got information about the organization setting. The main goal of this IT center is to have operational excellence in service provision in terms of efficiency and reliability, reducing at same time costs. Its five divisions present high synergy and they are aligned with the IT center core to maximize the ROA, increasing the resources reusability as much as possible.

In the second phase, the IT governance was mapped and we got the Governance Arrangements Matrix and the IT Governance Design Framework (Figures 2 and 1). As it can be seen in the ITG framework, to achieve the proposed goal, it is necessary to optimize and standardize the processes and project procedures and count on employees with very good technical background and highly committed with the organization goals. The evaluation of IT service quality is performed through the measurement of KPIs (Key Performance Indicators) related to service quality and responsiveness to customer needs and claims through proactive problem detection and correction, short time to problem solving, fault recovery and equipment maintenance. In this case, the IT Governance is enforced by several mechanisms such as committees, system and network management and intranet communication.

In the third phase, it was identified as priority to improve the mechanisms and promote a better integration between the organization divisions. In the case of mechanisms, it was decided to follow the ITIL [13](Information Technology Infrastructure Library) approach and focus on the problem and incident management disciplines, considered the most critical ones. It implied the integration of service desk, data center, networking and maintenance divisions in order to guarantee shorter time to problem solving, fault recovery and equipment maintenance.

In the fourth phase, the ITIL problem and incident management disciplines implementation was planned and executed. It was performed with the consultancy of an external company, which provided also the ITIL software system and tools.

Nowadays, in the last phase, we are collecting information about the outcomes got from the implemented IT Governance system and refining some processes. As soon as these tasks are completed, we intend to incorporate new ITIL disciplines in our ITG systems. As first results, we have verified that the time to solve problems and perform equipment maintenance has reduced and when it is not the case, we are able to give a better feedback to our customer.

6 Final Considerations

A number of IT governance frameworks at different levels of analysis have been proposed as the MIT – CISR framework and COBIT [1]. However, it has not been developed yet a methodology that allows the implementation of IT Governance in a systematically and gradually way.

This paper proposes a methodology for IT Governance design and assessment detailed in a systematic way through the description of its phases, the corresponding activities and outcomes of each phase. It took as basis the MIT-CISR framework that is very simple and practical once it is based on field research in enterprises of different sizes, strategies and industry branches.

The proposed methodology supports the usage of different frameworks simultaneously [12]. In the presented case study, it was adopted the ITIL. The selection of the proper IT Governance mechanisms depends mainly on the enterprise strategy and performance goals as it discussed in Section 4.

Finally, it should be emphasized that the proposed methodology can be adopted by enterprises, which want to implement the IT governance from scratch or need to redesign already existing IT governance. In both cases, the process of IT Governance implementation can be performed gradually.

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The E-Government: A Jigsaw View

Adeel Ghayur
1 H2O Power Pvt. Ltd. Islamabad-Pakistan www.h2opower.com.pk
adeel@h2opower.com.pk

Abstract. E-Government, today, is being regarded as the panacea for many of the conventional government ills, such as rampant corruption in developing countries to costly service deliveries in the developed countries. This paper provides a quick introduction to the e-government and proceeds on to describe a new framework developed for the transition of a government into an e-government – more specific to the environment of a developing country like that of Pakistan. This model draws parallel to a jigsaw, thus has been called the Jigsaw Model. The fundamental strength of this model lies in the fact that it has acknowledged the society as a foundation pillar in the e-government model and the entire economy progresses with the coalescence of all four parties included.

Keywords: E-Government, e-governance theory, e-economy model, Jigsaw Model

1 Introduction

E-Government has an enormous potential in terms of improving service delivery and efficiency, better response to business and citizen needs, and providing affordable government services. Defined as "Government's use of technology, particularly web-based Internet applications, to enhance the access to and delivery of government information and service to citizens, business partners, employees, other agencies, and government entities [5]", the e-government makes possible for its different departments and organizations to have direct access to grassroots and vice-versa. While, it cuts down the costs and delivery times for the government it also becomes a tool for check and balances against the government in the hands of the citizens. The e-government thus also acts as a tool for good governance – transparency, participation, regulations and accountability. It may also be defined as "the continuous optimization of service delivery, constituency participation, and governance by transforming internal and external relationships through technology, the Internet, and new media [3]".

The two main applications of e-government are e-services and e-transactions. Though the geographical area makes implementation of the aforementioned

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applications less efficient for a government than for private sector firms [8] as companies can do business outside their national boundaries thus increasing their customer base however, the governments can make it up with the size of their population. This is especially true for countries like Pakistan having sizeable population – 150 million.

Based on the activity, e-government has been divided into four distinct areas, namely: e-democracy, e-service provision, e-management, and e-governance [7]. And based on interactions we have divided e-government into three categories, namely: government and business (GnB), government and citizen (GnC), and government and government (GnG), which are further divided into government to business (G2B) and business to government (B2G), government to citizen (G2C) and citizen to government (C2G), and government to government (G2G) nationally and internationally respectively (Fig. 1). This division is based on the flow of services in one direction and flow of money in the other. For example civil servants working in government would be considered under C2G category.

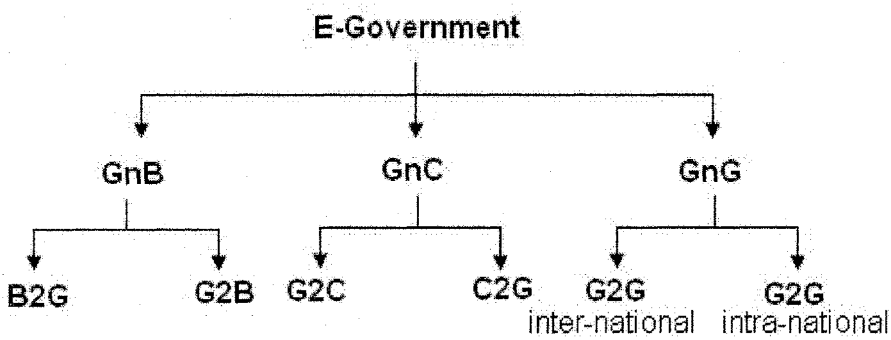

Fig. 6. E-Government categories based on interactions. The division is based on the flow of services in one direction and flow of money in the other.

This paper attempts to develop a framework for transition of a government into an e-government – more specific to the environment of a country like Pakistan. The paper first looks at different e-government theories in section 2 followed by description of three different types of e-economy models in section 3. Then the paper focuses on the core of the paper, the Jigsaw Model in section 4 and the paper closes with some concluding remarks in section 5.

2 E-Governance Theories

There is a growing sense towards the impact of today's Information and Communication Technology (ICT) tools on governance. It is not the tools themselves which are in question rather the use of these tools and the intentions preceding them. Usually these intentions are encompassed into four rival theories as discussed by Perri 6 [6] primarily based on the results they would materialize into.

However, after restructuring we have divided them into five. A look at these theories is needed to provide us with a view of what the possible end results are of implementing an e-government.

2.1 Rainbow Theory

This theory also called Rationalism Theory dictates that the ICT tools will be utilized to help in better decision making and optimization of the governance processes. The theory is further divided based on the two trends it might follow. The first theory, Primary Rainbow Theory states that the governments would implement e-governance by following the popular trends and adopting the ways of the leaders in e-governance. The second theory, namely: Supernumerary Rainbow Theory states that the governments would utilize the latest tools to implement e-governance but at the same time will take steps to keep the cultural and traditional heritage and values within the community rather than submitting to the overflowing outside influences as in case of Primary Rainbow Theory.

2.2 Kytoon Theory

Kytoon or Control Theory implies that the e-government tools would be used for better control of the populace. This theory is based on the concept of "information is control".

2.3 Smog Theory

Also called the Noise Theory; it is based on the argument that e-government tools such as Internet provide too much information for governance procedures such as decision making, hence ultimately piling up more problems than solving the piled ones. This view wholly rejects the cybernetic faith that information is control [6].

2.4 Virga Theory

Virga Theory implies that implementation of ICT tools will not have much impact on the governance. However, the government would still benefit from the potential of ICT tools such as speeding up of information and service deliveries. This theory states that changes in governance and government are socially and politically driven and Internet is one of the means. There is a thin line between Rainbow and Virga Theory. In Rainbow Theory the effective utilization of ICT tools requires changes within the government itself, which the government would carry out. Conversely, the Virga Theory states that a country might implement ICT tools but without requiring any changes in the government and not having a notice worthy impact.

2.5 Tempest Theory

Tempest or Chaos theory implies that e-government tools such as Internet would make a government loose control – mainly by malpractices.

3 E-Economy Models

Looking at the transformations of different economies into e-economies we have categorized their structures into three distinct e-economy models. Each model is comprised of three parties, namely: citizen, e-government, and e-business. The three models are differentiated based upon the roles three parties play and their respective structures. The shape and structure of an e-government depends upon the e-economic model a country is moving towards or is in the process of implementation and the e-governance theory which it has adopted as its underlying ideology or is inevitably heading towards. The three models are briefly discussed below.

3.1 E-Business Core Model

It is the dominant e-economy model in which the government and the economy are restructured in such a way that businesses can make the best out of today's ICT revolution (Fig. 2). Businesses are the main driving force behind the transition of the government towards e-government. The government starts its journey towards e-government mainly by facilitating the implementation of ICTs for the businesses and in due process evolves into an e-government itself.

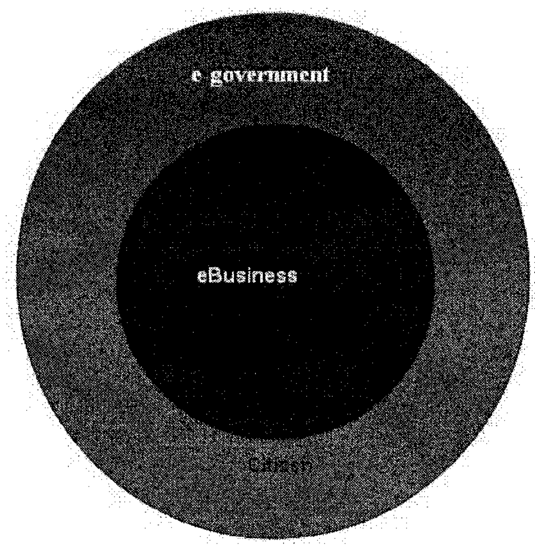

Fig. 2. E-Business Core Model. In the figure we can see e-business at the core of the model and the citizen and e-government structured around it.

3.2 E-Government Core Model

In E-Government Core Model (Fig. 3) the ICT tools are utilized and implemented mainly by the government. The businesses on the whole might still be operating in a pre-ICT era, while the e-government continues its evolution alongside the emergence of new ICTs. As a result of improvements within the governmental functions the businesses and citizens receive the benefits as well, and the businesses follow a similar path towards e-business.

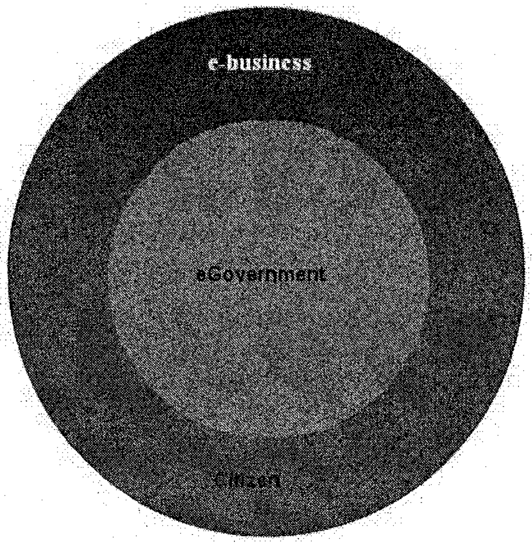

Fig. 3. E-Government Core Model. In the figure we can see the e-government at the core of the e-economy model.

3.3 Hierarchical E-Government Model

In every e-government model the hierarchical governmental structure is broken down into a flatter one, except here. In this e-economy model the government keeps its traditional hierarchical structure sitting at top of citizens and businesses (Fig. 4). The government adopts the ICTs to improve its efficiency between its hierarchies. The citizens and businesses also benefit as a result of ICT implementation in the government but the benefits to the two groups are the least in comparison to other models. Additionally the adoption of ICTs within the government do not provide any guarantee or incentives for the businesses to embellish themselves with these tools of twenty-first century, unlike in other models.

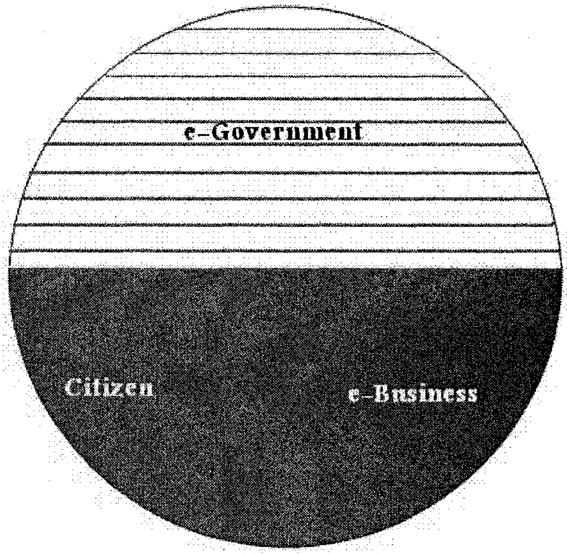

Fig. 4. The Hierarchical E-Government Model does not change the structure of the government, but simply introduces technology between the hierarchies.

4 A New Framework for E-Governance: Jigsaw Model

In the three prevalent e-government models, the e-economy is viewed as a product of three entities, namely; government, business, and citizen. The fundamental omission in these models is the absence of a core party which exists in today's economies and plays a major role within; the society. We propose a model which comprises of four parties including society in contrast to the three party models. Another characteristic of this model which draws parallels to a "jigsaw" is that neither party leads the rest. Instead, each party within the model complements the other and the progress and advancement of one mimics or follows the rest. This model aims for a government that does not sit on top of the citizens and businesses, rather stays in between (Fig. 5). The other significance of this model lies in the fact that e-government would not keep on evolving on its own whilst the other parties sit at bottom of the evolutionary chain. Before moving to the next stage of advancement any one party would make sure that the other parties are ready and able to move to the next stage as well.

The journey which a government takes towards a full transformation into an e-government can be divided into number of phases, each phase marking a significant improvement in terms of structure and tools used. In a similar fashion an economy following the Jigsaw model divides the progress of a government towards e-government into four stages. Each stage not only marks an advancement within the e-government but between the e-government and the other three parties in terms of technology, speed and relationship. In the following lines a detailed look at the four stages towards the deployment of an e-government is given. The other three parties would follow a somewhat similar path of evolution, but here only the e-government evolution is discussed. For businesses numerous staged models have been proposed over the last few decades following the adoption of ICTs in e-businesses and their supply chains such as Nolan Four [9], and Six Stages of Growth [10], Earl's Stages Model [11], and Hour Glass Supply Chain [4] respectively. The same or similar models would be just as applicable in the Jigsaw Model for transformation of businesses into e-businesses. Although these would require modifications to correspond to the development of four staged e-government model. On the other hand there hasn't been any major attempt to chalk out the stages in which a citizen and a society would or should evolve along with the ICT tools. Work is needed to develop a diverse set of staged models for citizens and societies as in case of e-businesses. However, we have worked on four party models and their staged development but in the proceeding lines we are only discussing the four staged e-government model; which is inclusive of e-democracy, e-service, e-management and e-government. However, we have mainly concentrated on the adoption of ICTs within the government and the development of relationship between the government and the citizen.

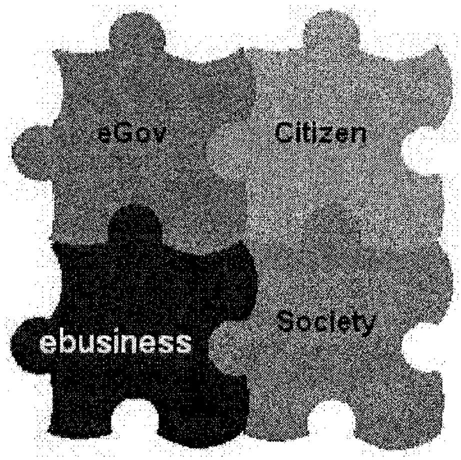

Fig. 5. The Jigsaw Model. This model as shown here consists of four parties. The main distinction of this model is inclusion of society as an individual party, and all parties complementing each other.

4.1 Stage One

This stage marks the beginning of implementation of the ICT tools by the government for the purpose of transformation of its governance and functionality. The government is considered to be in Stage One if it is implementing the following technologies.

Internal Networks. The first step towards utilizing the benefits of ICTs is implementation of Local Area Networks (LAN) within the government offices followed by the Internet connectivity.

Website, Email and Information Dissemination. Second step is the development of a web presence and providing email addresses to the employees of the offices. Sharing information is the least technical and most important aspect in e-government. However, ensuring the availability, accuracy, and timeliness of information is the biggest challenge [2]. Suitable tools like search options and site maps will need to be augmented with the provision of information on the web.

Electronic Forms. Third step is the availability of official forms on the Internet. Putting the forms up on the Internet does not demand high technical expertise nor is expensive. This should be high up on the priority list as it proves the willingness of the government to undertake the task of its procedural overhaul for convenience of the citizens.

Announcements. The fourth step is the periodic update of announcements' page.

Two Way Communications. Discussion boards need to be created for a two way communication between the officials and the citizens. It must be made sure that discussions are archived and have search options for future referencing and ease. Also, email addresses of the officials need to be made available on the web. These two tools would start the process of a two way direct communication between the public and the government officials.

Digital Data Collection. The process of data collection in digital format has to start in this stage. At this stage it will be done in a combination of employees typing in the data from physical documents and citizens entering some pieces of data online.

Tools for Help in Decision Making. Tools for helping and quickening the decision making process have to be implemented as well. Though primitive e-governance tools like spread sheets and budgeting software have been around for decades but they were mainly used by big organizations and at top levels of government hierarchy. Today however, the same software have fallen in their prices and house hold PCs are powerful enough to run them. Not only this but these off-the-shelf tools have been incremented by a wide array of variety. Appropriate measures have to be taken to implement these tools and make the civil servants accustomed with their usage.

Knowledge Management. Knowledge Management can be defined as the "management and use of collective knowledge or wisdom of an organization". The government has to start the implementation of knowledge management tools within the offices in this stage, be these basic ones.

Pilot Project. The stage one of e-government ends at testing of a pilot project for an e-service with e-transaction. Selection of the service can be based on any criterion like that of maximum users, easiest to transform into e-service, etc.

4.2 Stage Two

A government is said to be in stage two when the culture of e-transactions has started and majority of the citizens have access to the Internet. The ICT tools that a Stage Two e-government would be using and the level of relationship between the e-government and the citizen are discussed below.

E-Services and Intra-Office Networks. The government will have to take the initiatives to begin the process of transformation of its services into e-services. The office LANs would need to be technologically advanced along with backup capabilities. Appropriate security tools have to be utilized for the said purpose. Furthermore the process of integration of the networks of different branches of same office has to be started. This will be an integral part for effective provisioning of e-services.

Information Dissemination. The amount of information available at every department's website would be increased and augmented with details related to the official procedures, budgets, and expenditures. Search options and searching would need to be advanced to counter the time taken for sorting out the information through the ever increasing data.

Electronic Forms. The online downloadable forms have to evolve to accommodate for online submission and e-transactions.

Announcements and Updates. The websites are to be updated at regular intervals and should materialize the capability of sending automated emails to registered users. It is pointed out here that if the websites are not regularly updated the users would not be interested in re-visiting.

Two Way Communication. Two way communication is evolved to allow for live chats with the officials on special occasions. This will start the culture of citizens and officials chatting with each other in real time. This will be the prelude to teleconferencing.

Digital Data Collection. In Stage One majority of the data was being entered into the database by the employees. However, now the system would have to be upgraded so that the data is automatically generated from electronically submitted forms, information sorted and stored by intelligent software. The process of conversion of backlog data into digital format should be started as well.

Decision Modeling Tools. The decisions made within the offices would be taking advantage of Expert systems; the digital information being utilized in policy making and decision making.

Knowledge Management. Custom knowledge management tools would be seen being employed in more and more government offices. This will be the advancement in knowledge management area.

Government Portal Sites and Value Added Services. The government should develop an e-portal at this stage. E-Portal is a site which brings together numerous content providers, provides information, and develops a closer relationship between the government and the citizen. Main aim of E-Portal is to have one site from where users can get all the information. The finest examples of e-portal are FirstGov (www.firstgove.gov) of America, and eCitizen (www.ecitizen.gov.sg) of Singapore.

Unique ID. The government will have to take steps in assigning a unique ID to every citizen of the country. This can be done based on ID card, passport, driving license or birth certificate number. The same ID should also be used to provide a national email address to every citizen however; the email address should have the ability to forward the emails. This will create a direct communication link between the government and the citizen. The regulations would be needed to make sure private enterprises and citizens are not allowed to use this email address and procedures would be needed so that government employees can't misuse this facility. This would also be the first step towards e-voting and would be very useful in providing numerous statistical data such as how many citizens have access to the Internet.

Integration and Automated Exchange of Data – Pilot Project. The Stage Two will end at testing of a pilot project for automated exchange of data between two different offices, taking the government into next level of e-government.

4.3 Stage Three

By the start of this stage every government office would be online and data would be automatically sorted and sent to the respective agencies. Majority of the citizens are expected to be online as well.

Development of an Intra-National Network and Automated Exchange of Data. The first development in Stage Three should be the upgradation of government networks to accommodate automated transfer of data between different government offices. Two sites for e-government integration are Australia's state of Victoria's maxi (www.maxi.com.au) and eCitizen center of Singapore.

Information Dissemination. The necessary infrastructure developed is now capable of all information being stored electronically. The only addition left would be the video streaming and real time video streaming.

Announcements and Updates. The announcement system should become intelligent at this stage. An example of intelligent announcement in case of students is software's recognition of which email addresses belong to students of Pre-Engineering courses and then comparing the marks with the university merit lists it would send emails regarding the admission dates to the qualifying students.

Two way communication. The two way communication should be evolved to implement teleconferencing as a normal means of communication. However, the other means of two-way communication would still be available.

E-Democracy. By now the security problems and encryption techniques as well as the unique identification of the citizens would have been achieved. Theoretically the government should be ready to implement the e-democracy which requires capabilities for e-voting and real time chatting with the constituents over the Internet.

4.3 Stage Four

When the entire government is integrated into one giant network with automated flow of information the government would be considered in Fourth Stage. By now every governmental service would be available electronically. This stage wouldn't implement any new e-services but the concentration would be on upgrading of the technology of existing e-services. The other significant advancement in this stage would be the start of integration of different e-governments, the ultimate aim of today's e-governance.

M-Commerce. By the time the e-governance reaches Stage Four, its contemporary e-business block would have stepped into m-commerce (mobile commerce). Public would have become accustomed to surfing the net on the move, e.g. from Internet enabled cars, mobile phones, etc. It would be imperative for the e-government to evolve just as well – into m-government.

Inter Government Integration. Turning the world into one giant global village is the ultimate dream for tomorrow and by the time an e-government arrives at the end of the road of the fourth stage it would be ready to integrate with the global network of e-governments.

5 Conclusion

Internet is a tool that is equally and easily accessible both by the poor and the rich. This tool also facilitates the development and transformation process coexisting with participation, transparency and accountability. As President Bill Clinton said, "The Internet has the potential to strengthen our democracy and to make government more open, efficient, and user-friendly" [1].

Developing countries need to tap the vast potential – employment, trade and services – that the ICT sector offers in addition to bringing greater transparency and ease. The utilization of the surging potential in the ICT sector is crucially linked with transforming governmental functions to e-government albeit in phases and with pilot projects.

The technology available is neither expensive nor complicated. Development of e-services does not require complicated processes either. A functioning e-government is feasible in every corner of the globe. This paper has been an attempt in this direction.

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TAM Derived Construct of Perceived Customer Value and Online Purchase Behavior: An Empirical Exploration

Kok-Wai Chew, P.M Shingi, Mohd. Ismail Ahmad
Faculty of Management, Multimedia University, Jalan Multimedia, 63100 Cyberjaya, Selangor, Malaysia
kwchew@mmu.edu.my, shingi@mmu.edu.my mohd.ismail@mmu.edu.my

Abstract. Technology Acceptance Model (TAM) was initially created to be a simple model to explain specific technology behavior in information systems. Over the last 18 years, due to its popularity, the TAM has been augmented by including various context-specific constructs to explain phenomenon in e-commerce, e-learning, e-banking, and wireless technologies besides information systems. This study, in the context of e-commerce, or more specifically the online purchase behavior, attempts to consolidate a cohort of existing constructs using the emerging tenets of Customer Value-based Theory and reinstate the parsimonious intentions of TAM. A total of 1730 questionnaires were collected from Internet users who owned a credit card. The respondents came from all the State capitals in Malaysia, including Cyberjaya, which is the smart city of the Multimedia Super Corridor in Malaysia. Out of 1730 questionnaires, 1440 formed the sample for further data analysis. Bivariate, partial correlations and stepwise multiple regression were used in this study to determine the impact of customer value. The results have shown that Perceived Customer Value is an important determinant of Online Transactions Behavior. With the presence of Perceived Customer Value, only Behavioral Intention is a significant predictor on Online Purchase Behavior. Hence, the Customer Value-Based Model is proposed to obtain a parsimonious conceptualization in predicting consumer acceptance of e-commerce transactions.

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1 Introduction

Technology Acceptance Model (TAM) [1] was initially created to be a simple model to explain specific technology behavior in information systems. Over the last 18 years, due to its popularity, the TAM has been augmented by including various context-specific constructs to explain phenomenon in e-commerce, e-learning, e-banking and wireless technologies besides information systems. As context changed, the researchers added appropriate additional constructs to the basic conceptual stock to bring in the relevant factors in the model. Instead of the original five main constructs, today one is tempted to use as many as 18 constructs, and their interrelated complexities, depending on the nature and the scope of the study [2]. Furthermore, while most of these constructs were conceptually sound, they displayed weak theoretical support in their zest to build models instead of explaining the targeted behavior. This study, in the context of e-commerce, or more specifically the online purchase behavior, attempts to consolidate a cohort of existing constructs using the emerging tenets of Customer Value-based Theory [3] and reinstate the parsimonious intentions of TAM.

2 Technology Acceptance Model

Technology Acceptance Model (TAM)) expounded for modeling user acceptance of information systems is an adaptive modification of Theory of Reasoned Action (TRA) [1]. The aim of TAM was to explain user behavior across a broad range of computing technology in a parsimonious way and based on a theoretical foundation. TAM identified a small number of fundamental variables dealing with cognitive and affective determinants, along with two specific beliefs, *perceived usefulness* (PU) and *perceived ease of use* (PEOU), posited as constructs of primary importance for computer acceptance behaviors (see Figure 1).

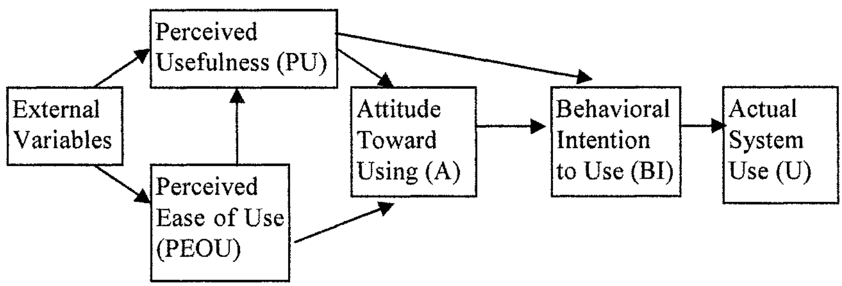

Fig. 1: Technology Acceptance Model

There is a significant relationship among TAM constructs namely Attitude and Behavioral Intentions, on the one hand, and the Usage Behavior on the other [4, 5]. In more recent modifications, perceived risks of different kinds, Perceived Trust of different kinds, and Facilitating Conditions have found place in explaining intermediate, or more specifically TAM specific basic constructs.

In the context of e-commerce, the authors could identify a sufficiently large number of constructs which over a span of 8-10 years found entry into TAM specific literature. Besides PU and PEOU, some of these constructs included: Perceived Convenience, Perceived Enjoyment, Trust in Online Companies, Trust in Internet Security Technology, Perceived Financial Risk, Perceived Physical Risk, Perceived Performance Risk, Perceived Psychological Risk, Perceived Social Risk, Perceived Time Loss Risk, Perceived Privacy Risk, Perceived Overall Risk, and Facilitating Conditions.

These additions probably reflected the complex nature of technology acceptance behavior. Furthermore, as behavioral context kept changing, like that from acceptance of e-mail and graphic systems in the late eighties to that of online purchase, online banking, and e-learning in early twenty-first century, the context specific constructs found several applications. The question remained whether the theoretical base which supported the original TAM conceptualizations remained valid for the emerging context of online transaction based consumer-behaviour. We would like to argue that a broad based and appropriate theoretical framework is needed to explain and account for an emerging battery of constructs more meaningfully. Against this backdrop we would to propose and empirically explore the utility of customer-value based theoretical conceptualizations.

3 Customer Value

Slater [3] reports that foundation for the customer value-based theory of the firm was laid decades ago by Alderson [6] and Drucker [7], among others, and was further developed by many marketing theorists. Unprecedented socioeconomic and demographic changes, growing demand for higher levels of quality and service, emergence of new media and distribution channels, rapid rate of technological changes, and hypercompetitive environments are forcing firms to organize themselves around customer value delivery processes. Customer value-based businesses strive to develop better understanding of the customers and focus on intangible value proposition.

4 Research Questions and Propositions

Can customer value-based conceptualizations be used to supplement the Technology Acceptance model in predicting online purchase behavior? Can the cohort of existing TAM tested constructs be appropriate utilized to develop an independent scale for measuring customer value? In what way the well established relationships between cognitive, affective, and facilitating variables are likely to get altered as a result of alternative conceptualization? In other words, the objective of the paper is to explore the usefulness of incorporating the customer value-based concept in TAM model.

Based on the findings of the previous TAM specific studies as well as the intended research questions, we are proposing the following seven hypotheses for testing.

H1: Customer attitude towards online purchase behavior has significant and positive relationship with online purchase behavior.

H2: Customer's behavioral intention towards online purchase behavior has significant and positive relationship with online purchase behavior.

H3: Trust in Online Companies in the context of e-commerce transactions has significant and positive relationship with online purchase behavior.

H4: Trust in Internet Security Technology in the context of e-commerce transactions has significant and positive relationship with online purchase behavior.

H5: Facilitating Conditions in the context of e-commerce transactions has significant and positive relationship with online purchase behavior.

H6: Perceived Customer Value in the context of e-commerce transactions has significant and positive relationship with online purchase behavior.

Derived from these six hypotheses, in the context of Perceived Customer Value, a null hypothesis is proposed as follows:

H7: The relationship between Attitude, Behavioral Intention, Trust in Online Companies, Trust in Internet Security Technology, and Facilitating Conditions, on the one hand, and actual Online Purchase Behavior would remain positive and significant even when the influence of Perceived Customer Value is controlled for.

5 Computation of Composite Index of Perceived Customer Value

Researchers and managers tend to agree that delivering superior customer value is essential to favorably gain consumer response and retain competitive advantage in turbulent market place. Conceptualization and measurement of perceived customer value as a construct, however, remained challenging [see 3, 8, 9, 10]. In their efforts to discover appropriate scales or empirical referents, the researchers made various observations. Some of these included (a) customer value is customer centric and customer driven; (b) it is judgmental; (c) it is evaluative; (d) besides attributes driven, it is consequences driven, actual or perceived; (e) it is an overall assessment of utility, perceived worth, and/or trade off between price and perceived benefits; (f) it is dynamic in the sense it differs over time for same customers or differs across different customers at the same time; (g) it may intrinsic as well as extrinsic; (h) it involved high level of abstraction; (i) It is contextual; (j) it is highly personal; (k) it is multidimensional; (l) it has decision-making implications; and (m) it refers to monetary as well as non-monetary consequences [3, 8, 9, 10, 11]. All these observations point out that operationalizing the construct of customer value is quite complex. While some admirable efforts have been made to develop independent scales for different objectives, in the context of e-commerce and technology acceptance conceptualizations, we have adopted the following operational definition of the perceived customer value. This operational definition comes closer to Zeithaml's [8 p.14] overall conceptualization that "perceived value is consumer's overall assessment of the utility...based on perceptions of what is received and what is given". Zeithaml does make a reference to benefits and sacrifice components of perceived customer value. Based on these observations and the available stock of TAM specific constructs, we have used the following formula to compute the composite index of perceived customer value:

$$\text{Perceived Customer Value} = \frac{\text{Perceived Customer Benefits}}{\text{Perceived Customer Cost}}$$

$$= \frac{\text{(Perceived Usefulness + Perceived Ease of use + Perceived Convenience + Perceived Enjoyment)}}{\text{(Perceived Financial Risk + Perceived Physical Risk + Perceived Performance Risk + Perceived Psychological Risk + Perceived Social Risk + Perceived Time Loss Risk + Perceived Privacy Risk + Perceived Overall Risk)}}$$

As can be seen from the formula, perceived customer value is a ratio of perceived customer benefits associated with the reference response and the perceived customer costs. In this study the summative index of perceived benefits included four constructs namely Perceived Usefulness, Perceived Ease of use, Perceived Convenience, and Perceived Enjoyment. Similarly, the summative index of perceived cost included eight constructs namely Perceived Financial Risk, Perceived Physical Risk, Perceived Performance Risk, Perceived Psychological Risk, Perceived Social Risk, Perceived Time Loss Risk, Perceived Privacy Risk, and Perceived Overall Risk associated with the reference transaction.

In our study we have considered PEOU as a benefit to the customer for a variety of reasons. Though PEOU has been found to be an antecedent of PU in TAM specific literature, in the original model it also had direct causal influence on the attitude. In a given context, affirmative perceptions regarding ease of use can have positive decision making consequences. In the similar vein, negative perceptions can be treated as a cost parameter. Positive perceptions on the other hand reflect an overall favorable assessment of the utility and its potentially beneficial worth.

6 Methodology

The variables and the number of items describing the variables for this study are summarized below. All items were measured using 5-point Likert scale.

6.1 Actual Online Purchase

For the purpose of this study, actual online purchase of air tickets is used as the dependent variable. The data collected from the respondents included the number of air tickets purchased through (a) travel agency, (b) the Internet and (c) airline counters, for business, personal and family travel together, within the last 12 months from the date the survey was conducted. For data analysis purpose, the number of tickets bought through Internet as a percentage of the total tickets bought from all sources for all purposes was used as a variable.

Airline ticket purchases were chosen to test our model because the price for airline tickets generally remains same regardless of the channel of purchase, i.e. either through the travel agent, airline ticketing counter, or the Internet. The focus of our customer value-based model for e-commerce is only for online purchase behavior, hence the actual costs associated with other channels like cost of driving to travel agency, parking the car or calling the travel agency vs. making the booking online were not considered in our model.

Perceived Usefulness: The original scale used by Davis [4] to measure Perceived Usefulness of electronic mail was modified to reflect the buying of an airline ticket on Internet. The Cronbach alpha value for the seven items in the final survey was 0.91.

Perceived Ease of Use: The original scale used by Davis [4] to measure Perceived Ease of Use of electronic mail was adapted to suit the context of purchasing an airline ticket online. The Cronbach alpha value for the four items in the final survey was 0.74

Perceived Convenience: Three items measuring perceived convenience of technology assisted shopping [12] were modified to suit the context of online purchase. The Cronbach alpha value for the three items was 0.85 in the main survey.

Perceived Enjoyment: Three items measuring perceived enjoyment of websites [13] and two items measuring perceived enjoyment of technology assisted shopping [12] were modified to suit the context of online purchase. The Cronbach alpha value for the four items was 0.90 in the main survey.

Financial Risk: Three items measuring financial risk for online shopping [14] and two items measuring financial risk of e-services adoption [15] were modified to suit the context of online purchase. The Cronbach alpha value for all the five items for the main study was 0.80.

Physical Risk: Two items measuring physical risk for online shopping [14] were modified to suit the context of online purchase. The Cronbach alpha value for both items was 0.85 in the main study.

Performance Risk: One item measuring performance risk for online shopping [14] and three items measuring performance risk of e-services adoption were modified to capture information about online purchase for this study. The Cronbach alpha value for all the four items was 0.89 in the main study.

Psychological Risk: Three items from Kehoe's study [14] and one item from Featherman and Pavlou's [15] study were modified to suit the context of online purchase. In the main study, the Cronbach alpha value for all the four items was 0.90.

Social Risk: Three items measuring social risk [14] for online shopping were modified to suit the context of online purchase. The Cronbach alpha value for all the three items was 0.87 in the main study.

Time-Loss Risk: Four items measuring time-loss risk for online shopping [14] were modified to suit the context of online purchase. The Cronbach alpha value for all the four items was 0.91 in the main study.

Privacy Risk: Two items measuring privacy risk of e-services adoption [15] were modified to suit the context of online purchase. The Cronbach alpha value for both items is 0.90 in the main study.

Overall Risk: Four items used to measure overall risk of online shopping [14] and two additional items to measure the overall risk of e-services adoption [15] were modified to reflect online purchase of airline tickets. The Cronbach alpha value for all the six items in the final study was 0.90.

Trust in Online Company: All the items from two studies [14, 16] were modified to suit the context of online purchase of airline tickets. The Cronbach alpha value for all the six items in the final study was 0.89.

Trust in Internet Security Technology: The initial scale measuring Trust in Internet Security Technology for online shopping was modified to reflect the context of online purchase. The Cronbach alpha value for all the five items in the final survey was 0.94.

Facilitating Conditions: Items measuring facilitating condition for the intention to use Internet/WWW at work [17] were modified to determine the facilitating condition of the Internet for purchase. In the main survey, the Cronbach alpha value for both items was 0.80.

6.2 Sample and Data Collection

A pilot study to test the study instrument for the main survey was carried out by interviewing undergraduates enrolled in an electronic business course at a large private university in Malaysia. Undergraduates vary widely in their skills and knowledge, and this variance helped in being able to clarify the wording, content, and general layout of the survey instrument.

The population for the main survey consisted of Internet users who had credit cards and their own income. Online purchase can only be done by someone who was familiar with the Internet and owned a credit card. Similarly, they must be earning to be in a position to buy products online. Therefore, the respondents who fulfilled the following three criteria were selected for obtaining responses: (a) use the Internet; (b) has a credit card; and (c) currently working or self-employed.

Since the sampling was limited to a specific target group, purposive sampling was considered suitable as a sampling design [18]. This method was appropriate to collect data from specific types of people who could provide the desired information. A total of 1730 respondents filled the questionnaires, mostly in the presence of investigators. The sample was drawn from the capital cities of all the states in Malaysia, including Cyberjaya which is the "Smart City" in the Malaysia's Multimedia Super Corridor. State capitals and Cyberjaya were chosen as the locations to collect data as prospects of both the population and the respondents fulfilling the three criteria were better as compared to small towns and rural areas since Malaysia is still a developing country.

A survey method was preferred for this study as responses on a large number of scale specific items were needed to systematically measure various constructs. The scales used in this study were derived from previous studies which had also used the survey method. Survey method also allowed us to get a sizable number of responses and be consistent with previous TAM studies. This consistency was needed for the purpose of this study.

Of the 1730 questionnaires, 120 questionnaires were discarded as many items in the questionnaire were not answered. Furthermore, 170 respondents indicated that they were not aware that airline tickets could be bought through the Internet. Since online purchase required the Internet users to be aware of this possibility, responses of these 170 respondents were not used for data analysis. Thus 1440 respondents who were aware that airline tickets could be bought through the Internet formed the sample of this study.

The authors had access to data which could be analyzed using sophisticated techniques such as structural equation models. Since the primary purpose was exploration, analysis based on simple bivariate, partial correlations and stepwise multiple regression was preferred to more effectively determine the impact of customer value. Version 12 of SPSS was used to process the data.

7 Results

7.1 Demographics

Around half of the sample were male (51.4%, n=740). The major ethnic groups in Malaysia were well represented in the sample [41% Malays (n=591), 36.0% Chinese (n=519), 20.8% Indian (n=299) and 2.2% other ethnic groups (n=31)]. The youngest respondent is 18 years old while the oldest respondent is 64. The mean was 33 years with the standard deviation of 8.152. 20.3% have primary or secondary school qualifications (n=289), while 69.9% (n=1006) has either certificates, diploma, bachelor's degree or professional qualifications and 7.3% have Masters and PhD degrees (n=105). 1.3% did not mention their highest academic qualification (n=19).

7.2 Hypotheses Testing

Table 1: Influence of Perceived Customer Value on other variables.

Control Variables		Tickets bought from Internet as % of tickets bought from all sources
None-(a)	Tickets bought from Internet as % of tickets bought from all sources	1.00
	Attitude toward Online Purchase	.175(**)
	Behavioral Intention	.239(**)
	Trust in Online Companies	.173(**)
	Trust in Internet Security Technology	.141(**)
	Facilitating Conditions	.157(**)
	Ratio of Perceived Customer Value	.293(**)
Perceived Customer Value	Tickets bought from Internet as % of tickets bought from all sources	1.000
	Attitude toward Online Purchase	.022
	Behavioral Intention	.090(*)
	Trust in Online Companies	.043
	Trust in Internet Security Technology	.017
	Facilitating Conditions	.010

** Correlation is significant at 0.01 level, * Correlation is significant at 0.05 level, a Cells contain zero-order (Pearson) correlations.

The results of the hypotheses testing are shown in Table 1. The results indicated that all the six hypotheses were supported. This meant that the relationships between variables like Attitude (r = 0.18), Behavioral Intention (r= 0.24), Trust in Online Companies (r=0.17), Trust in Internet Security Technology (r=0.14), Facilitating Conditions (r=0.16) and Perceived Customer Value (r=0.29), on the one hand, and actual Online Purchase Behavior on the other were significant at 0.01 level. These results were in the expected direction. However, when Perceived Customer Value was used as a control variable, the results of the partial correlations showed that all relationships between Attitude (r = 0.02), Behavioral Intention (r= 0.094), Trust in Online Companies (r=0.04), Trust in Internet Security Technology (r=0.02), Facilitating Conditions (r=0.01) and actual Online Purchase Behavior became non-significant except Behavioral Intention which showed substantial reduction in its impact on actual air ticket purchase online and which was marginally significant at 0.05 level. Therefore, H7 as a null hypothesis was rejected.

Consistent with the above results, the results of the stepwise multiple regression, as shown in Table 2, indicated that perceived customer value was the most significant ($p < 0.01$) predictor of online transaction behavior followed by behavioral intention ($p < 0.05$). All the other variables got excluded from the analysis.

Table 2: Stepwise multiple regression results for Perceived Customer Value

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.633	3.938		.923	.357
	Ratio of Perceived Customer Value	.334	.040	.292	8.285	.000
2	(Constant)	-11.326	7.567		-1.497	.135
	Ratio of Perceived Customer Value	.268	.049	.234	5.432	.000
	Behavioral Intention	1.883	.814	.100	2.313	.021

Dependent Variable: Tickets bought from Internet as % of tickets bought from all sources

8 Discussions

The results have shown that Perceived Customer Value is an important determinant of Online Purchase Behavior. So far, this key construct has not been used with TAM for e-commerce in previous studies. With the presence of Perceived Customer Value, only Behavioral Intention is a significant predictor on Online Purchase Behavior. Hence, the Customer Value-Based Model (Figure 2) is proposed to obtain a parsimonious conceptualization in predicting consumer acceptance of e-commerce transactions. Since constructs such as trust and facilitating conditions were found not significant due to the influence of Perceived Customer Value, these constructs were not included in the proposed Customer Value-Based Model.

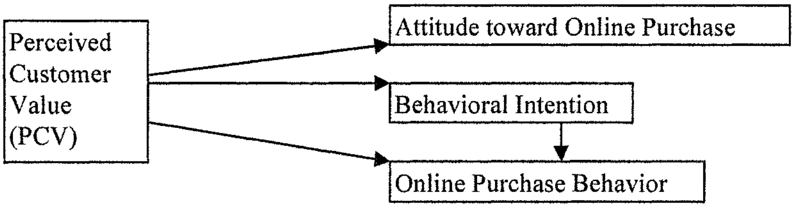

Fig. 2: Customer Value-Based Model for e-Commerce

9 Conclusions

Perceived Customer Value as a sound theoretical construct has important implications for online purchase behavior. Though this construct is increasingly gaining ground in the field of marketing, it has equal relevance for the field of e-commerce.

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P2P Users: Important dimensions for changing to legal online music stores

Américo Nobre G. F. Amorim, Jairo S. Dornelas
Federal University of Pernambuco
Administrative Sciences Department, PROPAD, NEPSI Research Group
Av. Profº Moraes Rego, 1235, Recife-PE, 50670-901, Brazil
home page: http://www.dca.ufpe.br/nepsi
americoamorim@gmail.com, jairo@ufpe.br

Abstract. P2P services made music sharing popular. Users got used to get the songs they want for free, and use it freely, without restrictions. With some years of delay, online music retailers started to sell legal digital song files, mainly with DRM protection. Recent studies shows that P2P networks continue to grow, attracting more and more users. In this scenario, this work is dedicated to find out some evidences about what can be done to convince users to migrate from the P2P services to legal online music stores. The main question that rises is: How to convince users to start paying for what they already find for free? The empirical research was conducted in two phases: First, interviews with 7 specialists from the music and internet businesses (recording companies, music sites, legal online music stores) were done. With the identified practices and insights about the problem, it was created an online survey that was answered by a sample of 10.123 Brazilian online music users. Using a factorial analysis, 3 dimensions (website attributes, competitive differentiation and anti-piracy) were identified. Results indicate that in order to convince users of P2P services for buying music, the music industry must implement several integrated tactics. In general, website attributes and competitive differentiation are perceived as more important than anti-piracy actions. For occasional users, this process seems to be easier, and might be done with less tactics. The more frequent the P2P usage is, weaker the anti-piracy dimension was perceived as important. These findings can indicate that different managerial and marketing approaches are needed to address the migration of users for online legal music stores. Reward programs and exclusive contents seem to be good options in this direction. At last, limitations and suggestions for further studies are presented.

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1 Introduction

The commercial use of Internet started in nineties. In the same period, the audio compression format MP3 (MPEG-1 Audio Layer 3) was developed and released. By allowing the compression of sound files in an average of 11:1 with reasonable audio quality, the MP3 allowed users to transfer audio files on the internet.

In the beginning, only a few websites started offering MP3 files for download. The current internet connections (mainly dial-up) were too slow for transferring song files, and that process took a long time. In this early scenario, no importance was given to MP3 by the music industry. But in 1999, the broadband internet connections were spreading, and a young student created a software called Napster [1]. It allowed its users to easily share and search for music files in a Peer-to-Peer network [2].

Napster was a huge success; millions of users from all over the world learned how to share music. MP3 files have no built-in digital rights management (DRM) so that users can burn them to CDs and transfer to portable audio players (ex: iPod). P2P services became one of the most popular internet services, and several others followed Napster with more advanced technologies such as Kazaa, Gnutella and eMule.

Then, the music industry started to worry about MP3 and file sharing. In 2000, the Recording Industry Association of America (RIAA) started lawsuits against several music sites, including Napster, which went offline in the same year. But other P2P services survived, and users kept sharing their files. Until 2003, users had no other real option to download songs online. Since there was no good digital music store, they had to use P2P software, and they got used.

The first plausible online music store was Apple's iTunes, released in 2003. The site offered tracks for 99 cents and also full albums, and in its first year it sold 70 million tracks. The marketing mix included cross-selling Apple's digital music player iPod, the product got a huge success, and soon it became one of the company's bestselling products. Following iTunes initiative, in 2004, other players joined the online music market: Wal-Mart, MSN Music, Virgin Music, Sony Connect and MyCokeMusic. Napster also came back as a legal service, offering subscription and also per track sales.

Trying to support the online stores, the music industry continued to fight P2P software. RIAA changed its tactics in 2004, when started to sue individual users [3] and sabotaging P2P by uploading damaged files. Even with the huge increase in the legal music offer, the P2P services continued to grow. The number of P2P users seems to double every two years [4]. That clearly shows that a lot more has to be done to transfer users from free P2P to the legal music businesses.

In this scenario, this research work is dedicated to find out some evidences about what can be done to convince users to migrate from the P2P services to online legal music stores. The main question that rises is: How to convince users to start paying for what they already find for free?

The empirical research was conducted in two phases: First, several interviews with key-specialists from the music and internet businesses (recording companies, music sites, legal online music stores) were done. With the identified practices and insights about the problem, it was created an online survey that was answered by more than 8.000 music site users.

2 Literature Review

There are several studies about online music distribution, from different areas as computer science, marketing, psychology, law and others. Krueger, Swatman and van der Beek [5] identified that the majority of research focuses on the phenomenon of P2P and its impacts to the music industry and ways that the music industry should react to sales declining. Due to space constrains, the main concepts involved in the phenomena and the pertinent literature will be highlighted.

2.1 Music as a digital good

Digital products are described as any form of information that has some meaning and does not need a specific physical exchange media to be carried from the producer to the consumer. As such, most intellectual goods can be labeled digital products, such as: music, software, videos, books, maps, news etc. All of these have content that can be digitalized and transmitted over the internet from the developer to the client [6].

Once within the client's possession, the digital products can be used on the same hardware that provided the internet connection or can be transferred to other physical means of support, for example, music can be burned in CDs or uploaded to digital audio players. Regarding to the business models for music as digital products, there are currently two standards [3]:

- **Pay-per-download**: Users can buy any song they want and transfer them to portable devices or burn CDs. This model is used by iTunes, MSN Music, Wal-Mart and Tesco (UK).
- **Subscription services**: Allows users to download a certain number of songs for a period of times. In some services like Napster, songs can be transferred to portable devices and are playable within the subscription time.

Digital products have been conceived as having some specific intrinsic characteristics like: indestructibility; which prevents them from suffering common time effects like traditional goods; transmutability is also present, meaning that consumers can make changes on them; and reproducibility, the most important difference, which makes them easy to copy or reproduce, reducing the marginal cost to almost zero.

According to early estimates [7], the main costs of digital retailers are: rights to publishers and recording labels (60% to 70%), financial transaction (10% to 15%), marketing (5% to 10%), staff (3% to 5%) and internet hosting (2% to 5%). All these numbers can be minimized due to scale gains, but they are useful for comparing digital distribution to the traditional CD, the reproduction cost, internet hosting, is the lowest in music as digital product.

2.2 Online Music Marketing

In order to get in touch with their clients, online music retailers use principles of online marketing applied to the music distribution. Some authors advocate that the traditional marketing approach trough the four P's – Product, Price, Place and Promotion is not the best choice for on-line environments and that it should be replaced by the four C's [8-10]. According to this concept, online retailers should focus on:

- Consumer needs and wants: Needs of consumers are in the center of decisions. Companies should provide new products, including digital products that can be delivered instantly.
- Cost to consumer: Costs should be reduced by the use of e-marketing, and pricing issues must be faced by segmented markets.
- Convenience: Use the Internet as a distribution channel for digital products, direct sales and the presence of the infomediary.
- Communication: The customization is maximized; products and services can be offered by online advertising (banners, email marketing, sponsored links).

Applying the 4C's to the online music distribution marketing mix, Krueger, Lu and Swatman [11] compared two online music retailers with Amazon and eBay. Their conclusions indicate that beyond any pricing strategies, the music industry needs to have the ability to sell online music as a core competence. They argue that this can only be done if clients are treated as allies using communication, convenience and customization tactics to attract new users. The cooperation between music companies must be granted, this is important to enable the offer of a great variety of music, fulfilling the user needs.

2.3 Digital Rights Management

In order to sell online music, almost all retailers are required by recording companies to use Digital Rights Management (DRM) technologies. The aim of DRM is to control how digitalized content, such as music, is used by the clients [12]. So when a user buys a song that is DRM-protected, depending on the license, he might not be able to copy it to other computer, burn it to a CD or transfer the song to a mobile audio player.

The main goal of DRM systems is that they give content producers (artists, publishers, labels) the choice to control how their work will be used by users [13]. On the other hand, consumers get restricted access to goods they paid for. This can lead to serious frustrations and marketing problems, including repudiation of use [14]. Some authors also discuss the adoption of different pricing and DRM levels in the context of piracy [15].

There are different DRM software now available [16], iTunes, for example, uses Advanced Audio Coding together with FairPlay DRM. It allows the clients to burn songs up to 7 CDs and copy files to 5 different computers. Microsoft implemented its own DRM in the Windows Media Audio (WMA) file format. WMA is used by several digital music retailers and is compatible with thousands of popular mobile audio players.

3 Research Method

In trying to answer our research question, How to convince users to start paying for what they already find for free?, we conducted an empirical research in two phases.

Phase 1. In the exploratory phase, we wanted to find out some evidence and insights of which actions might be taken by online music retailers to attract clients from P2P services. The specialists were asked, by email, to tell any tactic or idea (even if not implemented yet) that could help legal music websites to attract P2P users. They were chosen by two main criteria: experience in online music business and accessibility by the researchers. The final sample contained the seven specialists:

- Two main executives of online digital music retailers;
- One internet anti-piracy specialist, member of one recording companies association.
- One music producer;
- Three founders of popular music websites.

Phase 2. Based on results from Phase 1, a checklist of possible tactics was created. To verify the users' perceptions about these insights, an online survey was created. With 13 questions, the survey covered the checklist topics using a 4-point Likert scale anchored by "No Importance" (1) and "Strong Importance" (4). The survey also had two questions about the user experience in buying songs and using P2P services. A pre-test was conducted with five graduate students from management and computer science courses. At this time, minor adjustments were implemented to make the questions easier to be understood by users.

To select the sample of users that would answer the online survey the main criteria used was the interest of the user in online music. This was done to ensure that the sample would reflect accurate, real results from online music users. After that, researchers contacted one of the most popular Brazilian music websites (sombrasil.com). Since 1998, SomBrasil is one of the most respected and visited music sites in Brazil. Today, it has more than one million page views/day.

With the collaboration of the site, researchers invited by email more than 230.000 users that had subscribed to the website mailing list. The email explained the purposes of the research, described the privacy policy that would be adopted for the respondents and asked for the user's participation by clicking on a special link that would take the user to the survey. The link had a unique random-generated ID, so that each user could only answer the survey once.

The survey was available from December 1st to 5th, 2005. It was answered by 10.123 users. Incomplete surveys were discarded, resulting in the total of 8626 valid users for the sample.

4 Results Analysis and Discussion

From the interviews with the specialists (phase 1) and the literature review, a list with the tactics that could be used by online music retailers to convince users to pay was compiled. The analysis of the interviews was done with a content analyses approach, grouping similar answers in tree macro-categories.

Attributes of digital music retailer websites. Almost all specialists talked about some specific characteristics for music retailers websites. In their opinion, if the sites meet several criteria, it's easier for them to attract and retain clients.

- Fast downloads. Sites should have fast Internet hosting, so that users can benefit from their broadband Internet connections without having to wait for other users like in P2P services.
- Security assurance. Sites should guarantee that all files have good sound quality, are complete and virus-free.
- Comprehensive music library. Retailers should offer a wide range of artists, styles and songs, including rare and currently unpublished music.
- Easy to use. Sites should be easy to navigate, search and buy. Search mechanism must help users to find what they want with collateral information such as artist background, related songs and other useful and unavailable information in P2P services.
- Low prices. Users don't want to spend much money on what they can get for free. Low pricing seems to be one pre-requisite.
- Flexible DRM policies. DRM has to be almost transparent to users. P2P users are used to do everything they want with their files. By putting a lot of restrictions, DRM protected files might be rejected. The trade-off is how to assure a reasonable level of protection without creating trouble to the user.

Value added content provided by retailers. Some specialists argued that in order to convince users to migrate from P2P to legal services, retailers have to "offer more" than P2P.

- Exclusive bonus contents: Retailers could offer contents that users are not used to find in P2P services such as: extra tracks, remixes, photos, music education content such as lyrics with chords for guitar students.
- Rewards: By buying songs, users would earn points that could be changed to bonus, tickets to shows, souvenirs or even the traditional CD.

Music Industry anti-piracy actions. Some specialists believe that anti-piracy measures are essentials for getting users out of P2P. These actions can be taken by recording associations with strong media coverage.

- Artists statements against the use of P2P, asking fans to change to legal services;
- Attack P2P networks by placing corrupted song files on P2P servers and other technological measures to make P2P services worse for their users.
- Take legal action against P2P users and release information about it to the press, creating the sense that using P2P is risky and illegal.

The survey with music users (Phase 2) was done to identify if the tactics pointed by specialists were perceived as important for online music users. The sample revealed that the average respondent was 33 years old, 62% were males and 38% females. The first question revealed the P2P usage frequency of the respondents, as shown in Table 1.

Table 3. P2P Usage frequency for the sample.

Daily	1 to 3 times per week	1 to 3 times per month	Rarely use	Never use
15,2%	14,4%	13,3%	26,2%	30,9%

The second question showed that only 9,4% of the users had already bought digital music files, while 90,6% said they never bought digital songs. This might be important information for online retailers of how low their market-share is, at least in the Brazil, where this survey took place.

To analyze the results from the questions about the tactics, we conducted an exploratory factor analysis, trying to identify the main dimensions that were represented by the 11 questions about the tactics. The determinant of the correlation matrix found was .017, greater than the minimum required of .00001, showing that multicollinearity is not a problem for the collected data. The KMO value obtained was .898 which means a great value and indicates that factor analysis is appropriate for the data (Kaiser, 1974). All variables also had appropriate values for the measures of sampling adequacy (MSA). The Barlett's Test of sphericity was also significant at the .000 level.

The factor extraction method used was the Principal Component Analysis. To determine the number of the factors for extraction we primarily used the scree plot method [18], which indicated 3 factors. The Eigenvalue for the third component was .972 which is very close to the 1.0 recommendation of Kaiser [19] and also higher than the minimum of .7 described by Jolliffe [20]. It was also used the varimax method for factor rotation. The identified factors explained 64.37% of the total variance. Reliability analysis was done using the Alpha [21]. According to Malhotra [22], values higher than .5 were accepted.

The factor analysis (see table 2) indicated that the 11 variables could be grouped into 3 factors. Their scores were saved for use in further analysis. The variables grouped into Factor 1 indicated that it clearly represents website attributes. Factor 2 was formed with variables that represent competitive differentiation tactics. Anti-piracy actions formed the Factor 3.

In order to understand the influence of P2P usage frequency on each factor, a mean analysis was conducted (see Fig. 1), showing that Competitive Differentiation (F2) and Website Attributes (F1) are generally perceived as more important than Anti-Piracy Actions (F3). To find out if there are significant changes within each factor and the P2P usage frequency, it was conducted a Kruskal-Wallis Mean Test because of the non-parametric data. It indicated that the importance of Factor 1 (Website attributes, $H(4) = 20.11$, $p < .05$) and Factor 3 (Anti-piracy, $H(4) = 109.1$, $p < .05$) were significantly affected by the P2P usage frequency.

From this, it's possible to say that, for the studied sample, users that access P2P networks tend to give a slight decreasing importance to website attributes. Daily users perceive this dimension as less important than occasional users. The same seems to occur with Anti-Piracy actions (F3) but in a higher degree. Daily users of P2P services give less important to such dimension than non or occasional users of P2P services.

Table 4. Factor Analysis Outcomes. (Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization)

Variables	Factor 1	Factor 2	Factor 3
Factor 1. Website Attributes (F1)			
Fast downloads	.796		
Security assurance	.840		
Comprehensive music library	.745		
Easy to use	.732		
Low prices	.551		
Factor 2. Competitive Differentiation (F2)			
Flexible DRM policies		.593	
Exclusive bonus contents		.780	
Rewards		.763	
Factor 3. Anti-Piracy Actions (F3)			
Attack P2P networks			.822
Legal action against P2P users			.839
Artists statements			.530
Total Variance Explained	**28.48%**	**19.26%**	**16.62%**
Reliability Alpha Coefficients	**.852**	**.704**	**.676**

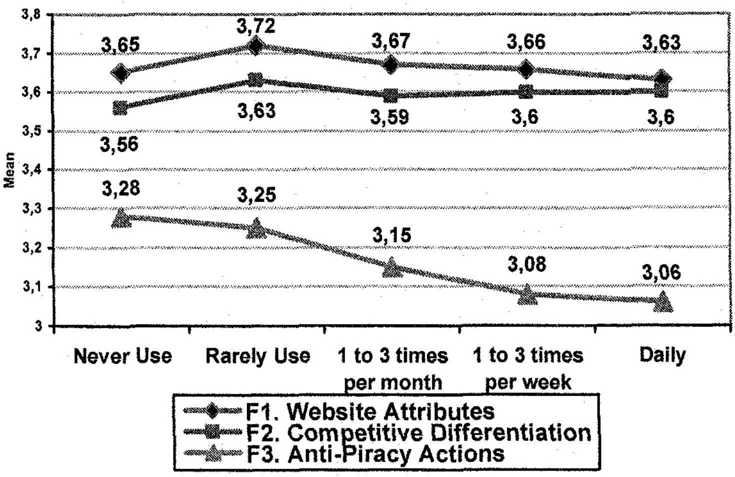

Fig. 4. Factors and the P2P Usage Frequency

5 Conclusions

From the research conducted we can conclude that in order to convince users of P2P services for buying music, retailers and music industry must implement several integrated tactics such as website attributes, competitive differentiation and anti-piracy tactics. Website attributes, including usability and pricing issues, has a higher level of perceived importance than anti-piracy measures. That corroborates e-marketing literature that defends the business focus on providing the 4 C's.

The use of isolated anti-piracy actions, which seems to happen in some markets, will not have the desired effect. Anti-Piracy actions seem to be more effective with new clients, which are not frequent P2P users. The significant decrease in the importance of anti-piracy actions for more frequent P2P users seems to indicate that for this group other dimensions are more important.

It's possible to speculate that this behavior shows that frequent users feel much more confident that they will not be affected by anti-piracy actions. That can happen because they believe that their own technology knowledge is sufficient for them to avoid the effects of the various types of attacks against P2P networks (viruses, damaged songs etc). The sense of impunity can also be stronger in frequent P2P users because they might believe that it is difficult to find and prosecute internet crimes, especially for experienced users like themselves.

We can also speculate that anti-piracy actions that are have been implemented, especially legal actions against P2P users, might have a negative impact, making clients feel as enemies of the music industry. Using Image Theory lens [23], the decision to use illegal songs can be a consequence of the negative image that clients can make about the music companies. This can lead to the emergence of a decision pattern where they tend to ignore their normal values and ethics, which usually drive their decisions, and consider the option to pirate as fair in this context. To face this kind of problem, music industry might need to implement what is told on the basic marketing literature: clients must be treated as allies.

At last, it's possible to say that the findings indicate that a deeper marketing approach has to be implemented in order to convince P2P frequent users for buying digital music. Managers might need to focus on offering more benefits for these clients, using joint strategies such as pricing and a better product mix, by adopting some of the competitive differentiation tactics (Flexible DRM policies, Exclusive bonus contents, Rewards etc).

The main limitation of this research is the composition of the sample. Even with a representative amount of users (8626), the results might be slightly different if the survey was ran in other countries, specially in the ones that online retailers are more active and popular. For further studies, we suggest the replication of the e-survey with users from other countries. Another approach would be to trying to identify other variables which would better describe the consumer behavior with digital music. A deeper analysis of the decision process for using illegal files is certainly an important issue, and Image Theory might be one of the plausible approaches for studying this issue.

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Users' Benefit and Provider's Revenue of Content Delivery Services with Priority Control

Kyoko Yamori, Yoshiaki Tanaka
Kyoko Yamori and Yoshiaki Tanaka:
Global Information and Telecommunication Institute
Waseda University
1-3-10 Nishi-Waseda, Shinjuku-ku, Tokyo, 169-0051
Yoshiaki Tanaka:
Japan kyamori@waseda.jp, ytanaka@waseda.jp
Advanced Research Institute for Science and Engineering
Waseda University
17 Kikuicho, Shinjuku-ku, Tokyo, 162-0044 Japan

Abstract. Recently, a large amount of content is delivered to users by content delivery services through broad-band networks. The necessity for the service which guarantees quality is increasing in the Internet, because users' requirements are diversified. Differentiated services, which have multiple classes using priority control, are being introduced. The limited network resources can be used effectively by applying priority control in content delivery services. In such services, it is important to predict users' requirements and to provide the services that suit users. In this paper, the user's behaviour in content delivery services with priority control was modeled by using willingness to pay, while the total users' benefit and the provider's revenue in two different content delivery models are maximized. One model is the content delivery service using only streaming, and the other model offers streaming and download services. In this paper, it is proved that optimal pricing for users and that for providers are different.

1 Introduction

In recent years, content delivery services are attracting attention as new services with the development of the communication network by ADSL (Asymmetric Digital Subscriber Line) or FTTH (Fibre To The Home). The present IP network is best-

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effort and does not guarantee the quality of service. Since all users are treated equally in best-effort communications, not bandwidth guarantee is offered to particular users. On the other hand, the bandwidth is a key point in real-time applications like video-on-demand, because user's utility is extremely sensitive to quality degradation. Therefore, bandwidth requirements of users have been diversified.

Thus, to meet the diversified bandwidth requirements of users, differentiated services have been examined. The main problems with differentiated services are guaranteed bandwidth and pricing. To study the problems, the relation between user's utility and price for the services has been researched [1-3]. There have also been many studies on quality and utility in fields such as quality evaluation [4,5]. Moreover, there is a considerable amount of research about content delivery with priority control [6,7]. Generally, waiting time and packet loss rate are used for evaluation of content delivery services. However, user's utility does not change linearly against these factors [6]. Therefore, user's utility cannot be evaluated correctly only with these factors alone. We believe there is need for additional evaluation of user' utility in view of the price, application environment, the purpose, etc.

In this paper, the relation between the service quality and the price is quantified using WTP (willingness to pay), which is used to create a model of user's behaviour. We have also considered the pricing so that to maximise total users' benefit and provider's revenue in two different content delivery models with priority control.

2 Network Model

In this paper, we consider a network model in which the content is delivered to users through a single transmission line. We assume that content delivery service with priority control is provided on the network. Fig.1 shows the network model.

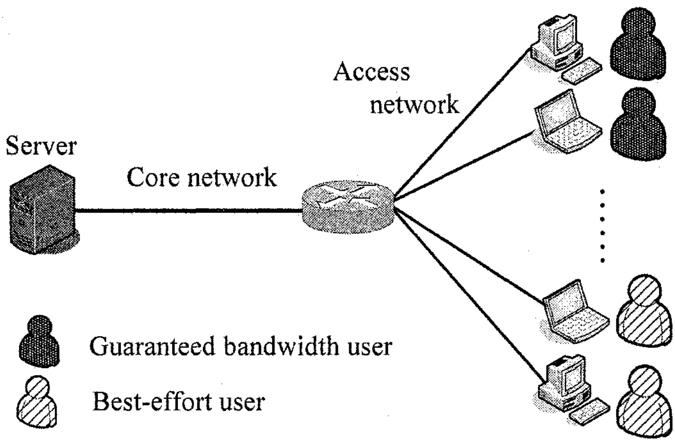


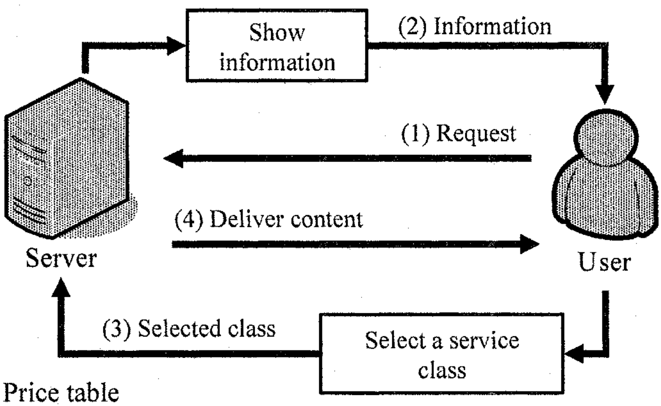
Fig. 1. Network model

Two basic priority classes are provided and stand for high and low user priorities. The high priority class specifies the minimum guaranteed bandwidth, so that even if the network is congested, the minimum bandwidth is guaranteed. When the network utilization is low, the bandwidth is distributed among all users on best-effort basis. When network utilization is high, and the assigned bandwidth to a particular user approaches the minimum guaranteed bandwidth, bandwidth distribution is different and while high priority users get at least the minimum guaranteed bandwidth, low-priority users get only evenly split bandwidth that is left over after high-priority users. Moreover, the maximum bandwidth assigned to the high-priority class is fixed, and, therefore, the number of users in the high-priority class is restricted.

The process of content delivery is shown in Fig.2, along with the pricing table below.

(1) A delivery request originates from a user and is sent to the content server.
(2) The information about the present state of priority classes is offered to the user by contents delivery server
(3) The user selects the delivery class from all offered options.
(4) Delivery of the content begins.

It is assumed that the price for the delivery of content is directly proportional to the duration of delivery. The basic price is also included for joining in the content delivery service. By paying more money, the user can obtain connection on a higher priority class.



Price table

Service class	Service quality	Price
Low-priority class	Best-effort	Basic price
High-priority class	Guaranteed bandwidth	Basic price + Extra price

Fig.2. Connection flow and price

3 Content Delivery Model

In this paper, two different content delivery models with priority control are defined, that are S-S (streaming vs. streaming) delivery model and S-D (streaming vs. download) delivery model. Table 1 shows details about both models.

Table 1. Details about considered content delivery models

S-S delivery model	High-priority class	Streaming service by minimum guaranteed bandwidth.
	Low-priority class	Streaming service by best-effort.
	Information to users from content server	a) Bandwidth for high-priority class. b) Mean bandwidth of low-priority class. c) Extra price for high-priority class.
S-D delivery model	High-priority class	Streaming service by guaranteed minimum bandwidth.
	Low-priority class	Download service by best-effort.
	Information to users from content server	a) Bandwidth for high-priority class. b) Estimation of waiting time. c) Extra price for high-priority class.

In S-S delivery model, since the content is delivered to the low-priority class users using streaming service without the minimum guaranteed bandwidth, when the network is congested, the quality of content deteriorates considerably. On the other hand, in S-D delivery model, the content is delivered to the low-priority class users using download service without guaranteed service, when the networks is congested, the waiting time for complete download becomes excessively long.

To compare S-D and S-S delivery models, the quality of content is guaranteed since the low-priority class is delivered using download service. However, it takes time until download is completed.

We predict the time by using the method of exponential smoothing. Exponential smoothing is a typical time-series-analysis technique which is used to predict future value from the preceding time series data. The predicted waiting time is defined by Eq.(1),

$$T = \theta T_p + (1-\theta)T_a, \tag{1}$$

where T is the predicted waiting time, T_p is the last predicted waiting time, T_a is the last actual waiting time. Parameter of θ stands for weight, and in this paper is set to $\theta = 0.5$.

4 Willingness to Pay

In order to evaluate the differentiated services, one has to match user's behaviour model which determines whether a user joins in service to a price paid for the service. However, since such services do not yet exist in real networks, we need to choose a hypothetical user's behaviour model.

WTP (Willingness to pay) is one of the methods used to define user's behaviour model [8]. WTP is often used for evaluation of services which do not actually exist yet. In the case of using paid services, WTP stands for the maximum amount of money that a user is willing to pay. Therefore, since user's maximum utility can be defined by WTP, it can be used as a measure of user's utility.

Let the price of content be 1. The relation between the WTP and the quality of service is defined by Eqs.(2) and (3),

$$U_{\text{streaming}}(w) = \frac{\alpha_1}{1 + cw^{-\alpha_2}} + 1, \tag{2}$$

$$U_{\text{download}}(t) = \beta_1 \exp[-\beta_2 t] + 1, \tag{3}$$

where α_1, α_2, β_1, β_2 are parameters pertaining to a particular user, w is the available bandwidth of a user, t is the waiting time, and c is constant.

Eq.(2) contains the function that defines the relation between WTP and the available bandwidth in streaming service. This function and its parameters are verified by subjectivity evaluation experiment. In the experiment, various quality motion pictures are shown to assessors, which specify how much extra charges can be paid for the guarantee bandwidth [9]. Actually, WTP is influenced by not only bandwidth but jitter and the maximum delay time. To simplify the discussion, we have considered only bandwidth.

Eq.(3) defines the relation between WTP and the waiting time for delivery of 1GByte content using download service. This function and its parameters are tested by a questionnaire.

In the questionnaire, the content size and waiting time are shown to assessors, which are inquired as to how much extra price they are willing to pay considering the waiting time offered to them.

The streaming WTP converges to a certain value, where α_1 is the value to converge to. And α_2 represents sensitivity to the available bandwidth. When α_2 is large, WTP increases at a higher rate. β_1 stands the download WTP in the case when no waiting time occurs. β_2 stands for the sensitivity to the waiting time, when β_2 is large, WTP decreases at a higher rate. Although the value of WTP itself is depends heavily the particular market, service, and users, it is thought that the tendency is the same.

Figs.3 and 4 show samples of the WTP functions. These samples are obtained with the following parameters: α_1=1.3, α_2=0.6, 1.0, c=3.38, β_1=1.2, β_2=0.012, 0.017.

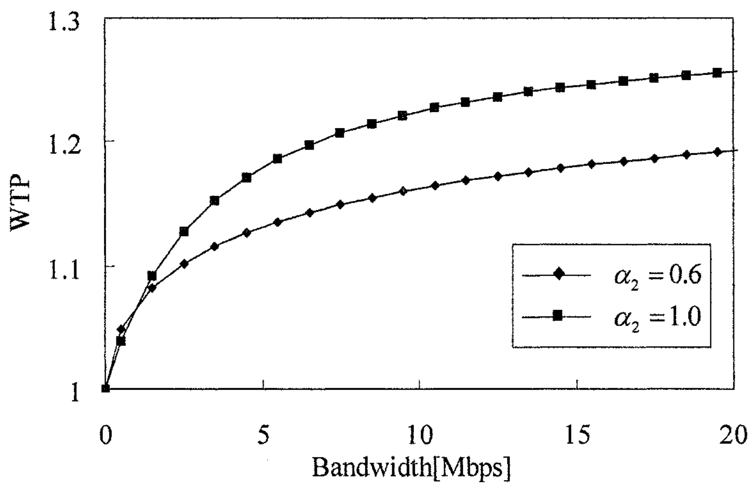


Fig.3. Sample of streaming WTP functions

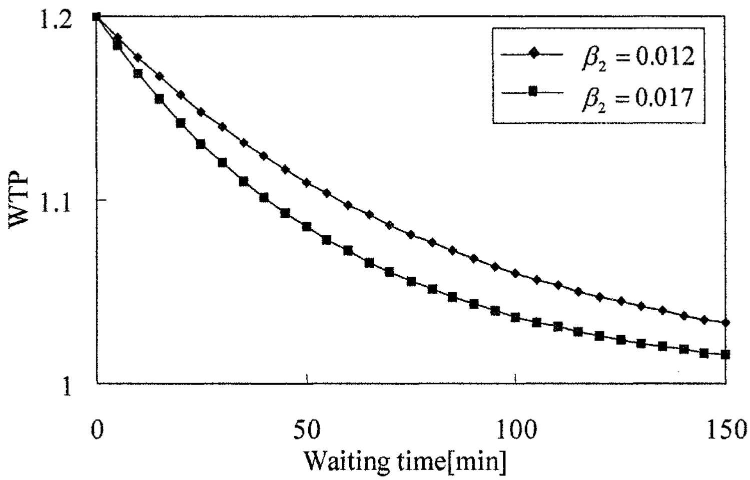


Fig.4. Sample of Download WTP functions

5 User's Behaviour Model

In order to define a user's behaviour model, we need to define user's benefit as per Eq.(4),

$$B_i = U_i - p_i \quad (i = 1,2) \quad , \tag{4}$$

where i is the number of the delivery class, i.e. i=1 is the high-priority class and i=2 is the low-priority class. U_i is WTP of each class and p_i is a price of each class. The user considers the benefit of each class based on the information received from the content server. After that, the user selects a class which maximises the user's benefit. If $B_1 \geq B_2$, the user chooses the high-priority class, if $B_1 < B_2$, the user goes for the low-priority class.

$$\begin{cases} B_1 \geq B_2 \Rightarrow (i = 1) \\ B_1 < B_2 \Rightarrow (i = 2) \end{cases} \tag{5}$$

6 Simulation Studies

We have evaluated total users' benefit and provider's revenue of both considered delivery models using simulation.

Table 2 shows the conditions of the simulation. The parameters of WTP functions are given to users at random in the range shown in the Table 2. In case of the streaming service, WTP is calculated by the minimum used bandwidth while the content is being delivered. In case of download service, WTP is calculated by the waiting time until the delivery is completed.

Table 2. Simulation setup

Number of content items	1
Transmission time of streaming service	3600 [sec]
Content size	1 [GByte]
Link bandwidth	300 [Mbps]
Minimum guaranteed bandwidth	2 [Mbps]
Maximum bandwidth of the high-priority class	150[Mbps]
Parameters of WTP functions	$0.2<\alpha_1<0.4$
	$0.6<\alpha_2<1.0$
	c =3.38

	$0.18<\beta_1<0.22$
	$0.12<\beta_2<0.17$
Request arrival rate of S-S delivery model	2, 2.5, 3 [times/min]
Request arrival rate of S-D delivery model	2, 2.3, 2.5 [times/min]

Three request arrival rates are given to each delivery models. Total users' benefit per hour and the increase in provider's revenue per hour in the priority control are displayed for each of request arrival rates in Figs. 5-8.

Fig.5 displays the total users' benefit of S-S delivery model, Fig.6 shows the provider's revenue of S-S delivery model, Fig.7 shows the total users' benefit of S-D delivery model, and Fig.8 shows the provider's benefit of S-D delivery model.

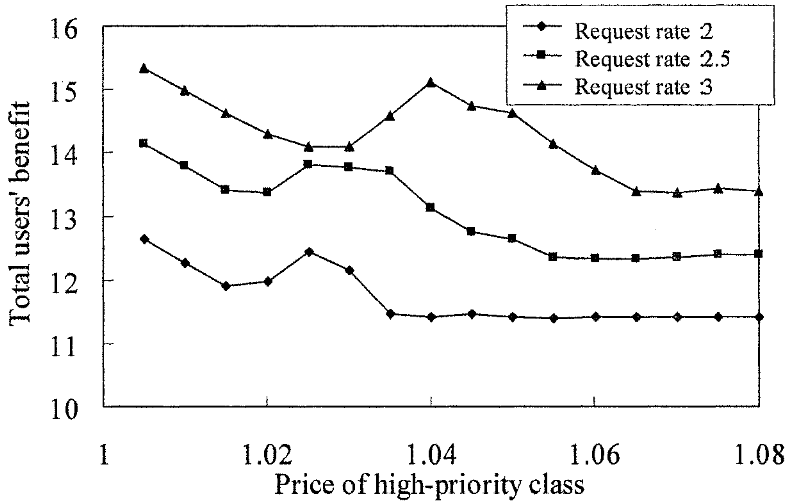


Fig.5. S-S delivery model : Total users' benefit

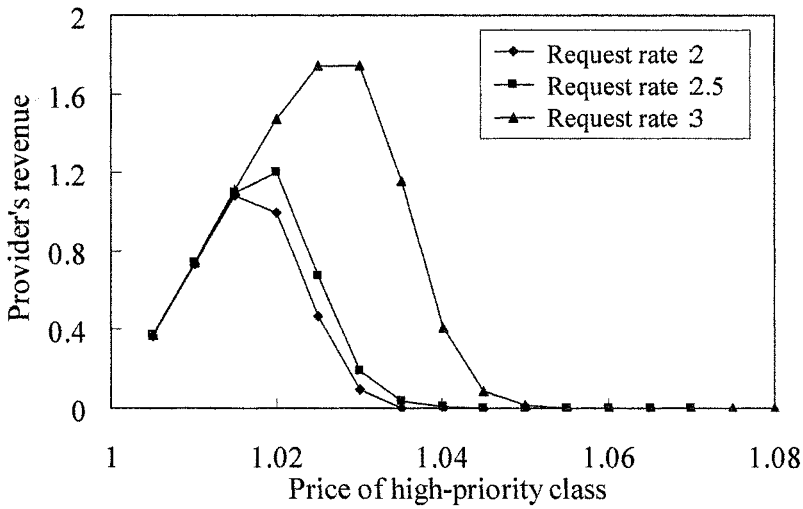


Fig.6. S-S delivery model : Provider's revenue

First, let's consider the results obtained from the S-S delivery model. Figs.5 and 6 exhibit the fact that total users' benefit and provider's revenue change similarly for each request arrival rate. At low prices, the total users' benefit decreases as the price grows. However, when the price is raised even more, total users' benefit is high. This happens because only users who have large WTP join the high-priority class. If the price is raises even more, user's benefit starts to drop. This is because users choose not to join the high-priority class, because the price is too high. As a result, the numbers of the users which join the low-priority class increases. Since the content quality which is delivered to the low-priority class deteriorates, that causes the decrease of total user's benefit as well. Finally, total users' benefit reaches the area where it doesn't change, and that is because users do not join the high-priority class at all. That is, in this area, it is exactly the same as the content delivery without priority control. Considering total users' utility, it can be concluded that it is more beneficial for users to deliver content with priority control than on best-effort basis.

Comparing Fig.5 with Fig 6, provider's revenue reaches the maximum value when the total users' benefit is low. It means that the optimal price for users differs from the optimal price for the provider.

Finally, the results of the S-D delivery model have to be considered. Fig.7 exhibits that the total users' utility increases when the request arrival rate is 2, and decreases when the request arrival rate is 2.3 and 2.5. It means that when the request arrival rate is low, it is better for users to deliver content without priority control, and when the request arrival rate is high, it is better for users to deliver content with priority control. Fig.8 shows that the provider's revenue is considerably high when the request arrival rate is 2.5. That is, when request arrival rate is high, priority control is very effective for both the users and the provider.

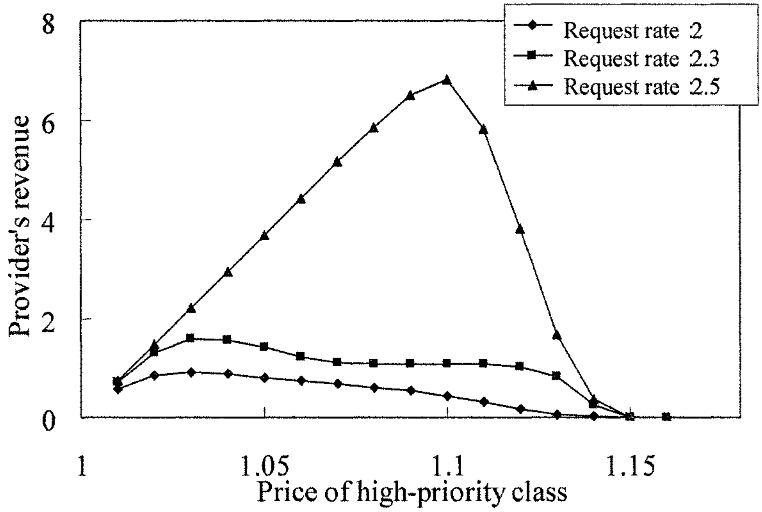


Fig.7. S-D delivery model : Total users' benefit

In the simulation study, content time and size were fixed. As a result of this, the network utilization rate is only affected by the request arrival rate. However, various sizes of content are possible in the actual network. Therefore, it is necessary to examine the relation between network utilization rate, total users' benefit, and provider's revenue.

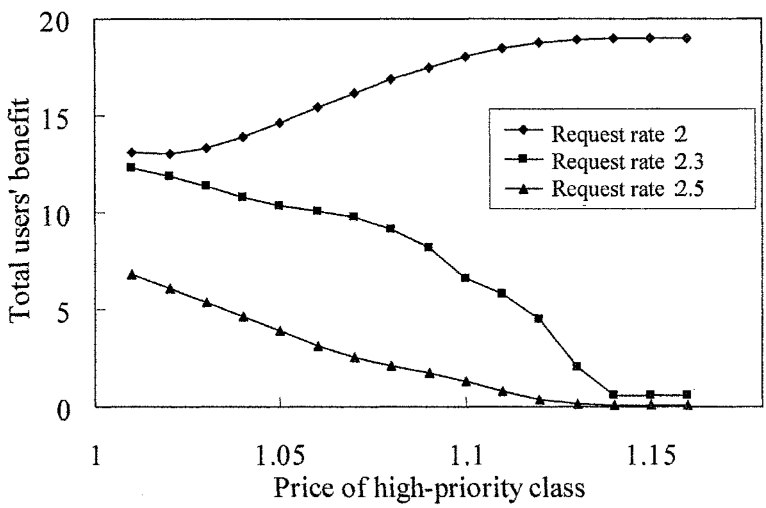


Fig. 8. S-D delivery model : Provider's revenue

7 Conclusions

In this paper, we have evaluated total users' benefit and provider's revenue using WTP in content delivery services. As a result, when content is delivered using only streaming service, at any request arrival rate, priority control is very effective for both the users and the provider. On the other hand, when delivery is done over streaming and download services, the effect of using priority control depends on request arrival rate.

As the result of this paper, it is expected that there exists the relation between optimal pricing and traffic load which can be found by adjusting request arrival rate and content size. In order to carry out more flexible optimal pricing, it is necessary to define this relation. Besides, since the optimal price for users differs from the one for the provider, it is necessary to examine the pricing method for each player. These are subjects for the further study.

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Business Model Scenarios for Remote Management

Olivier Braet and Pieter Ballon
Interdisciplinary Institute for Broadband Technology – Centre for Studies on Media, Information and Telecommunication (IBBT-SMIT), Vrije Universiteit Brussel, Pleinlaan 2, 1050 Brussel, Belgium
{obraet,pballon}@vub.ac.be
WWW homepage: http://smit.vub.ac.be/

Abstract. Based on a cross-industrial research project[4], we describe the different business model scenarios for the introduction of remote management technologies at the end-customer's premises. While remote management is introduced to aid the digital convergence between previously dissociated islands of end-user devices, and new service opportunities are created, several dominant industry trends run counter to this attempt at centralization. We offer a critical appraisal of the business challenges posed to the existing business models. Four business model scenarios are proposed that describe the most feasible evolutions in the coming years. Strategic business requirements are identified to appreciate the viability of each business scenario.

1 Introduction

With the growing complexity of networked devices in the home premises, there is a need for a service management solution that allows for remote management of devices on the customer's side (see e.g. [1, 2]). This holds a promise of simplification and better management control for the network access providers, content providers, and software application providers. The possibility exists of adding revenue streams or cutting costs through managed services such as home security, automation, and device management.

Our research problem stems from the architectural premise that several technical islands of user-devices (such as the television, the personal computer, or the electricity meter) have to be able to deliver a variety of services such as video-on-

[4] The authors gratefully acknowledge the inputs from and discussions with the project partners. The Armad@ project ('Autoconfiguration and Remote Management of Any Device @ Home') was co-funded by the IBBT (Interdisciplinary Institute for BroadBand Technology, a research institute founded by the Flemish Government).

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demand, music-on-demand, personal video recorder (PVR), or remote metering. During the delivery of these services, a remote service platform (or auto-configuration server) guards the quality, timeliness and integrity of the services delivered, or can install entirely new functionalities.

Within the scope of this article we aim to make explicit business models that are relevant for remotely managed support services (for the end user) through the use of a home gateway, where a separate remote management layer supports service delivery and quality. This separate management layer retains the initiative of the upgrading, patching, or adding of new functionalities.

What actor will fulfill the function of *gatekeeper*—occupying a position within the service value chain through which all other services must pass if they want to keep in contact with the end-consumer—will be of strategic primary importance. All actors must realize that consumers might veer away from a closed solution where the communication between services, applications and devices is fenced off from one another..

2 Business Modeling Approach

In order to take into account the different interests, resources and competences of the different actors from these disparate technical domains, we follow the methodology of business modeling. Business modeling attains a cross-industrial view, and attempts to describe the value network that creates a set of services. Business modeling is situated on a higher level of abstraction than business process modeling, which focuses on the flow or progression of activities within a company or within one specific industry.

2.1 Theoretical Background

Business modeling is multidimensional and strategic in character. It incorporates the multidimensionality of Kaplan and Norton's balanced scorecard view [3], the resource-based view of Jay Barney [4,5], and the strategic management insights of Gary Hamel [6]. According to Barney, companies must first mobilize their available resources and capabilities, in order to produce and bring to market a portfolio of products and services. Next, those products/services that create customer value appropriate a certain financial value that can be reinvested back into the capabilities of the firm.

2.2 Business Modeling Cycle

The business modeling cycle presented below is based on [5] and [7]. From Barney the primary importance of resources and capabilities is retained. His 'resources and capabilities' are an instance of organizational design, his 'products and services' an instance of 'technology design', his 'customer value' corresponds with the service design, and his 'financial value' with the finance design. The concept of 'roles' is basically synonymous with 'capabilities': roles will be defined as the bundle of business actions undertaken by corporate actors, with the aim of creating customer and shareholder value.

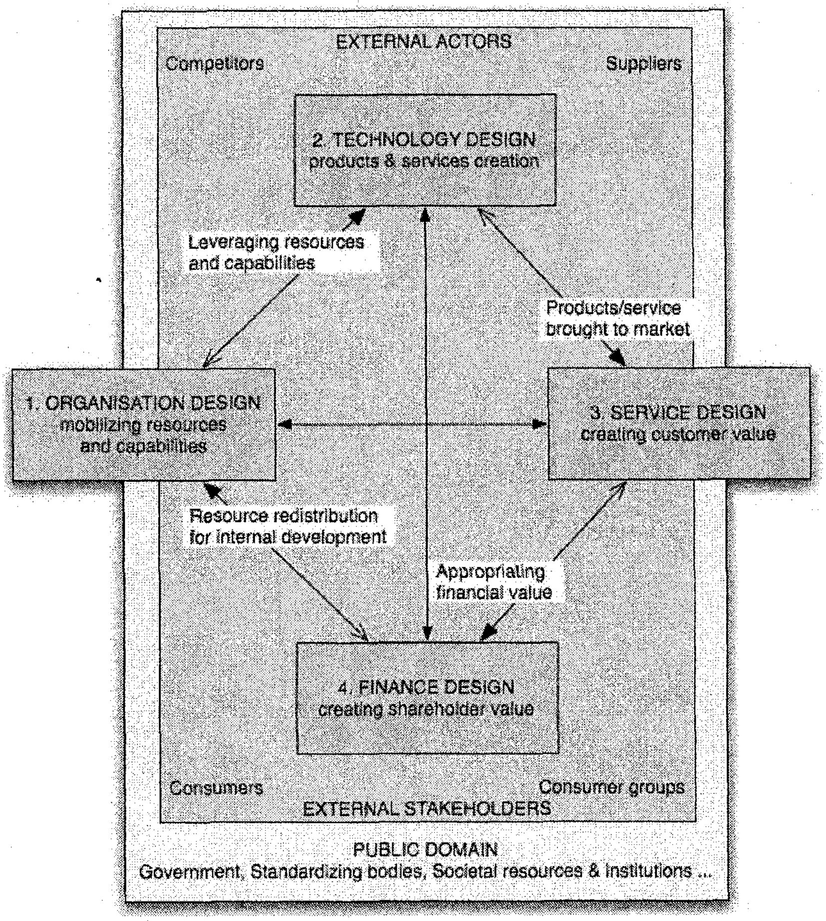

Fig.1. Business Modeling Cycle

The four business modeling design phases thus are:

1. Organization design phase. The organization design involves defining a business scope (what customers will we try to reach and how), identifying distinctive competences, and taking business governance decision (make versus buy decisions).

2. Technology design phase. The technology design involved defining the technology scope (what technical design are we trying to develop and how), identifying the systemic competences that will contribute to the business strategies,

and deciding on the IT governance (how will we develop or acquire the needed technical competences).

3. Service design phase. The service design involves choosing a specific value proposition towards the user, which implies choosing for a specific strategic scope.

4. Financial design phase. In a final phase, the financial modalities are formalized in binding contracts that clearly describe each partner's responsibilities, and the financial or other benefits they will receive in return.

2.3 Business Modeling Building Blocks

In business modeling, three main building blocks are distinguished: business actors, business roles, and relationships. **Business actors** can be physical persons or corporations that participate in the creation of economic value, through the mobilization of tangible or intangible resources within a business value network. **Business roles** are logical groups of business processes that are fulfilled by one or more actors. Business actors provide value to or derive value from the business roles they play. Finally, **business relationships** are the contractual exchanges of products or services for financial payments or other resources.

2.4 Value Disciplines as Strategic Thrusts

When choosing how to approach its end customers, a company can choose between three basic strategic thrusts: product leadership, operational excellence, or customer intimacy [8].

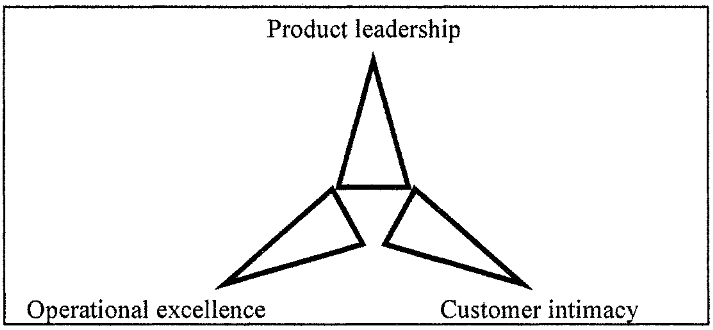

Fig.2. Treacy and Wiersema's [8] Value Disciplines

These three dimensions sum up the three basic reasons why and when consumers will adopt a new product:

- When aiming for operational excellence, a company attempts to attract a critical mass of consumers through cost-advantages that make the price of the product/service drops below that of the competition's;

- When choosing for product leadership the service or product offered is of premium quality and innovative, and comes at a premium price;
- When adopting the customer intimacy strategic thrust, the consumer is shown the advantage of having a more intimate relationship with the provider of said products/services through customized products/services.

As a company it is impossible to excel in all three areas, and very difficult to excel in two areas simultaneously. Therefore, a trade-off has to be made between these dimensions.

3 Research Methodology

The conceptual framework introduced above guided the research that was undertaken. After having conducted a literature review of existing business cases that are relevant for remote management, exploratory questionnaires were provided to all company partners of the project. The answers that were supplied served as a first input in the formulation of the business requirements, critical resources, and actor interactions. Subsequently, in-depth, face-to-face interviews were organized with representatives from each company partner organization.

Next we described, based on the input acquired through the series of business case studies, the identified actors, roles and requirements, and several business scenarios that vary from closed-loop to on-demand business models [9]. The two initial phases of business modeling design, i.e. the technology and organization design phases, are treated in the section below. The four business scenarios will outline the service and financial design phases.

4 Business Modeling for Remote Management

4.1 Technology Design

The technical architecture within the scope of the Armad@ project considers three main technical domains:

- Subscriber loop: The integrated network access solution as provided by the Network access providers, with the aid of infrastructure providers.
- Access and service gateway: The home or **access gateway** contains the routing/bridging function as well as the modem function. The **service gateway** is a platform on which the provider(s) deploy services.
- End user devices (or 'customer premises equipment' or 'terminal devices') in the home network (LAN). The end-user device with which the user consumes the service (TV, PC, PDA, IP-Phone,...). This can be an IP-enabled device (PC, game station) or a non-IP device (TV, Telephone).

Considering the outlined architecture, the business models scenarios will have to take into account a) different models for remote and local management, b) different models for application and content service provision and c) models that allow the execution of supporting services. More specifically, the location and functioning of the service platform as a passage point that can be controlled and exploited economically by gatekeepers, will be the focus of attention.

4.2 Organisation design

On the organisation design level, the different actors and roles that are active within a given value network are distinguished. The following categorisation of actors and roles is based on the categories of Camponovo and Pigneur [10].

a) **Technology** actors provide the hardware and software infrastructure needed to offer the remote management service to the end user.

- Network Equipment developers: Actors that develop the network equipment, necessary for the manufacturing of network equipment.
- Network Infrastructure Integrators: Actors that provide integrated network solutions to network operators.
- Content / Application Developers: Actors that develop the content or applications that will be delivered to the end-customer.
- End-user device manufacturers: These include Consumer Electronics device manufacturers, personal computers manufacturers, digital peripheral manufacturers, and telecom device manufacturers.

b) **Services** includes both content service providers and application service providers. These actors are responsible for providing value-added services.

- Content/ Application Service Providers: Sell integrated and branded packages of content / applications to specific end-customer market segments.
- Aggregators: Actors that aggregate the wide variety of applications and/or content available on the network.

c) **Communication providers** provide the end user with access to communication services, networks and the internet.

- Network operators: In the scope of our project, this term refers to all network operators that at least perform the role of network access provider.

d) Last but not least comes the **end user**, which can refer to both businesses and retail customers.

- End-users: An individual, group of people, or a company that is the final link in the service value chain, and consumes the services created and offered by the various previous links in the service value chain.

e) Camponovo and Pigneur do not consider the role of the **advertiser**, which we do include in all business model scenarios.

- Advertisers: Actors that mobilize marketing budgets in order to appear alongside content or applications.

Summarizing the above, the following figure shows a generic service value chain that delineates how the phases of production, integration, delivery / distribution and end-usage follow chronologically. This general business service value chain serves as the foundation on which a variety of feasible business scenarios can be mapped.

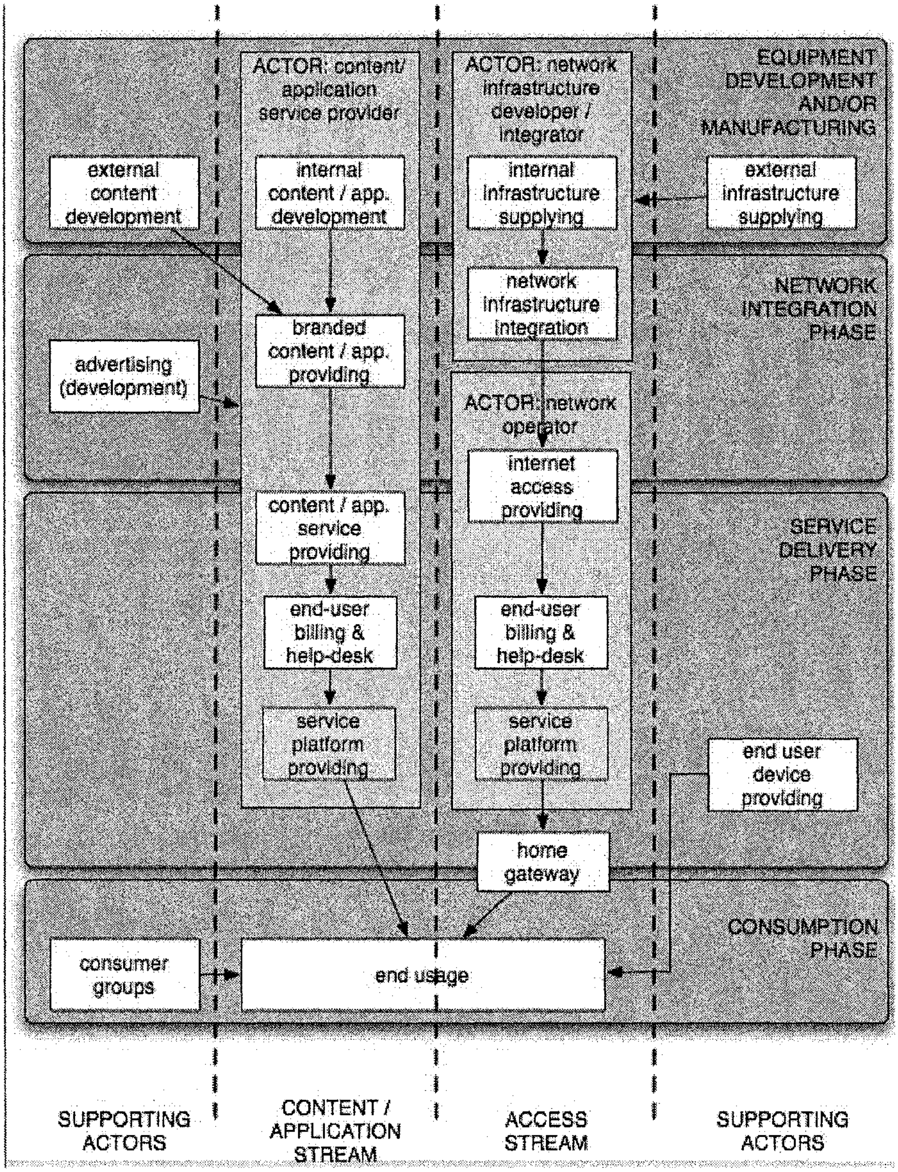

Fig.3. General Service Value Chain

5 Business Scenarios

Four potential business model scenarios are distinguished along two dimensions: whether they adopt a vertically integrated versus a modular service development approach, and whether they retain full remote management control, or delegate responsibilities to the end-user.

Table 1. Four business model scenarios

	Vertical service development	**Modular service development**
Strong remote management	NETWORK ACCESS PROVISION	PURE SERVICE PROVISION
Soft remote management	INFORMATION AGGREGATION	HYBRID SERVICE PROVISION

5.1. Business Model Scenario 1: Network Access Provision

In this scenario the network operator provides a unifying platform for external content or application providers in the form of a 'walled garden'. Users pay a one-time subscription fee, and/or a pay-per-use fee depending on the services provided and the payment formula offered. External service providers who choose to remain outside of the network operator's walled garden could experience markedly lower levels of service quality, except if they invest in their own remote management layer [11]. This solution allows the network operator to retain full control—but also: responsibility—of the quality of service of delivery, and may be most suitable for the delivery of critical high-end business software such as human resource management software, enterprise resource planning software, sales or supply chain management software [12].

Concerning revenue and service flows, there are revenue flows between the end customer and the network operator for the internet access. The consumer subscribes to content or applications via the network operator, and all consumed services appear on one telecom bill.

5.2. Business Model Scenario 2: Pure Application (or Content) Service Provision

In this business model scenario both the content and the application service provider remain completely independent from both one another, from the network operator, and from a device manufacturer.

Revenue flows exist between the consumer and the network operator concerning internet access provision and the implied remote management functionality. Because the customer buys his or her content or applications directly from the content or application providers, no advertising revenues are possible between the advertisers and the network operators. The third party content/application providers bear the responsibility of good QoS. The service providers may aim for lower quality mass-market reach through low pricing. In most cases, the third parties—if the network operator does not provide a preferred link to its subscribers—will obtain their customers through a content aggregator or through a search solutions provider (see fourth business model scenario).

5.3. Business Model Scenario 3: Hybrid Application (or Content) Service Provision

In this scenario, a service provider develops and markets an application or content service platform through alliances with content owners / application owners, and uses control of part of the delivery channel to create an attractive customer value proposition. This solution can lead to a 'content walled garden': only certified content, protected through proprietary DRM, will be consumable. In this scenario, a dominant hybrid service provider becomes—e.g. through an integrated hardware-software solution—a critical gatekeeper for content developers to deliver their content to the public.

Concerning the revenue and service flows, the access provider retains the control and management of internet access provision, and reaps the income from these services, but the content service provision and the affiliated advertising income can be captured by the content service provider.

5.4. Business Model Scenario 4: Information Aggregation

In this scenario a content aggregator or portal will attempt to position itself as the preferred partner for content and application retrieval with or without the use of a proprietary Digital Rights Management (DRM) solution. The content aggregator will only utilize a remote management layer for its DRM client software [14].

Concerning revenue and service streams, the customer only pays the network operator for internet access. Both the content and application service providers and the content aggregator capture a part of the generated advertising revenue. If the portal has sufficient critical mass, the marginal loss of the advertising income to the content aggregator at the expense of third party service providers is made up by the increase in content/application downloads.

6 Comparison and conclusion

6.1 Viability of business scenarios

Table 2 compares the strategic viability as well as the implications of the four scenarios outlined above according to the basic strategic thrust characterizing each business scenario, the degree of openness to third parties of the business model, the degree to which the remote management layer will be centralized or decentralized, and the main value proposition plus the main risk/obstacle of each business scenario.

Table 2. Strategic viability of considered business model scenarios

Gatekeeping role	Strategic thrust	Open vs. closed business model?	Centralization of remote management?	Main value proposition? — Main risk?
Scenario 1: Network Access Provision	Product leadership ++ Customer intimacy + Operational excellence -	Rather closed	Centralized within the network operator domain	Integrated service offering, aimed at premium market segment — Uncertain revenue model for mass consumption services
Scenario 2: Pure Application/ Content Service Provision	Product leadership - Customer intimacy + Operational Excellence ++	Rather open	Decentralized: Each application / service provider works independently	Fast introductions aimed at large markets; — Islands of content or applications hamper adoption; Lock-in of customers through proprietary standards
Scenario 3: Hybrid Service Provision	Product leadership ++ Customer intimacy + Operational excellence -	Rather closed	Rather centralized: Service delivery mechanism managed by content service provider	Fast adoption growth through portability — Business processes imitable by competitors
Scenario 4: Information Aggregation	Product leadership + Customer intimacy - Operational excellence ++	Very open	Decentralized: Search portal only sells ad space around search results, does not interfere with service delivery.	Transparent cost structure and self-evident customer value — Privacy concerns / secrecy concerns for customers; No control over collected data

The scenarios demonstrate that is feasible in a business sense for various stakeholders to install and manage a remote service platform. Network access operators present the primary and most obvious choice because of their traditional core business of managing and controlling network transport and service delivery, and because of their existing relationships with customers. However, several scenarios also point to a strong tendency towards decentralisation of remote management platforms. Concerning the risks of the remote management platform being bypassed, it is likely that the ability of external application and content service providers to circumvent specific internet-based platforms will persist and even increase.

It can be expected that the more business critical / professionally oriented the service offerings are, the higher the expected service quality levels will be, and the more likely a closed solution will become. Hence, while the entertainment cluster is witnessing the fastest growth, it may be the productivity cluster and the home management cluster—since they demand the highest levels of accurateness, timeliness and reliability—that will create the initial demand for a remote management layer. This forms an economic conundrum, since the slowest paths to profitability may require the highest levels of remote management functionalities, while the fastest paths to profitability are situated in a sphere of activity where the consumer has come to regard always-on connectivity and dynamic upgrading and patching functionalities as a given.

6.2 Implications for Remote Management

Given the likely decentralization of remote management functionalities towards the at least some content or application service providers, it can be foreseen that there will be a split in remote management functionalities between network-specific functionalities (residing in the network access provider domain) and content- or application-related functionalities (residing in either the network access provider domain, or in a variety of third party domains). Related to service gateway upgrades, the network access operator is most likely to build out a remote management layer, regardless of bypass threats or cross-selling opportunities, since it provides the network access provider with the possibility of longer hardware life cycles and lower maintenance costs.

Given the bypass scenarios by external service providers, duplication of remote management functionalities can be expected, as well as strategies by network operators to strengthen customer relationship and to aggregate and support attractive content and applications.

The remote management architecture should be sufficiently flexible in order to keep the most feasible future business options open, depending on what scenario will turn out to be dominant. One potential implication of the scenarios examined is that network operators, while offering advanced levels of remote management to selected external content providers and application providers in a 'closed', end-to-end manner, at the same time may be inclined or forced to open up the service gateway to additional content and application providers using just a minimal set of remote management functionalities offered by the operators.

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Electronic Activity Interchange EAI – a new way of B2B cooperation

Jarogniew Rykowski
The Poznan University of Economics, Department of Information Technology
Mansfelda 4, 60-854 Poznan, Poland
rykowski@kti.ae.poznan.pl

Abstract. In this paper, a new Electronic Activity Interchange EAI approach is proposed to support inter-business cooperation. This idea is based on using tele-activities, being pre-programmed piece of software that may be moved to certain locations and executed there. In contrast to traditional approaches, e.g., Electronic Data Interchange EDI, we consider both program and data flow rather than the information flow only. We propose a reasonable trade-off between a need for remote execution of activities owned and controlled by different business partners, and overall system security and efficiency. Our approach is based on imperative programming of activity code, and two basic activity classes: private, "untrusted" activities, executed with special care and with certain security restrictions, and public activities, being "trusted" code from the point of view of the local environment the activity is executed in. A balance between private and public activities may be defined by the business partners according to the specific situation and the business case.

1 Introduction

Traditional business is human-oriented - these are the humans who control business processes and information flow. However, modern business continuously searches for faster and more reliable ways of cooperation and management. Among others, two basic trends are of growing importance: mass applying of new information and telecommunication (IT) technologies, and tele-working. Modern IT technologies, such as personal communication devices, portable computers, satellite services, etc., changes the traditional ways of work. Due to the recent progress in computer hardware and software, a natural need arose to postpone some business processes, traditionally performed by the humans, to the computers. This trend is particularly visible inside an enterprise, starting from simple CRM and financial systems, through integrated, centrally managed production lines, to integrated, complex applications of SAP and similar systems. At the same time, fixed working place and

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working hours, caused by fixed, stationary devices and timetables, are being replaced by the tele-work, in order to deal with business problems at-the-place and just-in-time. A tele-worker has certain freedom to choose the place, time, and form of his/her work, in order to optimally fulfill the ordered tasks.

Growing importance of high level of computerization inside an enterprise and the tele-working (Shen, Norie, 2004) are not, however, necessary related with high level of integration of computer systems belonging to different business partners involved in a common business activity. There are several reasons for that, mainly related with overall safety and security, and a need of unification of different hardware and software systems owned by the business partners. Recently proposed technologies, as for example Web Services and Semantic Web, seem to optimize the inter-business cooperation from the point of view of the information owner. As a result, only information availability is taken into consideration, while further data processing is left to the business partners, to be performed separately in local partners' systems. One may see an analogy of such fixed places and tools of information processing with fixed, traditional working places of humans. Extending this analogy, one may see a need for a tele-work of computer software, with programs sent to different remote places to be executed there in the name of the program owner.

In this paper, we propose to extend the trend of mass applying of tele-work observed for human-based business and inter-business cooperation to tele-computing and tele-activities. Similar to human tele-workers, tele-activities are movable software programs, executed remotely in the name of the program owners, to realize certain business activities. A tele-activity is a standalone, completed, pre-programmed piece of software that may be instructed to move itself to a certain location to be executed there. All the tele-activities owned and executed in the name of different business partners form the system of Electronic Activity Interchange EAI. Comparing EAI with traditional approaches to business cooperation, like for example Electronic Data Interchange EDI, one may note the fact that rather than considering only the data flow, EAI deals with both program and data flow.

At the first view, it looks like the EAI idea may be implemented, in a natural way, by applying the technology of software agents. However, current agent-based systems and scientific prototypes are not flexible enough to deal with mass business cooperation. Wide applying of the agent technology is mainly limited by the trade-off between overall system security and a need for remote execution of the "alien" (from the local system point of view) agent code. More security means more administrative restrictions on user-defined code and code mobility that is hardly acceptable by the agent owners. On the other hand, more freedom in agent development and execution means limited control of agents' behavior, and limited control of the ways the locally gathered information is processed by the agents. Unrestricted and out-of-control access to local computer systems cannot be accepted by most of the business partners, unless the partners are really mutually trusted. As a result, nowadays software agents are used either in closed, mutually trusted environments with restricted number of users, or for some well-defined, fixed purposes and application areas, e.g., agent-based stock exchange, auctions, production lines, etc.

The main goal of this paper is to propose a new agent-based technology for an efficient implementation of the EAI idea. We propose a reasonable trade-off between a need for remote execution of activities owned and controlled by different business partners and implemented by software agents, and overall system security and efficiency, both from the point of view of the "local" business partner, and the activity owners. Our approach is based on imperative programming of activity (i.e., agent) code, and two basic activity classes: private, "untrusted" activities, executed with special care and with certain restrictions, and public activities, being "trusted" code from the point of view of the local environment the activity is executed in. A balance between the private and the public activities may be defined by the business partners according to the specific situation and given business case.

The remainder of the paper is organized as follows. In Section 2, continuous evolution of inter-business cooperation is discussed, and the idea of applying tele-work for computer programs is justified. In Section 3, Electronic Activity Interchange EAI approach is presented, taking into account general system architecture, and two basic assumptions: user-defined distribution of EAI business activities, and different techniques for imperative programming of behavior of these activities, depending on security restrictions. Furthermore, some implementation issues are presented related with applying software agent technology within the scope of the Agent Computing Environment ACE. Section 4 concludes the paper and points some directions for the future work.

2 Continuous evolution of the ways of business cooperation

The ways of inter-business cooperation were continuously evolved, as technical and organizational possibilities grew. We may distinguish three basic stages of this evolution: cooperation based on direct communication among humans, with or without certain communication devices, cooperation based on remote, however, still human-based access to computer systems, and finally, cooperation based on direct connections among computer systems belonging to different business partners.

The first evolution step in facilitating inter-business contacts was taken by mass applying of telecommunication utilities. Direct human-human interaction was replaced by remote cooperation in human-device-human mode, e.g., a direct talk was replaced by a telephone conversation, traditional paper letters by e-mails and fax prints, etc. At the beginning, the humans were much more "movable" than the devices. Thus, the humans were forced to visit the physical places the devices were available in order to use these devices, e.g., a telephone box, a computer room, etc. With the recent progress in telecommunication and miniaturization, we observe a quite opposite trend of "moving" devices closer to humans, e.g., cordless and mobile phones, handheld computers with Internet connection, etc. Note that "moving closer" sometimes means "logically closer" rather than "physically", to mention remote access to computer systems, remote control systems, networking, etc. The final phase of this evolution step is to massively use personal, portable devices – mobile phones, handheld digital assistants, palmtops, etc. Note that the interesting trend for improvement of this kind of devices is to put attention to different ways of the data transfer rather than simple human-2-human (i.e., voice) communication.

Mass applying of remote access to company's computer systems usually imposes some organizational changes of this company (Jagdev, 2001). However, as the business profits are high, such evolution is justified. Tele-work is an example of successful applying of modern telecommunication technologies and personal communication devices to traditional business processes (AMASE, 2005). From the tele-worker point of view, continuous computer&telecom support reduces the need for fixed working place and working hours. The work is performed at-the-place and just-in-time. Due to the on-line availability of all the information needed to complete the task does not matter the place and time, the worker efficiency is increasing. From the enterprise point of view, tele-work optimizes company's internal business processes and usage of the resources, including human staff.

Tele-work introduced a new quality for humans being distant representatives of a company. Even being physically and geographically away of the company, such representative is logically close to all the company's resources needed at the moment. Again, we may observe here the trend of "moving closer", especially if we take into account personal and portable communication devices. Note, however, that even the tele-work may speed up the process of uploading the information, the tele-working human staff must be physically present close to the information source.

The next evolution steps are forced by the need of replacement of the weakest entity in the inter-business communication process – the humans. As more and more business processes are automatized, more and more information is collected and stored by the computers rather than humans and traditional "paper" media. Thus, the communication process is extended to the computer-human-2-human-computer line. From the point of view of this process, humans at both sides of this process are additional "wrapping" activities. Human activity cannot be fully programmed, thus such activity is usually neither fixed nor fully repeatable. Human-provoked errors may lower the quality of the "wrapping" process to a great extent. Thus, from the point of view of the consumer of the information, eliminating human activity at the "source" side is justified. Such reduction may substantially improve not only the quality, but also the "bandwidth" of the communication. As a result, we observe mass applying of remote-access technologies, such as Web servers and server-side extensions, e.g., CGI scripts and servlets. Note that this trend is similar to the "moving closer" trend for personal and portable communication devices.

Mass applying of the direct access to remote computer systems by different business partners is limited by the conflict of interests of the "consumer" and the "producer" (i.e., the "source") of the information. The consumer controls the way of using the information, while the producer controls the way of accessing it. Business goals of the producer and the consumer are usually different. As long as both the producer and the consumer are humans, these goals are flexibly and efficiently negotiated. However, once a human is replaced by a computer, the negotiations are no more possible. Moreover, as the humans play active role in the communication process, the role of the automatized party is reduced. As a consequence, the responsibility for the activation and control of the communication process is shifted to the still-human party. The automated party is then realized as a set of passive information sources, usually Web pages or services, waiting for the access. These information sources are polled by the humans in order to detect “crucial” information changes. In such a way it is quite hard to provide “active” information sources, automatically pushing the information changes to the consumers.

The automatized services are common for all the business partners and the business goals. Thus, usually a need arises to perform some additional data processing at the “consumer” side (Bonnet, 2001), to deal with given business case, situation, partner requirements, etc. Such processing is restricted by at least three reasons. First, client-side information processing may substantially increase network traffic in comparison with the server-side computations. Second, the just-collected information maybe useless; however, one has to complete the whole processing in order to detect that fact. For example, polling for a new business offer requires periodical access to all the offers, among them only a few are finally taken into consideration. Third, some business partners are not interested in providing “raw” information to be processed at the client-side, with limited control of the information owner. For example, a hospital will not provide outside a full list of its patients in order to compute some statistical data only.

As long as the humans control the way of information exchange, direct communication between computers is reserved for local usage only, inside an enterprise. However, with a continuous need for faster and more reliable business contacts, external computer-2-computer cooperation becomes a must. So far, such cooperation is quite rare, and typical information flow is brokered by human staff, mainly due to security problems and architectural differences of the computer networks belonging to the cooperating business partners. What is also quite important is the lack of common standards for data exchange – format, ways of communication, knowledge and ontology representation, etc. There are several attempts to improve the speed and the quality of the inter-business cooperation, to mention Web Services, Semantic Web, and several proposals for systems realizing the idea of a Virtual Enterprise (Oprea, 2003; Petri, 2003). All these proposals are based on common standards for global information exchange, resolving the problem of hardware/software heterogeneity. However, similar to the human-based remote access to the remotely-stored information described above, there is usually a business conflict between an owner of a service and the consumer of the information to be accessed via this service. The service owner tends to offer a fixed and long-term service common for everybody, passively waiting for incoming requests. The service consumer expects a personalized information source, actively informing about “critical” information changes, with no need for additional data processing at the client-side.

Table 1 summarizes the evolution of inter-business cooperation methods, taking into account both human- and computer-based cooperation. Note that, according to the above discussion, the evolution of the computer-2-computer direct cooperation seems to be non-completed yet, in comparison with the human-based cooperation methods. Thus, the question arises how to improve direct communication among computers belonging to different business partners?

	H-2-H	*H-2-C*	*C-2-C*
Time	Direct meeting	Local access	Data transfer under human management, computer-human-computer data flow
	Remote contact	Remote access	Direct computer-computer data flow, client-side data processing
	Tele-work	Personal communication devices, remote access and control of programs	?

Table 1. Evolution of inter-business cooperation methods

Prior to answering the above question, we have to discuss in more details current approaches to inter-business information exchange, based on the idea of Electronic Data Interchange EDI. Typical EDI process of an information exchange is the following. First, the information is produced by a business partner and made available using an e-mail or a Web page. Second, the letter is sent to (the page is requested by) another business partner. Third, the just-obtained information is locally processed, including necessary wrapping (both format and contents, if needed), ontology/schema verification and adjustment, etc. Once processed, the information is available for the business partner.

The above information-exchange process implies common ontology/schema and fixed interfaces (formats) at both sides, in order to (1) establish a connection, (2) formulate a request understandable for the information owner, (3) generate a response understandable to the consumer. While more and more business partners are involved in the process, more difficult is to maintain common ontology and interfaces. As one cannot foresee all the possible expectations of all the possible business partners, no individualization is possible of the above communication steps at the server-side. Thus, all the post-processing and content/format wrapping must be performed by the business partners locally. Moreover, inter-business communication usually involves several human-based administration activities, as with the automatic services one cannot fix all the reactions to all the possible errors and unexpected cases. As a consequence, EDI-based cooperation is usually provided only for long-term, stable business connections. There is no support for ad-hoc and temporal cooperation, becoming crucial for nowadays business. In addition, connection maintenance and control is partially manual and thus expensive and error-prone.

As already stated, the process of information exchange is usually realized in passive and polling way. First, the information passively waits to be accessed by anyone interested in this information. As long as there is no request for the information, the information is useless. Thus, a need arose for continuous polling for changes of the information, usually generating huge network traffic from the place the information is accessible to the place the information is about to be used. The polling process needs substantial data treatment at the client-side, at least for the comparison and detection of information changes. Such treatment is usually time-and resource-consuming, and often needs a human-based coordination and maintenance.

One may see an analogy of the above-described inter-business communication process – fixed information sources, business partners, data format and ontology, local information processing – to the traditional, fixed, local working places of humans. Extending this analogy, one may see a need for applying the idea of tele-work, being natural consequence of modern IT technologies, to automatic cooperation of computer systems belonging to different business partners. Tele-working computer programs are sent to different remote places, to be executed at-the-place in the name of the program owners, similar to tele-working human staff.

3 Electronic Activity Interchange

In this section we propose to extend the trend of mass applying of tele-work observed for human-based business and inter-business cooperation to tele-computing and tele-activities. As already mentioned in the Introduction, similar to human tele-workers, tele-activities are movable software programs, executed remotely in the name of the program owners, to realize certain business activities. A tele-activity (an activity for short) is a standalone, completed, pre-programmed piece of software that may be instructed to move itself to a certain location and execute there. Each activity carries its business state and an authority of its owner – a human or another activity. The state, together with the information gathered at the execution place, may be used by the activity to undertake some business processes. All the activities owned and executed in the name of different business partners form the system of Electronic Activity Interchange EAI.

Below basic strategies are presented for: (1) activity distribution and maintenance, and (2) activity programming. The basic assumption of the EAI approach is that these are the activity owners who have full control over the place an activity is migrated to, and over detailed activity behavior at-the-place. Thus, the presented strategies are owner-oriented, however, taking into account generic security and safety requirements.

First we discuss the *global strategy for effective distribution and maintenance of the activities*. We assume that there are three basic classes of the hosts an activity may be sent to and executed: private hosts, generic network hosts, and server-side hosts. According to these host classes, we distinguish three basic activity pools: client-side pool, composed of the hosts controlled by the activity owners (i.e., business partners), middle-side pool, composed by some general-usage hosts, and source-side pool, composed by the hosts controlled by the service owners (i.e., business partners offering some services and access to business information). The pools are characterized by different methods for migrating, storing, searching for, and executing the activities. Below, a general characteristic is given of each pool, together with a description of purpose and functionality of sample activities belonging to these pools.

A functionality of a host from the source-side pool is optimized towards reliable and efficient access to selected data sources, from the point of view of the information owner (i.e., given business party). Activities operating in source-side hosts are usually owned by the information owner. For security reasons, storing and executing "alien" activities belonging to external business partners is substantially limited. A typical source-side host is reduced to a set of gateways, able to standardize an access to the data source(s) connected, with limited support for public telecommunication facilities (WWW access, SMS/MMS/e-mail asynchronous messaging, etc.), the latter described in more details later in this section. The gateways are equipped with several mechanisms supporting efficient, parallel, multi-user access to the data sources, as for example cache memories, proxies, synchronizers, semaphores, locks, query optimizers and serializers, etc.

Accessing activities from source-side hosts is similar to accessing public Web servers and services. The difference is the activities provide some additional communication, wrapping and brokering functionality, requested by the business partners, as well as some uniformity of the external access to several information sources. However, nevertheless the business partners have limited control over source-side activities – usually such activities are used as "black boxes", with limited possibilities of individualization of their behavior as well as the mode of operation.

Hosts from the middle-side pool are located in arbitrary chosen parts of the global network. In contrast to the source-side pool, middle-side hosts store and execute activities belonging to different business partners. A typical task list for the activities covers: brokering among source-side and private activities, wrapping and formatting messages exchanged by the population of activities, providing access via different telecommunication means and protocols. A stress is put on efficient access to the activities by the humans, using popular telecommunication channels and standards (WWW/WAP, SMS/MMS, e-mail, etc.). Activities executed in the scope of the middle-side pool are usually devoted to the tasks related with network-side monitoring – comparing information and detecting changes that are "interesting" for the activity owners. As already stated, what is "interesting" is programmed by the activity owner in the activity code.

Architecture and usage of a host from the client-side pool strongly depends on technical and communicational possibilities of an end-user hardware/software the activity owner posses at the moment. Private activities may be executed for example in the scope of a stationary PC, mobile equipment (a PDA, a notebook, or even an intelligent mobile phone). It is up to the activity owner to locate his/her activities either in a host from the middle-side pool, or in the private (i.e., client-side) host. In the first case, the network traffic may be substantially reduced; however, remotely executed user activities are less secured (from the user point of view) and less efficient (mainly because of additional security checks). In the second case, all the user activities are executed in a trusted (still, only from the activity owner point of view) environment, however, a lot of information must be transferred among distributed hosts.

For the activities executed at a portable/mobile device, a stress is put on fast and user-friendly activity-to-human communication. The technical capabilities of the device strongly limit the possibilities of executing the activities (small memory, limited battery time, difficult management, etc.). Thus, usually only a few private activities are located in a mobile host capable of performing some simple tasks, as for example final formatting of an alert message, filtering incoming messages, generating sound alerts, etc.

As already mentioned above, a stress is put on efficient communication among the activities, and between an activity and its human owner, the latter mainly for the administration and management purposes. To the first goal, XML-based messaging is applied. Choosing the detailed mode of communication, i.e., communication standard/language (e.g., SOAP), knowledge representation and exchange method (e.g., KQML, RDF), ontology synchronization (e.g., OWL), etc., depends on the activity owner. Due to the large offer of standards and protocols that may be used, a more detailed discussion on the methods for activity-2-activity communication is out-of-the-scope of this paper. As for the activity-2-human cooperation, we propose to use standard telecommunication facilities, based on natural-language conversation, and Web-like access, based on predefined pages with different forms, menus, etc. To facilitate the goal of efficient communication with activities, we propose to provide some ready-to-use activities specialized for a conversation via given telecommunication channel (Rykowski, 2005C). Such a communication activity stands for a wrapper between an activity and human-owned communication device/software, like for example mobile phone or an Internet browser. The communication activities are usually located in middle-side hosts, to be effectively used by large population of human users (Rykowski, Juszkiewicz, 2003).

3.2 Programming activity behavior

Similar to the real world, longer is the distance from the place of origin to the place of execution, less an activity is "trusted". Locally (i.e., in a host owned by the activity owner) executed, an activity is treated as trusted code, as it is developed by the exclusive owner of the local environment. Remotely executed, an activity is usually treated as an alien code, thus additional security checking should be applied prior and during the execution of this activity. Such checking substantially reduces privacy and execution efficiency, resulting in a trade-off between overall system security (from the local point of view) and privacy/efficiency (from the activity owner point of view). Setting up the balance of this trade-off, one may use several techniques for code development and execution, among others skeleton-based, declarative, and imperative programming are the most popular ones.

Skeleton-based approach is based on some predefined pieces of code being "patterns" for automatic creation of the programs to be executed in the name of the program owners. This approach maybe used in the case the overall system security is much more important than user privacy and code individualization. The main disadvantage of the skeleton-based approach is that the total software functionality must be known in advance, before the development of the skeletons. Thus, this approach is unacceptable for ad-hoc and temporal business cooperation (at least). The second above-mentioned programming technique – declarative programming – is usually based on a specialized programming language, originated from logical programming, artificial intelligence, goal-oriented programming (e.g., database programming languages), etc. Even if declarative programming is much more flexible than program skeletons, we think that it still cannot be applied for unrestricted user-defined design of the EAI activities. First, note that each declaration is automatically changed at run-time to an equivalent piece of software code, imperatively programmed by the system designers. Thus, similar to the skeleton-based technique, all the possible declarations (and thus total system functionality) must be known in advance. Each user has a choice of using or not certain declarations, however, he/she is not able to fully program details of the activity behavior. Second, providing run-time "compilation" of a declaratively-programmed activity certainly limits overall efficiency, both from the system (less throughput) and the activity owner (greater execution time, more resources consumed – memory, CPU, etc.) points of view.

Due to the following restrictions of the skeleton-based and declarative programming techniques, we propose to use imperative programming for setting up activity behavior, directly by the activity owners. In order to provide reasonable level of portability (migration) of the activities, and reasonable level of overall system security, we propose to apply a standard activity interface, and two primary programming techniques: interpretation connected with run-time code inspection for "untrusted" activities, and compilation for the "trusted" ones.

The main problem related with unrestricted usage of imperative code is limited system security. Remotely executed, imperatively programmed activities are treated as an "alien" code, potentially dangerous for the local environment. Such anxiety may be justified by insufficient level of code verification, or simply by pure psychological reaction of local system administrators. Even if from the "technical" point of view several security mechanisms are applied for the external code verification (i.e., code encryption and signing by digital certificates, built-in security verification for the compilers and kernels of the operating systems, etc.), the psychological fear maybe a serious obstacle for wide acceptance of user-defined, not-known in advance activities. However, note that similar problem has been already successfully resolved in the domain of the operating systems, by introducing two basic programming techniques: a shell language, used for example for preparing batch programs and desktop icons, and different programming languages, used for design of the application programs, further compiled to "executables". Most operating-system users are entitled only to manipulate shell scripts, and only some (usually system administrators) are able to install and control executables. Note, however, that the ordinary users are able to use given executables, even if such users have no possibility to change them. In contrast, the administrators rarely execute the applications, even if such users have full control over the application code, location, invocation parameters, etc.

Similar to the above division, we propose two basic techniques of setting up safe and secured activity behavior: the dedicated shell language, and full compilation. The shell language is used for programming mobile, remotely executed, user-defined activities (Rykowski, 2003). The language is based on the XML standard, and its syntax computational power is similar to the widely known shell programming languages. Note that we were not able to adapt any existing XML query language, as well as any generic XML transformation language, as these languages are specialized for node processing, generating a set of XML nodes as a result of processing of queries/other nodes. Instead, we adopted typical shell syntax, adjusting it to the framework of the XML documents. There are also some security restrictions for the execution of XML-encoded activity code. First, total execution time is limited (depending on the activity owner and current system load). Thus, never-ending loops and procedures are no more executed forever. Second, total number of activity's internal variables is restricted. Thus, any activity is not able to block the system due to continuous, still growing memory demands. Note that none of current shell programming languages/interpreters is equipped with such run-time checking.

The EAI idea is being implemented in the scope of the Agent Computing Environment ACE project. ACE system consists of a distributed set of Agent Servers, characterized by different functionality of system agents, and different communication means. Taking into account a specialization of an Agent Server for certain tasks and localizations, we may distinguish three basic classes of Agent Servers: source-side servers, connected directly to data sources and located at the same host (local area network) as a given data source connected, middle-side servers located in the network, not directly linked with any particular data source, and client-side servers for personal usage of a given agent owner. The servers are connected to each other, and they are able to transfer the agents among each other as well as remotely execute the agents previously transferred to a given place. More information about the ACE framework may be found in (Rykowski, 2006B; Rykowski, 2005D). Several ACE applications are now being tested in a real environment, with commercial services and different users. Early proposals – individualized bank access and telecom information services – proved the usefulness of the idea of using user-defined software agents for mass personalization purposes. Other our proposals cover e-office support (Rykowski, 2005B), individual, targeted marketing in supermarkets, support for temporal and ad-hoc Virtual Enterprises (Rykowski, 2006A), and many others.

4 Conclusions

Summarizing, the main goal of this paper was to propose a new agent-based technology for an efficient implementation of the Electronic Activity Interchange EAI idea. This idea is based on applying tele-activities to support inter-business contacts, with an analogy to tele-work of humans. A tele-activity is a standalone, completed, pre-programmed piece of software that may be instructed to move itself to a certain location to be executed there. Comparing EAI activities with traditional approaches to business cooperation, like for example Electronic Data Interchange EDI, we consider not only the data flow, but also the software (program) exchange and remote execution. We propose a reasonable trade-off between a need for remote execution of activities owned and controlled by different business partners and implemented by software agents, and overall system security and efficiency, both from the point of view of the "local" business partner, and the activity owners. Our approach is based on imperative programming of activity (i.e., agent) code, and two basic activity classes: private, "untrusted" activities, executed with special care and with certain restrictions, and public activities, being "trusted" code from the point of view of the local environment the activity is executed in. A balance between private and public activities may be defined by the business partners according to the current situation, business case, temporal and ad-hoc requirements, etc.

The EAI approach makes it possible to define an individual, distributed brokerage for existing information sources, as for example Web Services, and thus to personalize the behavior of the services to the maximum extent. In today's applications, the personalization level is restricted, due to potential service complexity and decreasing level of the overall system security. Our EAI idea fills this gap, as we allow to use user-defined, however safe code in different places of the network.

To our best knowledge, there is not a single proposal up to now to use imperative, mobile, user-defined software agents for supporting inter-business relations. Thus, we cannot deeply compare here our approach with a similar work. However, in (Rykowski, 2004) we included a comparison of the EAI/ACE approach with several strategies used for some existing agent-based systems, proposed for different reasons and purposes. A discussion on choosing either imperative or declarative way of programming the agents may be found in (Rykowski, 2006B), with similar conclusions to the ones stated in Section 3 of this paper.

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Modelling Value-based Inter-Organizational Controls in Healthcare Regulations

Vera Kartseva, Joris Hulstijn, Jaap Gordijn, Yao-Hua Tan
Vera Kartseva, Joris Hulstijn and Yao-Hua Tan:
Vrije Universiteit Amsterdam, Dept. of Economics and Business Administration, De Boelelaan 1105, 1081 HV Amsterdam, The Netherlands, {vkartseva, jhulstijn, ytan}@feweb.vu.nl.
Jaap Gordijn:
Vrije Universiteit Amsterdam, Dept. of Exact Sciences, De Boelelaan 1081A, 1081 HV Amsterdam, The Netherlands, gordijn@few.vu.nl

Abstract. Products and services are increasingly offered by value webs, rather than by a single enterprise. Typically, value webs need inter-organizational controls to prevent fraudulent behaviour of actors. To design and analyze controls, we developed the economic value-based methodology *e^3-control*, which so far has been applied mainly in commercial environments, which are regulated by contractual arrangements. In this paper, we use *e^3control* in a highly regulated environment, which contains public-private partnerships, namely the healthcare sector in The Netherlands. Lessons learned include that the notion of economic reciprocity – as present in a commercial setting – is not always apparent in highly regulated environments; and that a highly regulated environment requires artefacts like evidence objects, which can be dealt with as if they were value objects.

1 Introduction

Products and services are increasingly offered by *value webs* [17] rather than by a single enterprise, partly due to increasingly complex consumer needs. For understanding, modelling and analysing value webs, a few value modelling techniques are available (e.g. [11, 17], see [10] for an overview). One of these is the *e^3-value* methodology [5], which is used in this paper. The *e^3-value* methodology focuses on understanding how economic value is created, distributed, and consumed in a network of enterprises. In a way, an *e^3-value* model supposes an *ideal* or *normative* world, in the sense that it prescribes what happens when all actors perform their duties as agreed. Once we understand which valuable things should be

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exchanged, the next step is to relax the assumption of an ideal world, by supposing that some actors may perform *opportunistic actions*: commit fraud, or unintentionally do not keep their promises. To this end, we use *e^3-control* [6], a method that takes a value web as a starting point to analyze possibilities for opportunistic action, and proposes solutions to prevent these. Such solutions take the form of *inter-organizational controls*: procedures and guidelines for redesign, that aim to prevent, detect or correct opportunistic action.

Both the *e^3-value* methodology and the *e^3-control* methodology use the notion of *economic value*. Adopting an economic value perspective is reasonable when designing inter-organizational controls, because: (1) the business relationships that need to be controlled have to be understood first; (these are typically expressed as economic value exchanges in *e^3-value*); (2) many control mechanisms are themselves services, that have to be paid for (e.g. notary or escrow services); and (3) documentary controls can have an intrinsic economic value (e.g. tickets, Bill of lading). The value perspective is conceptually close to Transaction Cost Economics, which studies contractual safeguards against opportunistic action [18].

Related research is quite extensive in the security domain [15], but this does not provide insights into control issues for business models. In business modelling, there have been a few other conceptual modelling approaches, such as the Business Modelling Ontology [11], and value webs [17], but these hardly address control. Accounting literature [13,14] generally tackles control at the business process level, and mostly focuses on internal control.

The *e^3-value* and *e^3-control* methodologies have been successfully applied in a series of case studies in different industries, such as news, entertainment, Internet service provisioning, banking, and international trade procedures, see e.g. [7, 8]. These industries are commercial environments, regulated mainly by contractual arrangements. In addition *e^3-value* and *e^3-control* have been applied in the electricity sector, which was government regulated, but is becoming de-regulated right now [6]. Although an economic value-oriented approach works well in purely commercial settings, one could question whether such an approach is suitable for highly regulated environments. Such environments have a large number of procedures and regulations that are imposed on the execution of business processes by one dominant actor in the network, which is often a governmental agency. Often these environments involve public-private partnerships.

In this paper we discuss whether controls in highly regulated environments should be modelled as value-based controls or not. To investigate this question we have carried out a case study in the healthcare sector, specifically on recent changes to the governance and control of the Dutch public insurance system for exceptional healthcare (AWBZ). The emphasis in the paper lies on the case study, which is quite complex. The theory section must therefore remain relatively short.

The main contribution of this paper is to elicit issues for discussion, regarding the applicability of a value perspective in highly regulated environments which involve public-private partnerships, such as healthcare. In response to these issues, we present a number of lessons learned. The remainder of the paper is structured as follows. In section 2, we explain the basic concepts of our methodology for designing value-based inter-organizational controls. In section 3, we describe the AWBZ healthcare system, and the introduction of a "Social Chart", and analyse it using e^3*-control.* Along the way, we present lessons learned. Finally section 4 contains our conclusions.

2 Design of inter-organisational control mechanisms

The e^3*-control* methodology consists of the e^3*-control design framework* and the e^3*-control ontology.* Since e^3*-control* is an extension of the e^3*-value* methodology, we first briefly explain the e^3*-value* methodology.

2.1 The e^3-*value* methodology

The e^3*-value* methodology supports the conceptualisation of a business network by constructing a value model [5], representing it graphically in a rigorous and structured way, and performing an economic sensitivity analysis for all organisations involved. In particular, the e^3*-value* methodology provides for showing which parties exchange things of *economic value* with whom, and expect what in return. The methodology has been validated in a series of case studies in several domains, such as news, banking and insurance, electricity power, and telecommunications [5].
We briefly describe the concepts of the e^3*-value* methodology. For a detailed description, see [5]. Figure 5 shows a buyer who obtains goods from a seller and offers money in return. According to the law, the seller is obliged to pay value-added tax (VAT). This can be conceptualized with the following e^3*-value* constructs (in bold). **Actors**, such as the buyer, seller, and the tax office are economically independent entities. Actors transfer **value objects** (payment, goods, VAT) by means of **value exchanges**. For value objects, someone should be willing to pay, which is shown by a **value interface** being part of an actor. An interface models the principle of *economic reciprocity:* only if you pay, you can obtain the goods and vice versa. A value interface consists of **value ports**, which represent that value objects are offered to and requested from the actor's environment. Actors may have a **consumer need**, which, following a path of **dependencies,** will either result in another exchange of objects through a value interface, or end in a **boundary element**. The latter means that we do not consider additional value exchanges. A dependency path indicates that there is a direct link between the occurrence of one value exchange, and another.

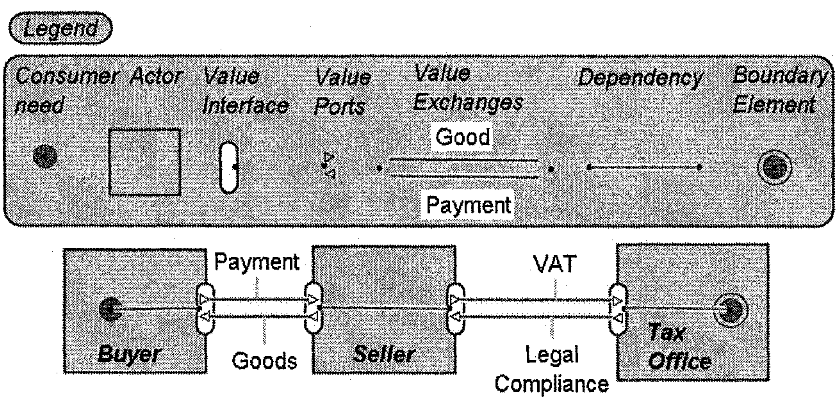

Fig. 1. An e^3-*value* model of a purchase with tax payment

2.2 The e^3-*control* methodology

In e^3-*value,* we assume that actors behave in an *ideal* way, meaning that all value exchanges occur as prescribed. This implies, amongst other things, that actors respect the earlier mentioned principle of economic reciprocity. In e^3-*control* [6,7] the economic reciprocity constraint is relaxed, to model **sub-ideal value exchanges,** represented in the diagrams by dashed lines. These represent the possibility that actors will for example not pay for a good, or not obtain a good while paying for it, or even obtain the wrong goods. These mishaps may occur intentionally (fraud) or unintentionally (errors). Scenarios of sub-ideal behaviour are often elicited by an analysis of the weaknesses in the business processes and organizations that implement a value exchange. Such an analysis makes use of risk indicators and principles of the auditing field [13], such as the principle of *segregation of duties.*

Thus, e^3-*control* can account for sub-ideal behaviour, whereas e^3-*value* typically models ideal or normative behaviour. Using e^3-*control,* we can reveal potential weaknesses in an e^3-*value* model, and suggest inter-organizational controls as a remedy. Application of the e^3-*control* methodology involves the following steps:

Step 1: Elicit an *ideal* e^3-*value* model with the actors involved and what they exchange of value;

Step 2: Analyse control problems, by a risk analysis of the underlying business processes and organizational structure, stating potential *sub-ideal* behaviour;

Step 3: Design *inter-organization controls,* stated as an e^3-*value* model or, if sub-ideal behaviour cannot be completely removed, stated as an e^3-*control* model.

3 Case study: Exceptional health care

In the Netherlands, the *Act on Extraordinary Medical Expenses* (AWBZ[5]) regulates the provision of care for chronic diseases, such as protracted illness, invalidity, learning disabilities, mental disorders and geriatric diseases. Because this kind of care is too expensive to insure in a private way, the system is arranged as a public health care service. A patient only pays a small part of the costs; the largest part is reimbursed by a government fund, filled by collecting a percentage of the income tax of each citizen. Clearly, the AWBZ system qualifies as a highly regulated environment. Patients need to apply for care through a tedious bureaucratic process. Various semi-independent governmental agencies perform tasks in the system, in return for funding. Although the government retains political control over the system, increasingly also private care providers are allowed to enter.

Currently, the exceptional health care system is undergoing major changes in terms of services, actors, financing and control. In this case study, we use e^3-*control* to explain some of these changes, and to analyse and design controls for the new

[5] In Dutch: Algemene Wet Bijzondere Ziektekosten (AWBZ)

situation. The underlying research question is whether e^3-*control* is applicable in such a highly regulated environment, and what we can learn from it.

The data for the case study was collected from a series of semi-structured interviews with five experts from different health care organisations. The resulting e^3-*control* models were verified by these domain-experts. In addition, data was collected from publicly available documents [3, 9] and government web sites.

3.1 The Exceptional Care System

To understand the case study at hand, we first provide an e^3-*value* model of the current Exceptional Health Care system in Figure 6. In principle, every Dutch citizen is entitled to exceptional care. Every citizen could fall ill, which is represented by the choice fork (triangle). Both healthy citizens (on the left) and patients (on the right) pay taxes. In order to obtain AWBZ funding, a patient needs to be assessed by a national organisation called Indication Centre[6]. Based on the medical condition of the patient, as evidenced for example by medical reports, the Indication Centre issues a needs document[7], which states to what type of care the patient is entitled to. Needs are formulated in terms of standardised functions: domestic care, personal care, nursing, supportive assistance, activating assistance, treatment and institutional care. For each function, there are different classes, which specify the intensity of the treatment. In Figure 7 this needs document is modelled as "Right for Functions". A local Administration Office[8] allocates to each patient specific care providers, who provide the care services that correspond to the needs functions. This is modelled as a value object called "Right for Care". Both the "Right for Care" and a "Personal Contribution" are needed to obtain the "AWBZ Care" from the care provider. This scenario already reflects some of the recent changes. Before April 2003, needs assessment and product allocation were performed by the same institutions, which resulted in a biased allocation of health care services.

The Administration Office is responsible for distributing funds to care providers, represented by the "Budget" object. To be accountable, the care provider needs to provide evidence about delivered AWBZ care to the Administration Office. On the basis of such evidence, the budget for the next period is determined. The budget is provided by the Ministry of Health, Welfare and Sport. The Administration Office is responsible for reducing health care queues. The Administration Office therefore receives "Funding" in return for "Administration Services and Queue Management".

The ministry receives its funding as a percentage of the income "Taxes" of each citizen. In return, one could say that the government guarantees "Access to Quality Healthcare". As a minimal quality measure, the government requires care providers to have an accreditation from the Health Care Insurance Board[9]. The accreditation is only issued, when care providers can prove that they have adequate facilities to

[6] In Dutch: Centrum indicatiestelling zorg (CIZ)
[7] In Dutch: Indicatiestelling
[8] In Dutch: Zorgkantoor
[9] In Dutch: College voor zorgverzekeringen (CVZ)

provide care that corresponds to the AWBZ functions. In Figure 8, this is represented by the exchange of "Evidence of Ability to Deliver Care" for "Accreditation". This is only a limited check. Please note that proper health care quality controls were only established from 2004 onwards (see below).

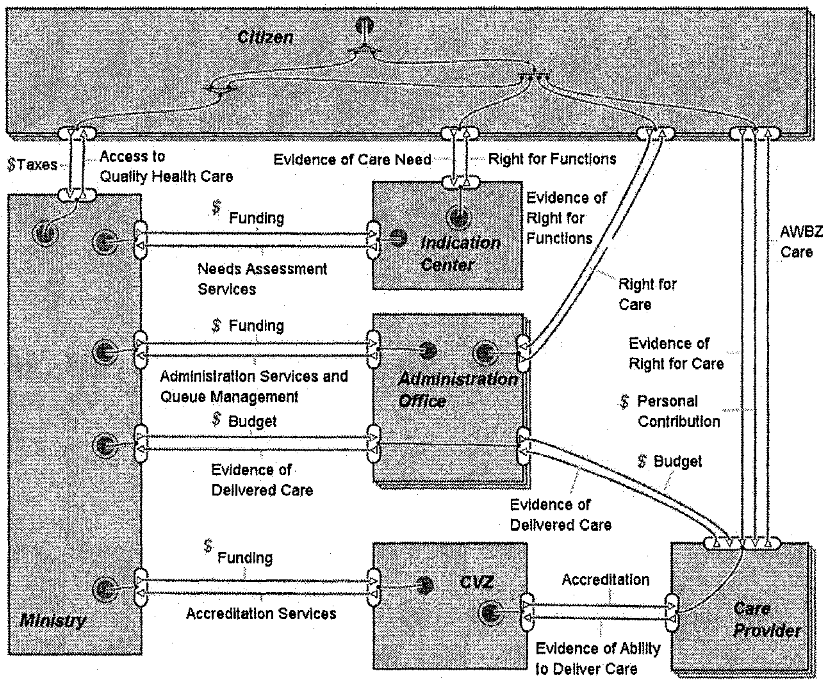

Fig. 2 .Value network for exceptional health care system in The Netherlands

Discussion

We have made an e^3*-value* model of the Exceptional Health Care System, which exemplifies a highly regulated network. The model identifies actors, and value exchanges between those actors. As always, modelling decisions can be subject to debate. We identify the following issues for discussion, and present the lessons we have learned.

Issue 1: Highly regulated settings contain *indirect reciprocities.*

Observation: In the private sector, in which cases are often regulated by contracts, we mostly see direct reciprocities: a customer obtains a good or service and pays for it accordingly. But in this case, the economic reciprocal relation is at most indirect. For example, the Indication Centre receives a sum for its task of needs assessment. It does not receive proportionally more funding, when it issues more rights for functions. In the AWBZ, the provision of care is largely paid for by the tax-payer. For most people, namely for those who are not suffering from a disease and are not

using the AWBZ system, the reciprocal relationship between care and taxes is even further removed. In a way, citizens pay for the guarantee that they will have access to health care of a certain quality, in case they would need it.
Lessons: First, we observe that in case of an indirect reciprocity, the dependency path (purple line) between a customer need (red dot), and the source of funding (big red dot), is often broken. Second, indirect reciprocities are modelled by guaranteed access to a service, in case citizens do not actually use the service at the moment. At a choice point (triangle) *e^3-value* can represent the relative proportion of cases in which one dependency path is followed, rather than another. This would make it possible to model insurance settings by a kind of probabilistic reciprocity, in which the total of insurance premiums collected (here from taxes) should at least cover the expected disbursements to patients. Third, in case of indirect reciprocity, access to a service can be restricted by other means, such as a system of *rights*, and *evidence documents* (see issue 2 and 3 below).

Issue 2: *Regulatory rights* are modelled as value objects.
Observation: A public-private partnership is often characterized by extensive regulations. This was also observed in the energy sector [6] and now in healthcare. Regulation can take the form of a system of rights, to restrict access to a service. Examples in the case study are "Right for Functions" and "Right for Care".
Lesson: In general, legal rights can be seen as a value object in *e^3-value* and so have to be modelled accordingly. This corresponds to case studies on international trade procedures [8], and copyright law for internet radio [7]. As a consequence, regulatory rights should also be seen as value objects. Because they guarantee access to a product or service, such rights are of real economic value to actors.

Issue 3: *Evidence documents* are modelled as value objects.
Observation: This case shows various requirements for evidence. Examples in the case study are "Evidence of Care Need", "Evidence of Right for Functions", and "Evidence of Delivered Care". Evidence often takes the form of a *document,* that has to be shown to an official, to obtain a product or service.
Lesson: Although usually the collection and interpretation of evidence is seen as a regular business process, in this case evidence documents can also be seen as value objects in *e^3-value*. Evidence documents are required to obtain other objects (rights, AWBZ care) and are thus of economic value for the actors. This reconfirms intuitions from case studies in international trade, in which evidence documents like the Bill of Lading, are also modelled as value objects [8].

3.2 Personal Budget and Social Chart

The exceptional health care system described above has a number of problems. The right to health care, through needs assessment, is disconnected from the care that is actually available. Care providers cannot always deliver the needed services, because their budget from the government has a limit. Because care providers do not have an incentive to provide services above their budget, the model in Figure 9 resulted in a *supply-driven* system, with queues of patients waiting for treatment. Therefore the Dutch government is moving towards a more *demand-driven* system. The new situation, the resulting control problems, and a possible solution are analysed with the three steps of *e^3-control.*

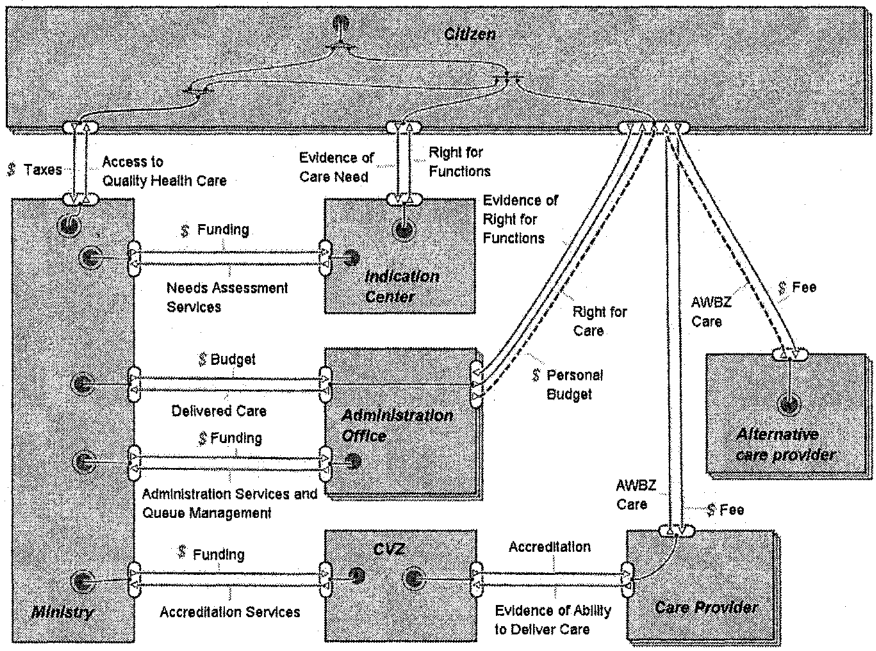

Fig. 3. Control problems with the Personal Budget system

Step 1: Introduction of a Personal Budget

Now, the patient can apply for a *Personal Budget* to spend on care services, provided either by traditional care providers, like a hospital or day care centre, or by *alternative care providers.* This may be any company or person, even a family member, who delivers (non-medical) services, such as cleaning, transport, or day care. This liberalization has led to more choice and an increased ability for patients to organize heir own lives. The system has some control problems, see Figure 3.

Step 2: Control Problems of the Personal Budget

Control problem 1: *Information about alternative care providers.*

Patients and relatives are not adequately informed about the available care, and the care providers in a region. Information about care providers is available from the Administration Office, but this only concerns accredited care providers. Based on interviews with domain experts, we observe that patients tend to select traditional care providers, rather than alternative care providers. This may stifle the development of the market for alternative care providers.

This observation corresponds to the general idea that *information asymmetry*, a situation in which the customer has less information about a product than the provider, has a negative effect on the emergence of new markets [1]. In Figure 3, this control problem is represented by a sub-ideal exchange (dashed line), labelled "Right for Care".

Control problem 2: *Quality of alternative care providers.*
Traditional care providers have to be accredited. Because of the large number of alternative care providers, the CVZ can not accredit all of them. So, alternative providers are not required to have an accreditation, which results in a quality risk. This problem is modelled by marking the exchange of "AWBZ Care" between the citizen and the alternative care provider as a sub-ideal value exchange (dashed line).

Step 3: Future Scenario - the Social Chart
To solve control problems 1 and 2 we suggest a possible future scenario, presented in Figure 4: a so called Social Chart. The Social Chart is an interactive website that provides an overview of the care services in a region, *and* provides facilities for community-based quality control. The concept of such a *dynamic interactive social chart*, focused on the care takers of patients with *dementia*, (DEMDISC) is currently being developed in the FRUX project [2].

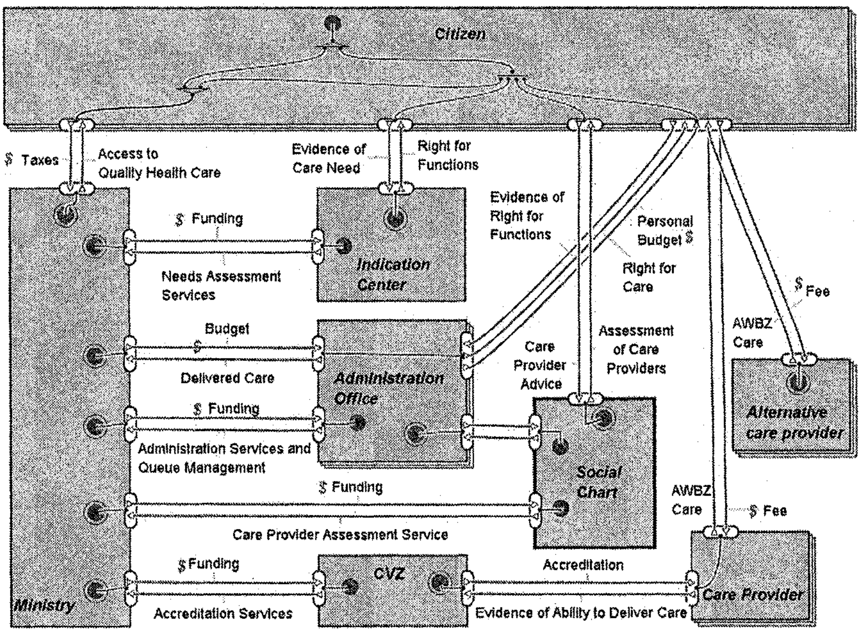

Fig. 4. Role of the Social Chart: informal quality control and care provider advice

Considering control problem 1: *Care Provider Advice.*
The purpose of the Social Chart is to provide information about alternative care providers, and help users select a care provider that satisfies their individual needs. In Figure 4 the Social Chart delivers a service called "Care Provider Advice". In one possible scenario, the Social Chart could be funded by the Administration Office. An increased usage of alternative care providers as a result of the "Care Provider Advice" offered by the Social Chart would reduce the queue problem, which is the Administration Office's responsibility.
Considering control problem 2: *Informal Quality Control.*
Quality control is a general concern in Dutch healthcare. Since 2004, an independent health inspectorate, Inspectie Gezondheidszorg, (not in the model) supervises the quality of care providers [2]. Given the expected explosion of new care providers, this organization cannot feasibly control the quality of all care providers. We therefore propose that the Social Chart should enable a kind of informal quality control. The Social Chart could provide, for example, a web-forum with testimonials, an online community peer review, a reputation mechanism, or collaborative filtering techniques [16]. In this manner, knowledge about the quality of care providers can be shared throughout the community of patients and relatives.

Such *community-based quality control* only works when users contribute to the community. That is why in one possible scenario, depicted in Figure 4, the Social Chart receives "Assessment of Care Providers" from patients. Since this informal assessment would reduce the administrative burden of assessing alternative care providers, one could argue that the Ministry of Health should subsidise the Social Chart, to stimulate the development of an effective virtual community of patients. So, in Figure 5, a value exchange "Care Provider Assessment Service" is drawn between the Social Chart and the Ministry of Health in return for "Funding".

Note that this is only one of many possible scenarios. A social chart could be set up for example by the patients association, by commercial parties like an insurance company or information broker, or by local or central governmental bodies. Members of virtual communities in healthcare are generally willing to contribute to the community [3]. We do realize that setting up a reliable system for online feedback is a research topic by itself. For example, testimonials tend to be biased. More quantitative comparisons also exist. For example a Dutch information broker, independer.nl, is using a large number of general practitioners to get statistically valid feedback on the healthcare services of various hospitals in the Netherlands.

Discussion.
Issue 4: Services can be *community-based*
Observation: A community-based quality control, like a feedback or recommender system, only works when sufficient members actually contribute to it.
Lesson: Sharing and exchanging valuable information, like experiences about care providers, can be based on solidarity and membership of a community. In e^3*-value*, this can be modelled by a value exchange between different instances of a so called *market segment* (stack of actors), aggregated over a longer period of time. One patient benefits from the contributions of other patients
Issue 5: Control services are often *commercial* services

Observation: A highly regulated environment requires many control services. Examples in the case study include needs assessment (Indication Centre), allocation of actual care services, and the allocation of personal budgets (Administration Office), and providing information about care providers, and care provider assessment (Social Chart).
Lesson: Control services can be seen as commercial services, which can in principle be outsourced. This is clearly modelled: all controlling parties, whether they are government agencies or not, need to be funded or paid. Control services may even spawn off new business opportunities, as in the case of the Social Chart.

4 Conclusions

In this paper we have analysed governance and control issues in the Dutch Exceptional Healthcare system (AWBZ), using the e^3*-control* methodology, which is meant for the design and analysis of inter-organisational control mechanisms. The AWBZ case is interesting, because it shows the complexity of a highly regulated environment, which involves public-private partnerships. Since e^3*-control* is based on an economic value perspective, it is reasonable to question whether such an approach is applicable in a sector like healthcare. The e^3*-valuel* and e^3*-control* approaches force us to model all actors as separate organisations with their own economic sustainability objectives, and, due to this network aspect, hidden interactions become visible. In particular, the e^3*-control* analysis of the AWBZ case demonstrates

(1) that rights, evidence and regulations can in fact be fruitfully analysed from a value-based perspective, and
(2) that e^3*-control* can reveal the existence of a business opportunity, because many regulative controls have inherent economic value aspects.

Hence, we conclude that value-based approaches like e^3*-valuel* and e^3*-control* are not only applicable in commercial settings, but also in the public domain. In particular, regulatory rights and evidential documents, two mechanisms that are often used by public institutions to regulate private businesses, can be seen as value objects.

Another contribution of this research is the distinction between *direct* and *indirect reciprocity*. In the contractual arrangements of many commercial relationships, economic reciprocity is typically *direct*: e.g. payment is required for each good or service, and vice versa. In this case study we found that economic reciprocity in public-private partnerships is often *indirect*. In particular, funding of a governmental agency may not depend on the number of cases dealt with.

We also learned that it makes sense to model the AWBZ as a kind of insurance: citizens get guaranteed access to the healthcare system, in return for their AWBZ contributions through taxes. In future research we will try to find out whether this model is also applicable to other insurance settings. Both insurance and community-based services rely on a notion of solidarity: some members benefit, from the contributions of all. As a final lesson, we have seen that also in the public domain, many control services should actually be seen as *commercial* services, which should be adequately funded. For our health care domain experts, this was actually the most important result: understanding and analyzing inter-organizational controls, spawned off a new business opportunity: the Social Chart.

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Extending Traditional Wiki Systems with Geographical Content

Piotr Gawrysiak
Warsaw University of Technology
Institute of Computer Science
Ul. Nowowiejska 15/19, Warsaw, Poland
pgawrysiak@supermedia.pl
WWW home page: http://www.ii.pw.edu.pl

Abstract. The paper is an overview of the project that is being carried out at the Warsaw University of Technology. The project strives to create a Wikipedia – like system, that will allow people to collaboratively create and edit vector data, especially city maps and plans (instead of text, as in traditional wiki systems, such as Wikipedia) in order to provide communities and businesses an accurate and cheap geospatial information. Contrary to other systems that have been created towards this purpose, and which could be potentially integrated into Wikipedia, the system which has been described assumes that geospatial accuracy is not achievable for ordinary users and thus provides built-in mechanisms for dealing with data uncertainty and inaccuracy. Additionally a collaboration infrastructure essential for Wikipedia-like growth (version control, possibility to discuss and revert changes, reliance on conceptual objects – such as crossroads – instead of absolute geospatial coordinates etc.) is also provided. Finally the system prototype is designed in such a way, that no external software (such as Java VM), apart from ordinary web browser, will be required.

1 Introduction

1.1 The importance of Wiki content creation model

Traditionally, all knowledge workers have been producing new information (in a form of business reports, scientific papers etc.) alone. Of course the work quite often

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was shared between several people, but the sharing was done only periodically, so in effect people individually created parts of documents that were later combined (also – usually – by a single person), or worked on subsequent versions of a single document. The computerization did not in fact change much in this model. Obviously, people were using electronic means of communication, and the document combining stage has become much easier, thanks to capabilities of modern word processors.

The real breakthrough in content creation has been achieved only with the advent of Internet and so called Wiki systems.

Traditional wiki [Cunningham05] (or wikiwiki as these were originally named, after word "quick" in Hawaiian language) is a collaborative web site, that allows its modification – be it addition of new information, deletion or edition – by any user. In practice such wiki systems are usually implemented as multiple tier systems, comprising of a database storing contents of web pages and a display engine, that creates individual pages on demand basing on the contents of the database.

While in theory it would be possible to allow users to use HTML to input contents of wiki pages, most systems use simplified formatting languages, that provide only limited formatting functionality (for example allow to mark sections of the text as bold of underlined) and simplified linking capabilities that facilitate including hyperlinks to other sections of a wiki site into text entered by a user.

Due to the fact that every user of the wiki system is able to change any piece of the content stored within, most wiki systems maintain a history of the changes introduced into pages and allow to compare current version of the contents with one of the stored, historical versions. Such functionality is crucial for effective growth of the content database. Various users may have different, and sometimes contradictory knowledge that can be inserted into database, so mistakes or even deliberate acts of vandalism (content deletion or falsification) are virtually unavoidable, thus ability to revert changes is required.

Wiki systems, while conceptually very simple, make possible unprecedented speed of creation of information resources. Due to drastically lowering entry barriers to creating web content – potential content contributors do not have to be IT professionals and do not have to know even the HTML language – wiki systems fulfill the promise of universal publishing rights.

Probably the most famous wiki system is the wikipedia encyclopedia [Wikipedia], that currently comprises over 940 thousand articles in English language (and several thousand in other languages including German, French, and Polish) what means that it is currently the largest available encyclopedia (for comparison Encyclopedia Britannica contains around 120 thousand articles).

Obviously wiki systems are not perfect. Their main weakness is directly related to their main functionality i.e. ability to change contents by virtually anybody. As long as all content submissions are honest, the system maintains its integrity, but as there is no content verification mechanism a malicious user can enter incorrect information into a wiki system, or delete important content. In practice however this problem is circumvented thanks to the so called many-eyes principle – it is assumed that a particular piece of content is observed by several people, so even if it is deleted or wrongly modified, it will be quickly corrected by other users, additionally abovementioned versioning systems implemented into most popular wiki sites, allow relatively easy reversion of destructive operations – such as massive content deletion [Krotzsch05], [Shah05].

1.2 Demand and supply – a reason for Wikipedia success

The rapid growth of Wikipedia was somewhat unexpected and is regarded sometimes as a one-time phenomenon. It was however only possible as a natural consequence of a typical economic[10] demand and supply lack equilibrium. With the ever increasing importance of knowledge economy, the need for good quality information becomes stronger while traditional information repositories – such as encyclopaedia – become not sufficient for a variety of reasons:

- **Cost factor** – while for most inhabitants of western countries the cost of i.e. Encyclopedia Britannica seems to be relatively small, it might be prohibitive for citizens of developing countries. Moreover, some more detailed sources of information (such as special – purpose information repositories, market reports, constantly updated news services etc.) may have even higher cost.
- **Reliability** – information repositories that are not free can be manipulated or censored and thus the information quality might be poor while the repository created by its users in wikiwiki style is basically a peer-reviewed content database and as such, potentially very reliable.
- **Copyright restrictions** – copyright restrictions imposed on content stored in traditional sources limit usually the applications of this content, while the free (in GNU/FDL sense) information can be put to more uses. Metaphorically one might say that a free content can live independently while traditional content is just passive.

On the other hand the technical infrastructure of the internet became sufficient to allow construction of a collaborative editing system, that would allow to exploit the "wisdom of crowds" effect, observed for example by Sir Francis Galton[11]. Towards this end the system must exhibit at least these two properties:

- **information aggregation mechanism** – obviously, the pieces of knowledge that are possessed by individual users of the system must be somehow integrated. Textual, encyclopedic content is especially well suited to such integration, as even traditional reference books have many authors.
- **low entry barrier** – the success of the system is dependent on its ability to attract users. Therefore the mechanism used to input knowledge into a database must be user-friendly and not intimidating. Wikipedia, via its of web page editing (no HTML knowledge is required, users do not even

[10] Obviously, we deal with knowledge economy in his context.

[11] Who observed that a group of people gather on a trade fair can collaboratively (by expressing their guesses and averaging them) approximate quite well a weight of a ox which was exhibited there. For description and a detailed discussion see for example [Surowiecki04].

have to create accounts in a system in order to edit contents) makes it possible.

1.3 Non textual content types

Currently available wiki systems are text oriented – they allow entering and manipulation of text (in some cases illustrated with simple images). While text is certainly the most prevalent means of human expression, there are many other ways of storing concepts and ideas. These include music (in notation form but also as recordings), sculpture, painting, diagramming etc. While most of these means of conveying ideas are not easily susceptible to computerization, some seem to be quite for systems similar to wikiwiki. The content that could be potentially edited in a wiki system must of course be in some way dispersed or decentralized – so that everyone can add his piece increasing overall scope of the entire database. It must be also easily editable in a collaborative way and finally it must be relevant to wider audience since the ability to attract people contributions is essential for system growth. Lets consider some examples:

- **Music** (or audio in general) – there is currently no easy way to edit this content collaboratively, however polyphonic music could be potentially created this way;
- **Sculptures** – it potentially could be decentralized, but current technology does not allow for collaborative, online editing; someday perhaps, with robotic tools or 3D virtual environments, it should be achievable;
- **Scents** – definitely this is not a content easily editable, but it could be very useful. One might imagine for a example a "wikiparfum" database;
- **Source code** – this sounds interesting. Editing source code „wiki style" is a wild idea (such software would not even compile most of the time), obviously not doable with all kinds of programming languages – with scripting languages it should be feasible;
- **Photographs** – difficult to imagine the collaborative editing process, perhaps retouching could be collaborative. There is however no „crowd wisdom" to be tapped, as long as one considers only single photograph at a time. On the other hand the collaborative photographic databases are possible, such as Flickr! [Flickr];
- **Drawings** – this seems to be the most suitable content type for wiki editing. Drawings are – similarly to text – a content that where smaller pieces can be combined in order to create bigger drawings; it is possible to create a collaborative editing tool (see next chapters) and finally – there is quite a lot important information contained in drawings – such as, for example, city maps and plans.

2 Drawings as wikicontent

2.1 Problem Description

There are practically no free (as in GNU/FDL) repositories of map data, while (as for example Tim Berners Lee recently noted during a speech at the Oxford University and as various Google Local mashups [Gibson06] demonstrate) there is a lot of potential uses of this data. In short, this seems to be an ideal situation to be remedied by a community driven, collaborative effort, similar to Wikipedia.

Some work has been already done in this field (see for example [Haraguchi03] or [Openstreetmap]) but the results are highly unsatisfactory. Available tools are either too complex or too primitive to allow us to easily create together such a simple thing as a tube map and, while some efforts resulted in a creation of a public map wiki systems, these remain unpopular and contain practically no data yet.

Above statement might seem a bit surprising, as diagrams, and especially geographical diagrams, such as maps and plans, are especially good candidates for collaborative editing. Their complexity – as far as potential processing algorithms are concerned – is relatively small as most such diagrams can be represented as graphs. At the same time the information represented in this form is immediately understandable, highly useful and usually not easily available to individual users. Most GIS data is protected by quite restrictive licenses, so while there are in theory many sources of good vector maps of – for example – major cities, and quite a large number of consumer products incorporating this data (map booklets, mapping software etc.), it is very difficult and expensive to obtain royalty free geographical data, for example for small, non commercial projects.

In most cases exact geospatial data – i.e. exact geographical coordinates is not crucial for typical applications, as long as logical map structure, that is the street and crossroads layout is complete. In other words a city plan is in most cases sufficient and detailed map is not required.

Above observation is important, as most people are able to draw plans and not detailed maps. This means that it should be possible to create a wiki system, where different people could be able to submit information about geographical features – such as street layout of the city or location of points of interests. Of course such data would be in many cases incorrect or incomplete, but as it will be reviewed by many people, the quality of such map would constantly improve, provided that the system would be equipped with algorithms able to automatically resolve conflicts in submitted data such as different locations of i.e. streets.

An OpenStreetmap system, mentioned above, is a good example illustrating a failed attempt of such system, where above observation was not considered important. This system, enforces accuracy on users, do effectively in order to add information about a geographical feature, such as street, one must know its exact location, which is usually impossible to obtain without a GPS equipment. Additionally, the system is based on Java applets, so its relatively slow thus further increasing entry barrier. In effect the number of contributors and amount of data stored in OpenStreetmap remain miniscule.

A counter example might be a Placeopedia system [Placeopedia], which is a rough geotagging tool for Wikipedia entries. It allows quick adding of approximate geographical location (using Google Maps API) relevant to selected Wikipedia articles. As the entry barrier is very low (to add content one must just click on Google map or a Google satellite image around a place which he thinks most appropriate) the system is growing quickly and is already quite useful for Wikipedia users.

2.2 Demand and supply analysis

Lets consider demand and supply factors mentioned in the introduction, concerning geographical diagrams and their collaborative editing.

Demand:

- Usefulness of such data is unquestionable, as numerous Google Maps mashups demonstrate.
- There exist many repositories of GIS data, in most cases created by public government institutions. However usually the information contained in these repositories is available only at a fee and is heavily copyrighted. Some efforts are underway to open (or "liberate") these repositories (Tim Berners Lee for example is campaigning for opening the databases of Ordnance Survey of United Kingdom), but are not yet successful.
- Usefulness of data obtained from commercial maps is usually very limited. Even such natural operation as xeroxing a section of a map in order to show friends how to drive to ones house in most cases represents a copyright violation!
- Commercial maps may contain errors, even deliberate:
    - Soviet maps were known to contain non-existent streets – to confuse enemy soldiers
    - Commercial maps contain so called „EasterEggs" (non existent streets, misspellings in street names etc.) to track illegal copying of map data

Supply:

- The ability to draw diagrams and plans is quite pervasive in literate societies (however this do not apply to drawing maps which would be accurate in geographical sense, in other words – not many people are natural born cartographers) .
- Just as it is relatively easy to continue writing a text commenced by other person, it is also easy to complete a drawing sketched by someone else, so the content can be created collaboratively.
- Drawings capture human knowledge (maps, blueprints, activity diagrams, organizational charts etc.) in a way not dissimilar to text. After all a „professional" map of the world is also a sum of work of many cartographers.

- It is very popular activity (you probably drawn your first drawing several years before writing your first letter) so the amount of potential, useful content is high.

Some problems can be also identified. First of all the plans, that most people are able to create are often inaccurate (in GIS sense). However, as popular experience shows in most cases such plans are sufficient for orientation and route planning, as long as intersections, and relative road lengths are sensible. The plans can be also very different, as our mental representations of geographical surroundings might be also different. However this might be also seen also as an advantage as it creates a diversity of opinion that is required for the emergence of "wisdom of crowd" effect [Goldstone05]; perhaps also such various mapping perspectives might turn out as a useful feature. One can supply a lot of useful, but different between two people, information on a map – examples may include favorite pubs, tram stops, wifi hotspots etc. It is also possible to be able to represent even different versions of the street layout, for example for historians, who want to create maps of eg. Victorian London and compare them with current maps.

It seems therefore the, as the supply and demand are out there, the missing piece remains a collaboration tool, that would guarantee a low entry barrier for all people willing to share their geographical knowledge. Such that would deal with inaccuracy, exploit diversity of „casual" map data that ordinary people (not GPS fanatics) can provide and which will allow to store & retrieve a variety of map related data. Our team at the Institute of Computer Science of the Warsaw University of Technology started to design and implement a prototype of such system, calling it with a temporary name *Wikiplan.*

3 A Wikiplan system

3.1 Technology issues

As the most important property of a editing system seems to be its low entry barrier to new users, it should ideally be a web browser based tool, not requiring any download. This is a difficult task, as web browsers are tools for displaying (and sometimes editing) mostly textual contents and not vector data.

However, with the recent advent of AJAX technology (Asynchronous Javascript and XML) it became possible to create browser based applications that behave in a way not dissimilar to desktop programs. Examples of such software include primarily Google offerings such as GMail or Google Maps, however AJAX is being used more and more frequently, sometimes credited as a technology that might potentially lead to a whole new category of Internet experience for end users, dubbed Web 2.0.

Using AJAX it is possible to create a web page that would dynamically react to user input in real time. In order to implement a map drawing tool, an ability to display vector graphics is also required. Such requirement is much more difficult to fulfill, as the most popular web browser – Microsoft Internet Explorer version 6.0, does not support vector image display. However other popular browsers (beta version of Internet Explorer 7, Firefox, Safari) support the SVG vector image standard, and it is possible to install a plugin in IE6 giving it the same functionality.

Summing up – using AJAX and SVG support for browsers it is possible to create a diagramming tool that does not need external applications. A proof of concept of such design may be for example Ajaxsketch [Ajaxsketch]– an online vector editor, compatible with popular Firefox web browser.

Of course apart from a good user interface, a system backend is also necessary for data storage, user management, versioning & conflict resolution etc., but such being a server side application, it can be implemented in a well established technology such as Java.

3.2 Prototype description

The Wikiplan prototype is being developed with several assumptions, such as:

- **portability** – the system backend is being implemented in Java (with some additional tools such as Hibernate for object persistency) and thus is immune to incompatibilities between operating systems;
- **graphical user interaction** – the main principle is simplicity here, as it is crucial to create a very low "learning barrier" for new users in a manner not dissimilar to traditional wiki system; to this end a graphical user interface is being implemented as Ajax+SVG system mentioned above with a minimalist approach to interface design; currently the system is being tested only on Firefox, with planned support for other web browsers at later stage of development;
- **openness** – the system is being developed in open source model from the start and will remain free software;
- **ability to incorporate into existing textual wiki systems** – the Wikiplan system is being implemented in such as way, as to facilitate its integration with other wiki systems, thus allowing creation of the web site where people can edit both text and maps (see next chapter for example applications of such combination);
- **automation** – the system is able, to certain extent, to automatically resolve conflicts in data submitted by users (for example when two people think that a given street is in two different places) and compute approximate properties of geographical object when no sufficient data is provided by a user;
- **versioning** – a system is storing detailed information about all changes introduced into a given map, allowing to reverse ay editing action and display map history – analogously to history mode of traditional wiki systems.

Considering the internal processing engine, the main assumption is that geospatial accuracy is not required (however it is possible, when sufficient data is provided). A

coordinate system that is being used is flat, so no geographical projection is applied. Such system is perfect for city plans, but of course at the expense of prohibiting the creation of larger maps, where curvature of the Earth would become relevant.
Each map object has associated a certainty level, which is highest for GPS data and lowest for objects that can be dubbed as "prototypes" – i.e. users know that such objects (say point of interest) should be placed on a map, but have no idea about their exact location. Consequently every user can position objects in a place, that seems right to him – or „confirm" a proposal of other users, and the system is to calculate average properties of objects based on above inputs. Obviously, the more users confirm the location of the object, the higher their certainty level.
It is possible to create objects with undefined properties. A good example would be a street with unknown length, but which is known to join two other streets. The system stores information about such object using the mechanism of "anchors" – metadata that captures the allowed spans of other properties for an object and marks these properties which are certain. In a situation presented on a Figure 1, a Parkingowa street object will be associated with anchor objects, defining possible placements of both ends of a street (and joining it to these streets at the same time). This way we store *certain* information (that Parkingowa joins Nowogrodzka with Jerozolimskie between two particular crossroads) and inaccurate information (such that we do not exactly know where Parkingowa is located).

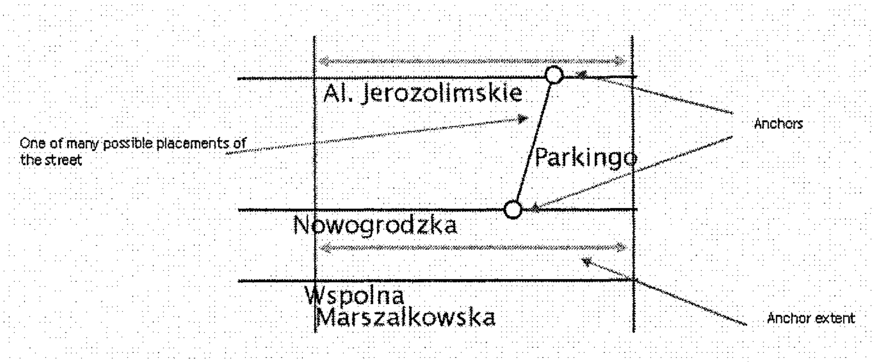

Fig. 1. Illustration of anchor objects

The system is also equipped with a variety of wiki-like tools. There is possibility to create comments and discuss changed made to the map, every user can create his own layer (both for streets and points of interest – this allow creation of several versions of a single map). For professional use (or for populating the system with readily available data) an additional Java editor is provided, which can also import and export map data in several formats.

4 Applications and conclusion

There are many possible applications for a system such as Wikiplan. First obvious area of application is of course acquisition of base geographical data in situations where such data (i.e. information about streets etc.) is not readily available. However, even if such data is available (as is often the case in eGovernment applications, when the basic map data pertaining to street layout is free for use for government institutions), the Wikiplan system can be used to augment it with community created data about points of interest – such as most interesting restaurants, dangerous places, best shops, best views etc.
Thanks to system capabilities people can collaboratively create information resources containing geographical metadata – such as travel guides or "best in the city" listings. Additionally it is also possible to share information of a spatial nature (such as – the favorite bicycle trips, locations of favorite shops etc.) with others, in a way similar to sharing own though on a blog site, or personal photos in services such as Flickr! [Flickr].
Other possible applications might include:

- Street plans, country borders, highway maps editing on Wikipedia and similar systems based on Media Wiki software;
- Augmenting Google / NASA satellite imagery with street data;
- Augmenting „professional" geospatial wiki system (such as Openstreetmap) with a „rapid prototyping tool";
- creating diagrams of machinery, circuits etc. (however for this task a much simpler editor is probably more appropriate – not necessarily dealing with uncertainty, but still Ajax+SVG based)
- creating databases of POI, for example linking all wikipedia entries dealing with a given POI
- allowing people to create their own sections of map data – for example „best pubs in London and how to get from to another"
- creating standalone open source applications (route planning software, postal code databases etc.) using free map data.

The system is still far from completion, but the functionality that is already implemented allowed us to create a prototype wiki system that allows to create a database of the most respected pubs in vicinity of the University with information about commuting between them. When completed, we hope that it will enhance popular wiki systems with ability to share "graphical" knowledge and thus further increase the amount of free (as in freedom) information available to humanity.

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Integrated Search Based on Image Contents

Ramon Mas Sansó, Xisco Tous Llull, Joan Oliver Mesquida', Felip Salas
Ramon Mas Sansó:
Universitat de les Illes Balears
Unidad de Gráficos y Visión por Ordenador
Universitat de les Illes Balears
ramon.mas@uib.es.
Xisco Tous Llull, Joan Oliver Mesquida and Felip Salas:
Fundació Illes Balears per la Innovació Tecnològica (IBIT)
Parc BIT Ed.17(3,D-2), 07121, Palma de Mallorca
{xisco,fsalas,joliver}@ibit.org

Abstract. This works describes a new metaphor to make a contents search in an image database and to recover the results obtained using an automatically selected bandwidth. The increasing use of electronic commerce and the consequent publication of image catalogues through internet make evident the necessity to incorporate alternative mechanisms to the traditional search by key-words. Our work explores the scope of image-content access of databases. We use textual description, shapes, patterns and color similarities. At a later stage and due to the cost of the transmission of high quality images, we analyze the available bandwidth and we adapt the size of the resulting images to cope with the user requirements.

1 Introduction

The increasing use of electronic commerce and the consequent publication of image catalogues through internet make evident the necessity to incorporate alternative mechanisms to the traditional search by key-words. This is especially true in cases where the search is based on criteria subjective and hard to include as text fields. In this article we explore the scope of content based access to databases of images by means of alternative searches to the textual description such as shapes, patterns or color percentages. The methods and metaphors presented try to provide any customer who deals with huge image databases with a portable and easy to integrate methodology that allows the use of search and recovery of images by content descriptions. The methodology we propose is based on two phases. First we use off-line image processing tools to automatically recognize features. Second, the information obtained is used to index a database of images. In a later stage, the user

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performs a search using any of the available criteria and the resulting series of images is returned. The quality of the resulting images is automatically adapted to the available bandwidth using the constraints imposed by the user (maximum download time).

The results obtained can be easily added to existing on-line product catalogues of industries where appearance of the goods plays a significant role, so as clothes, ceramic tiles, wallpaper and other. This methodology has been applied to the interactive search in a real clothes catalogue. In such applications a customer often is not sure of what his looking for, but has some clues concerning the final destination of the product (the color which best suits in the environment, the shapes it should represent or even a similar pattern he has previously seen or thought about).

2 Image search in internet

Content-based search techniques have been applied to medical images [1], art work[2], satellite imagery indexing [3][4] and videoclips [5]. However, the search of images in internet servers traditionally uses textual descriptions. Nowadays, there is ongoing research in the description of images using external annotations [6], author annotations [7] or anthologies. Except in a number of cases where alternative mechanisms can be used to search images, as for instance color contents and distribution [2] or direct selection [8], there is no tool using multimodal integration. In [2], a IBM's experimental query by image content is used. The user can arrange areas of color to approximate the visual organization to look for work of art in a museum database. The user-drawn canvas is used as a grid of colored areas that is matched to other images stored in a database. This tool is classified as a color distribution search.

In this paper we present a contribution to the semantic web by specifying a system that allows a simultaneous search by either textual or contents description integrating author described metadata labels following the Dublin Core standard [9], color tolerance, color percentages, spatial similitude or object shapes.

Those applications, often linked to internet, work with three different kinds of actors: users, image owners and server owners. Users are identified as clients browsing the application in internet; they connect to a server to perform an image search. Image owners and server owners may or may not be the same. In our research we also have in mind three corresponding levels of application. First, the access module or front-office attends the users requests, implements the search process and sends the resulting images in the most convenient size and resolution (depending on available bandwidth). Second the analysis module or owners back office that helps the actor to maintain the information system and automatically classify the images when they are inserted into the system. Third, the administration back office (in case of a hosting service) which should establish the system configuration parameters and the management of the owners.

To make the description process easier we consider that the owner of the images is also in charge of the maintenance of the server. With this assumption in mind, we do not lose any generality as the user can still add images to the server through

XML-SOAP messages (see figure 1). One of the most important constraints is the preservation of managed images with the same quality as they were entered in the system. We use compressed tiff format to store the image, a low quality image for image previewing and jpeg compression for image downloading, although other available image compression formats can be easily integrated.

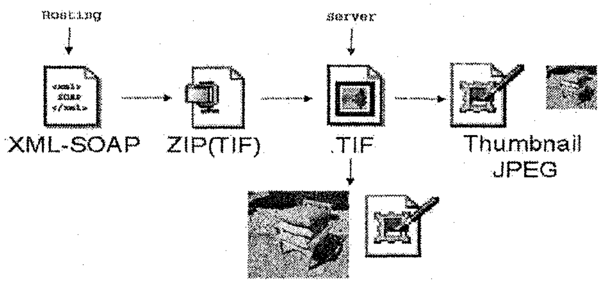

Fig. 1. Image storage and retrieval

3 Image analysis

First, during the database creation or addition of information, we automatically execute image processing algorithms to classify the images. When images enter the system we first apply a histogram analysis for color properties classification. A gradient operator detects the edges in the image and they are considered as characteristic points during the Hough transform. This transformation allows us to create a shape taxonomy. Similarities comparison is done through correlogram computation [10]. This preprocess is very important in the search process, as it drastically reduces the time search at the only cost of a non-significant amount of additional space on the database.

Although the histogram ignores the spatial organization of the pixels in an image, it is easy and fast to compute and it provides a graphical representation of the color frequencies [11]. Chromaticity moments have also been used [12] but they have a lower effectiveness in this area of application as they use a chromaticity diagram that characterizes too globally the shape and distribution of the image.

Correlogram describes the correlation of the image colors as a function of their spatial distance. Due to the huge amount of data to be processed, we use the autocorrelogram. The autocorrelogram is a subset of the correlogram that computes the probability of finding identical colors at a given distance. We keep a table describing the variation of spatial correlation between pixels of the same color.

The detection of object shapes in the image is performed using the Hough transform. We have successfully tried Hugh [13] to detect the existence and position of related lines in the image although it can be easily extended to other geometric entities [14].

While entering an image into the database, the user can also insert annotations using the metadata of the standard Dublin Core ontology. Metadata is coded in RDF (Resource Description Framework http://www.w3c.org/RDF) and is added to the image file.

The decision of including metadata in the image file has been taken to facilitate the interchange of this kind of data between different applications. So that the image creator can use his own application to label images directly.

4 The search process

The search process describes how the user can request images from the server database. Mainly, three criteria can be used:

- Color search: using as input a color tolerance, a percentage distribution of the colors and its tolerance we search in the image database comparing the frequencies of colors in each image. The color information is stored in normalized histograms.

- Similarity search: this criterion is based on the use of correlogram. The input parameter is an image, either from the system or a newly supplied one. Prior to the search, we compute the correlogram of the input image. Once we have the correlogram we compare it to those of the stored images. As a result we get a vector of pointers to images with a decreasing similarity level.

- Shape search: we use the results obtained when the Hough transform was applied to search the existence and/or the position of geometric entities in the image. As stated previously, the initial tests are done using only line detection although we currently extending to other simple shapes. When we detect a geometric attribute, we compute both its orientation and its location in the image. The image is divided in nine sectors in order to make the search request easier to the user. We identify the sectors where the shape belongs and later we use them to establish the matching criteria for the search.

- Textual search: as in any database, we can search using a text description of the image. In this case the affected fields are metadata included in the image.

5 Preliminary results

The resulting methodology of our research, based on the integration of the image analysis, metadata and geometric description has been applied to the interactive search in a real clothes catalogue. In such application a customer often is not sure of what his looking for, but has some clues concerning the final destination of the product (the color which best suits in the environment, the shapes it should represent or even a similar pattern he has previously seen or thought about).

To verify the efficiency and response time of the searches we have used a database containing more than 200 images of regional typical clothes of different colors and patterns. Following we show the results we have obtained with the searching criteria.

Let ask for the images 25% ping (RGB 266,141,146). The results obtained are three images that we show in figure 2. The response time is less than a second (including transmission time). In fact, on a test of 25 color searches we computed a mean of 0.5 seconds.

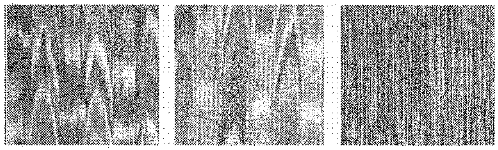

Fig. 2. a search using a 25% of RGB(226,141,146)

As can be easily foreseen, a decreasing importance in the percentage of appearance of a certain color remarkably increases the number of recovered images (figure 3).

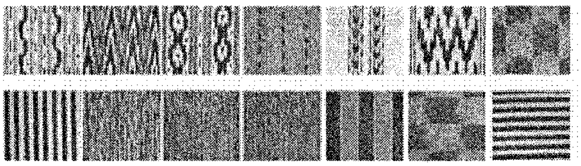

Fig 3. a 6% RGB(10,79,136) search

Concerning the similarity searches, we have noticed an important increase in the response time which is due to the much more time consuming process needed in the server.

Figure 5 shows the result of a similarity search using the pattern in figure 4. The response time (from the request to the visualization of the images) in this search is of 18 seconds. We have to take into account that most of this time is spent comparing the pattern against the 200 correlograms in the data base.

The fastest searches are those using the text information as they can profit the indexing system of the database management system. The response in these cases is instantaneous and the only time delay is the transmission of the thumb images that need to be displayed.

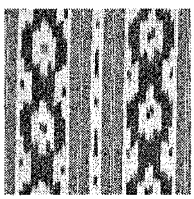

Fig. 4. Pattern used in the similarities search

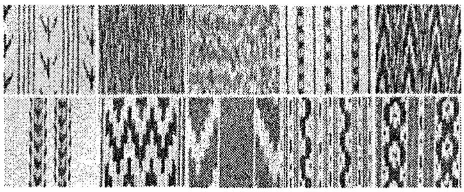

Fig. 5. It took 18 seconds to obtain those 10 images.

Finally we will discuss the results obtained using the geometric feature detection in the images. Figure 6 shows the results for a request of all the images with three horizontal lines distributed in the upper centre and lower sectors of the images. Let observe that the request does not exclude the images with more than three lines, as we are asking for images with at least three horizontal lines. The images were obtained in less than a second.

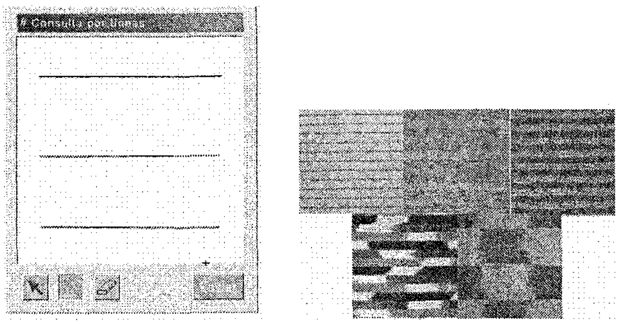

Fig .6. Three parallel horizontal lines (in the upper, middle and lower sectors)

The most important drawback in this search is the detection of characteristic points in the image to be used in the Hough transform. Although they are automatically detected using image filtering and binarization, they are sensitive to the nature of the image and a change in the application nature may require some minor changes in the parameters.

6 Image download

Downloading images includes the computation of the available bandwidth and the automatic selection of the image size and resolution to the effectiveness of the real time connection.

We determine the bandwidth available by sending information packets from the server to the client and tracking the elapsed time. The algorithm uses the following steps:

- First a bandwidth approximation is computed sending a small data package. The size of the package is system configured.

- Using the values obtained in the previous step we set the size of the next package to be sent. The main goal being to refine the computation of the real bandwidth.
- Then we send the image and use its size to verify the bandwidth.

The elapsed time since the request is computed in the client side. Once we effectively know the bandwidth of the connection, we compute the size of the image depending on the user configurable maximum transmission time. Our compression algorithm uses a precomputed table of values to adjust the size of the image.

7 Conclusion

In this paper we have shown that image taxonomy in terms of characteristics extracted automatically is a difficult process due to the heterogeneity of the images. However, if we work in controlled domains the process is highly simplified and the results are more than acceptable. Although performance comparison with other described methods is never easy due mainly to the difference of size in image databases and image quality, the mean response times we have obtained are of the same magnitude than other techniques despite the additional search criteria we incorporate. Qualitative results in our field of application, as shown in section 5, are good. However, to obtain quantitative comparisons we should all work using the same image database and this is not always possible as property rights are involved.

We have presented a new method for multimodal searches that allows the user to search images by their contents using textual descriptions, color percentages, geometric features or similarities with a defined pattern.

Although an annotation based description of images is easier and more reliable as it is a person who describes the images using his own criteria, the process is expensive and very subjective. The annotations have to be reusable so we must use standard formats and interoperativity techniques to ensure the compatibility with most of the applications. In our research we use the Dublin Core ontology.

We also automatically adapt the quality of the final images so as to ensure that the available bandwidth allows a fast transmission of the results.

In our research we have tried to unify both the automatic and the annotated classifications in a unique tool following the semantic web specifications and offering additional functionalities oriented to the search and transmission of images in internet.

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An Empirical Study on Business-to-Government Data Exchange Strategies to Reduce the Administrative Costs for Businesses

Rex Arendsen, Tom. M. van Engers, Robbin te Velde
Leibniz Center for Law, Faculty for Law, University of Amsterdam, Oude Manhuispoort 4, Postbus 1030, 1000 BA Amsterdam, the Netherlands,
rex.arendsen@kpnplanet.nl, VanEngers@uva.nl, www.LeibnizCenter.org.
Dialogic Innovation & Interaction, the Netherlands, tevelde@dialogic.nl,
www.dialogic.nl.

Abstract. In recently developed policies the electronic exchange of data with governmental organisations is seen as a means to help reduce the administrative burden for businesses. Even laws have become active to enforce electronic data filing. However, we do not know whether these eGovernment applications do help reduce the administrative burden, so we do not know whether this new legislation is effective either. Although many business-to-government systems are currently being implemented, the adoption of these data interchange systems in a governmental context has not yet been studied extensively. In the study reported in this paper we investigate data exchange related adoption strategies in order to be able to address (in)effective strategies for the reduction of the administrative burden. We present an analysis of adoption factors that influence adoption decisions of SME companies in this context. Based on a representative survey we found some factors that seem to be relevant for the (non)adoption of business-to-government data exchange systems. We found that especially small companies tend to outsource eGovernment related data exchange processes. Therefore we conclude that it is very unlikely that the governments' aims to reduce administrative burden are met using current implementation strategies. We suggest an adapted strategy.

1 Introduction

It has been widely acknowledged that inter-organisational information systems (of which EDI systems are an example) reduce communication costs and improve communication between (business) partners [5, 13]. While these benefits do seem very attractive they apparently have not yet convinced businesses to adopt

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governmental data delivery systems without hesitation. The majority of these systems support data streams related to so called information obligations, defined in Administrative Law. These data streams are vital to the functioning of governmental en societal processes. Tax filing, custom declarations, social security and employee information and statistics e.g. are the basis for policy making and the transfer of income and capital among citizens in a social constitutional state [14]. The top 10 of most voluminous business-to-government data streams in the Netherlands sum up to approximately 350 million messages a year.

For most businesses timely and accurate data delivery is a major burden. The investments for development and management of specific information systems make especially small and medium sized companies suffer under an administrative burden. In most Western European countries the administrative costs are estimated approximately 3% of the GNP which means that e.g. in the Netherlands the total of these administrative costs in 2004 was 17 billion euros. These costs hamper economic growth and employment [3].

Many countries try to develop their own solution by establishing effective and efficient electronic business-to-government interfaces. Finland e.g. introduced its TYVI system to support the delivery of financial data via private service providers. The E-CoRE project in Slovenia focussed on collection of raw data from enterprises. In Portugal business are legally obliged to send their tax file in a digital manner. And the Polish Complex Computer System for the Social Insurance Institute was an e-Europe Award winner in 2005 [7]. Whereas governmental organizations invest in these electronic data exchange solutions and link them to administrative cost reduction programmes, the adoption rate and usage by businesses appears to be rather unpredictable. The Dutch Tax Administration e.g. has experienced rather poor adoption rates of its proprietary electronic filing applications (their edi-based and web/xml-based applications were eventually used by less then 5% of the focus group). Adoption rates of customs and agricultural import and export related systems are very high (with 95% electronic delivery rates of customs declarations). Given the mixed experiences after years of following a more lenient 'seduction policy' several governmental organizations have recently chosen to compel by law data delivery by businesses in an electronic manner.

This study is one of a series of studies which should help to understand the mechanisms behind the (non-)adoption of edi in business-to-government relationships. This topic has received little academic attention thus far despite the huge expenditures on governmental edi services. Furthermore, little empirical or theoretical work is done with respect to the role of the (private sector) intermediary organisations although these intermediates play an important role in the eGovernment domain. In every day practice a host of intermediary private parties such as accountancy firms, trading companies, or engineering bureaus handle contacts (including data reporting) with governmental agencies on behalf of their business clients.

In this study we examine the factors and strategies that influence the adoption of business-to-governmental data exchange applications by small and medium scale businesses, specifically in the context of the previously mentioned businesses information obligations. In the next paragraphs we present the theoretical background of our research, the research model and methodology that we used, and some preliminary results and their implications for practitioners and researchers.

2 Theoretical background

A vast volume on research regarding data interchange systems exists. This topic has been studied from various perspectives: a technical innovation perspective on the means of transporting messages, e.g. the Internet [2], a standardization perspective, e.g. on EDIFACT and XML standards, and an inter-organisational system perspective [11]. In her classification of research themes Henriksen shows, that the business value perspective of electronic data interchange is one of the dominating themes. Business value (especially operational performance and strategic performance) were the main perspectives in twenty articles in the 1991 to 2000 top-five journals on Management Information Systems (MIS).

In a recent meta-analysis of electronic data interchange (edi) research, based on sixty-eight articles from 34 journals over the period from 1993 to 2002, Elgarah [8] concludes that the main topics addressed were the general outcomes and benefits from edi (operational performances as you like) and the diffusion and implementation of edi. Much less attention was paid to strategy and edi adoption. Little or no attention was paid to governmental organisations as an electronic partner. Previously conducted studies mostly involved autonomous companies that use data exchange to communicate with their business partners.

Next to the diffusion and adoption of innovations theory [15], the transaction cost economics theory serves as theoretical basis in the analysis of electronic data exchange. The concept of markets and electronic markets [13] might help us to understand intermediation and dis-intermediation processes. The concept of hierarchies and electronic hierarchies is applicable to inter-organisational systems in general and to interchange systems in the governmental context specifically. The focus within hierarchies is on internal efficiencies rather than on the relationships between partners [8]. Governmental organisations have a natural tendency to put internal efficiency benefits first when developing data exchange systems [3]. Furthermore governmental bodies have the power to persuade or enforce adoption via e.g. licensing or legislation. Involuntary adoption and use may occur when mandated by the government [8, 10].

Many edi adoption research relates in some way to Roger's diffusion and adoption theory. Among the different aspects of the theory the five characteristics of the innovation: relative advantage, compatibility, complexity, triability and observability, are often used as variables in this type of adoption research. Given the specific characteristics of these data interchange systems, researchers have build extended models to analyse the specific dimensions of these inter organisational systems. These models contain, next to the (technological) characteristics of the innovation itself, variables on the organizational level and on the environmental level [6, 9, 11, 16, 17].

In addition to the financial management accounting focus [1] and the more recent focus on governmental management and policy making [14] we see the research on information logistics as another useful approach to the analysis of information obligation costs. Fundamental changes in the information logistics might have great (second order) effects on the efficiency and effectiveness of the organizations involved [5]. Intermediary parties as managers of these information chains play an important role. Especially small companies find it hard to derive full benefits from using data exchange systems. Integration and full implementation within their business processes is hardly being effected [6].

Confronted with pressure or legal regulation regarding the adoption of an electronic data exchange system, there is a third possible decision next to adoption and non-adoption: the outsourcing of electronic contact to a service provider or intermediary. We have not found any research on outsourcing as an adoption strategy. In the next paragraph we present a research model with first hypotheses founded in the theoretical context that we described .

3 Research model: hypotheses and variables

In this paragraph we present a conceptual model to guide our research on adoption factors in the business-to-government context. With Henriksen we choose a technological-indifferent approach to the subject of electronic data interchange [11]. Consequently in this study we do not differentiate between the traditional peer-to-peer edi solutions and web-based solutions. In our practise we experience more or less the same adoption problems with both generations of systems. The overall model consists out of two sets of variables: adoption strategies and adoption factors (see figure 1). The adoption decision is the central element in the model. The adoption strategies *result* from the three possible outcomes of the adoption decision: adoption, non-adoption or outsourcing. We use the three main categories of adoption factors used in recent adoption research on electronic data interchange: the innovation-specific (technological), organisational and environmental characteristics. The adoption factors *influence* the adoption decision.

Founded in the above presented theoretical background we formulate the following general hypotheses underlying the model:

Businesses adopt electronic data exchange systems with government under specific innovation-specific, organizational and environmental conditions. The outsourcing of this exchange is a relevant adoption strategy to many businesses. Organizational size and governmental pressure are important factors influencing that decision.

This hypotheses is based on the following arguments: small businesses are less able to gain operational performance (cost, quality) benefits in an electronic hierarchical relation with government, professional (intermediary) organizations can more easily integrate with government and benefit from the so called electronic integration effect [13]; these organizations can then market more and cheaper data exchange services based on their electronic linkage with governmental organizations. Especially when governmental (legal) pressure rises – when non-adoption is no longer tenable, smaller companies will outsource this data exchange relationship.

The overall model and hypotheses are being explored, operationalized and tested in a current Ph.D. project. The model is in parallel being applied to three empirical studies, each focussing on a different subset of relations in the model.

This paper presents the results of one of these empirical projects, based on the partial model depicted in figure 1. The specific research model shows that we *focus mainly on the relations between innovation-specific and organizational adoption factors and the outsourcing strategy.* Other aspects of the model will also be addressed, but in a more qualitative manner.

In the next subparagraphs we separately address the two sets of variables used.

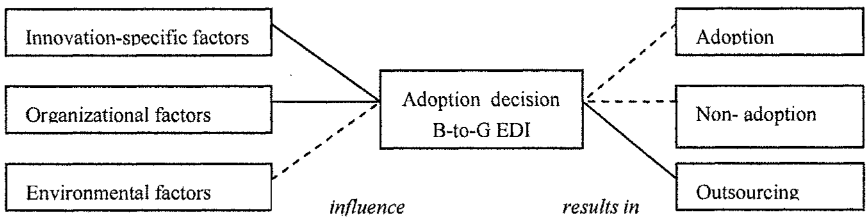

Fig. 1. The overall research model used in the Ph.D. –project of which this study is part of. The dotted lines represent relationships that were not included in this study.

3.1 Adoption strategies

Important phases in the adoption decision making process are knowledge gathering, persuasion, decision making, implementation and use of the innovation. A crucial moment in that process is the decision to adopt or reject (that is: non-adopt) the innovation. In this study we distinguish three adoption strategies: adoption, non-adoption and outsourcing.

Adoption is the result of a decision of an individual organisation "[to] make full use of an innovation at the best course of action available" [15]. Adoption is thus a mental or financial commitment towards the innovation or a physical acquisition of the artefact [11]. Chwelos uses the term "intend to adopt" to stress the fact that it exclusively concerns the initiation phase and not the implementation phase.

The possibility or intention of further integration and use within the organisation distinguishes adoption from the other two strategies: non-adoption and outsourcing.

Non-adoption is a rejection and reflects the decision not to adopt the innovation.

Outsourcing is the third adoption strategy. This strategy can be seen as a type of non-adoption decision: the organization has no intention of using (and possibly integrating) the innovation.

The three strategies also differ in the channels used for data delivery to government. *Adoption* leads to electronic delivery of messages by the individual business. *Non-adoption* in most cases leads to continuation of paper delivery by the business organization (contraire to the governments objective). *Outsourcing* means electronic delivery by an intermediary party.

3.2 Adoption factors

As stated earlier in this study we use the three layered technology-organization-environment model as a basis for research of the adoption decision. Many studies point at variables which go beyond Rogers' [15] innovation-specific characteristics: for instance organizational readiness, external pressure, competitive pressure and organization size [6, 9, 11, 12, 16].

Based on the presented theory we expect *five innovation-specific factors* to play a role in the exploration and explanation of our hypotheses:

Cost savings (efficiency) as a specific relative advantage and operational performance characteristic [11]. Efficiency was mentioned as one motive for adoption of data exchange in ninety-seven percent of the studies examined in Elgarah's meta-analysis [8].

Reduction of error-rates as a specific relative advantage [6] and operational performance characteristic. The reduction of errors is directly related to the reduction of the information obligation costs.

Enhanced productivity (business process speed up) as a specific relative advantage. This factor resembles the "reduced lead time" factor of the operational performance focus by Henriksen [11].

Complexity as defined by Rogers. Complexity may hinder integration of (EDI-) applications and therefore will frustrate cost savings especially in the case of small and medium sized companies [6, 8, 10].

Reduction of (cost of) outsourcing as a specific form of cost savings. This factor drives a possible dis-intermediation process [13] and is deliberately added because of its opposite direction to the hypothesized outsourcing strategy.

Based on the theory presented before we expect at least *two organizational factors* to play a role in the exploration and explanation of our hypotheses (due to practical constraints in the research plan we could not address more than two organizational factors):

Organizational size is often mentioned as a factor influencing the integration capabilities of an organisation and related to that the possibility to gain full benefits of EDI adoption [6, 8, 11].

Organisational IT experience is a combination of IT (knowledge) related factors as IT sophistication [6] and technological resources [12]. It is mentioned as a factor influencing the integration capabilities of an organisation.

The theoretical *environmental* factors competitive pressure, industry life cycle or external pressure [6, 16] have not been operationalized and tested in this study.

4 Research methodology

In January 2005 the Dutch Programme 'ICT and Reduction of the Administrative Burden' (ICTAL) performed a survey among individual businesses. This survey had the general objective to measure the perception towards governmental e-services and to focus specifically on electronic data interchange, reduction of the administrative burden and outsourcing specifically. We were involved in formulating the questions, and we could add specific questions needed for our purposes and afterwards we performed additional analyses on the data gathered.

Operationalization
The instrument used for the measurement of the various research variables is discussed below.

Outsourcing was measured in terms of the number of organisations that outsourced the handling of government services to a third party and in terms of the impact of the introduction of e-services on their outsource decision.

Cost savings, Reduction of error-rates, Enhanced productivity, Complexity, Reduction of (cost of) outsourcing were measured in terms of the perceived attitude in relation to the use of electronic data interchange with the government. (E.g. "Will the use of EDI enable your organization to save costs?")

Organizational size was measured in terms of the number of personnel working 15 hours per week or more.

Organisational IT experience was measured in terms of use of (specific) e-government services during the last 12 months.

Furthermore some general questions were formulated on the themes electronic data interchange, reduction of the administrative burden and outsourcing.

Data collection
For our study a detailed questionnaire was developed that was based on the theoretical model discussed above, complemented by results from similar field studies and insights gained from interviews we did with entrepreneurs and civil servants. The specific questions for this study were drafted in such a way that they could be included in the earlier mentioned broader perception survey. The questions were related to the more general questions in order to make cross sectional analysis possible. The questionnaire was reviewed, tested and performed by a professional telephone survey organisation. The results of the study are based on a representative sample of small and medium scale business in the Netherlands; alas intermediary parties were not included in the survey. The net response for this study was 503 small and medium sized businesses. In case of a non-response the non-respondent was replaced with another business from the database matching the same characteristics in order to guarantee the representative character of the sample. The plain results of the survey have been published in [4].

Sample characteristics
The response is distributed evenly among business sectors and size. The respondents are e.g. from industry (9 percent), repair and trade (16%), hotel and catering (19%), distribution (5%) and business services (16%). Within the latter sector there is no bias towards ICT services. The response does contain a slight bias towards small firms: 62 percent of the respondents work in a company with less than ten employees, 90 percent of the companies has 50 employees or less.

5 Results

In this paragraph we present the main results of the data collection in terms of factors and relations. The results are presented into two themes: the perception of electronic data interchange with government, and the perception of outsourcing.

5.1 Perception of electronic data interchange with government

The general perception of businesses regarding the possible channels for electronic data delivery is presented in table 1 (the question was answered by a subset (n=120) of the respondents - those businesses who had expressed a need for e-government services). We have related this general outcome to the organizational adoption factors.

Table 1, Most preferred electronic channel with government, source: [4]

The Internet (web sites, e-mail)	61%
Electronic data interchange with governmental organization (business sends)	23%
Electronic data interchange with governmental organization (government fetches)	3%
Outsourcing to an intermediary party	8%
Non of the above options	2%
Do not know	3%

With respect to the channels "edi, business sends" and "outsourcing" we calculated chi square to investigate the relations with *organizational size* and *organizational IT experience*.[12]

Neither for EDI, business sends" (X^2 =0.143) nor for "Outsourcing" (X^2 =0.080) a significant relation was found with *organizational size*. When a lower reliability level of 90% is used, a weak relation between "outsourcing" and *organizational size* was found: small business seem to have more tendency to outsource than larger ones.

With respect to the *organizational IT experience* there is a significant yet weak positive relation with "EDI business sends"[13]. Those businesses which prefer EDI as

[12] In all cases we used a reliability level of 95%; thus $X^2 < 0.05$ indicates a statistically significant relation.

the electronic channel to the government have relatively more experience with governmental e-services than the others (the specific contact with the Tax Administration was used as a control variable).

Possible effects of electronic data interchange systems with government in term of the innovation-specific adoption factors have been formulated into five theses. Table 2 presents in percentages the perception of the respondents (n=503) to these theses.

Table 2, Perceived effects of electronic data interchange systems with government, in terms of the innovation-specific adoption factors (in %)

Adoption factor / perception	Totally agree	Mostly agree	Not agree, not disagree	Mostly disagree	Totally disagree	Don't know, no meaning
Reduction of error- rates	11	29	20	16	16	8
Cost savings	12	31	15	18	15	9
Complexity	15	17	12	25	24	7
Enhanced productivity	14	31	16	13	19	7
Reduction of outsourcing	14	31	16	13	19	7

The results show a relatively positive attitude towards electronic data interchange with the government in terms of the innovation-specific adoption factors: 40 to 45% agrees with positive effects on the operational performance, 49% does not perceive complexity as an obstacle, and 44% of the respondents perceives possibilities to reduce (cost of) outsourcing. However a rather large group, approximately one third of the respondents, has a rather negative attitude towards the data interchange systems in this context.

Based on these results we investigated the relations between the perceived effects (innovation-specific factors) and *organizational size* and *organizational IT experience*, in terms of Pearson Chi-Square.

Table 3, Relations with perceived innovation-specific and organizational adoption factors

Perceived factors	Organizational Size	IT Experience
Reduction of error-rates	X^2 =0.200 (n=498)	X^2 =0.784 (n=359)
Cost savings	X^2 =0.002 (n=498)***	X^2 =0.848 (n=386)
Complexity	X^2 =0.000 (n=498)***	X^2=0.001 (n=408)***
Enhanced productivity	X^2 =0.086 (n=498)*	X^2=0.244 (n=379)
Reduction of outsourcing	X^2 =0.172 (n=498)	X^2 =0.305 (n=359)

[13] X^2 =0.043, contingency coefficient C = 0.355[13]

* 90% significance; *** 99% significance

One weak relationship and three strong ones exist. Large business somewhat agree more with the fact that electronic data interchange offers possibilities of enhanced productivity, small businesses do agree less. Large businesses do agree more with the fact that electronic data interchange offers possibilities of cost savings, small businesses do agree less. Small businesses do agree more with the fact that complexity hinders them to implement electronic data interchange, large businesses do agree less. The less IT experience the business has, the more it agrees; and visa versa.

5.2 Perception of outsourcing

The introduction of governmental e-services, e.g. electronic data interchange, could have an effect on the outsourcing decision. We measured how many business outsourced the handling of governmental services (Table 4), and what effect the introduction of governmental e-services would have on that outsourcing decision, (Table 5).

Table 4, Outsourcing percentage of the handling of governmental services (n=503)

Business outsources (some) activities	73%
Business does not outsource activities	26%
Does not know	1%

Table 5, Impact of introduction of governmental e-services on outsourcing decision (n=503)

Leads to more outsourcing	14%
Leads to less outsourcing	13%
No change in outsourcing decision	73%

Businesses which already outsourced have a greater tendency to outsource more than business which did not outsource yet. This is a statistically significant relationship.[14] Additional analysis shows that there is a positive relation between "more outsourcing" and the perceived administrative costs [4][15]. Thus those organizations which indicate "more outsourcing" have the tendency to have a higher perception of administrative costs than other organizations.

6 Conclusions

Most of the conclusions confirm results of earlier studies in the business-to-business context. Apparently eGovernment does not (yet) bring forth new and specific adoption arguments.

In general, businesses have a positive perception of the possible *benefits of data interchange* with the government, especially in terms of operational performance.

[14] X^2 =0.011/C*=0.147

[15] X^2 =0.015/C*=0.206

Here, organizational size is the discriminating factor. Larger businesses in general have a more positive perception of potential cost savings and productivity enhancement than smaller businesses. Furthermore smaller businesses feel that complexity hinders them to implement electronic data interchange. This perception of complexity is also influenced by the IT experience of a business: the less IT experience the business has, the more it agrees with the thesis that complexity is hindering implementation. This is confirmed by the fact that those businesses which prefer edi as the electronic channel to the government have relatively more experience with governmental e-services than the others.

The results show some effects of the rather outspoken perception on possibilities and set backs of electronic data interchange with government on the *adoption strategy* chosen. Small business e.g. seem to have more tendency to outsource than larger ones. This seems to correspond with another finding in the same survey: the fact that smaller businesses are relatively less in need for governmental e-services [4]. Again organizational size is the discrimination factor. A possible explanation is the fact that smaller businesses perceive no opportunities gained from the "electronic integration effect" [13] with government. At the same time they do expect professional intermediary parties to benefit.

This explanation is supported by the fact that businesses which already outsourced have a greater tendency to outsource more (influenced by the introduction of governmental e-services) than business which did not outsource yet. Those businesses that outsource more have the perception that the introduction of interchange systems with government will lead to a reduction of (cost of) outsourcing. Here too the possible explanation is that these businesses expect professional intermediary parties to realize these cost benefits instead of realizing these effects for themselves.

7 Implications

This study presents a theoretical and empirical analysis of factors influencing the adoption strategies of business-to-government electronic data exchange systems. Outsourcing of this exchange is a relevant adoption strategy to many, especially smaller, businesses. One obvious question is how SMEs can realize a reduction of their administrative burden in this context.

In our opinion more attention should be given to the role of intermediary parties in these e-government services processes. These professionals in data logistics are better able to exploit the advantages of the electronic integration effect with the electronic government than individual (smaller) businesses. These intermediaries form a channel through which individual businesses can by reached electronically. The real challenge in that case for governmental organisations and individual companies is how to transfer the efficiency benefits gained by intermediaries into financial benefits (cost reduction) for individual (SME) companies. In our opinion competition plays an instrumental role. Two examples from the Dutch situation illustrate this *market mechanism regarding eGovernment services.* First of all we see the emergence of a totally new market of B-to-G electronic data interchange services offered by private application service providers (ASP's). These ASP's offer data transportation, data security and data management services to intermediaries and individual organisations, competing on quality and price. Secondly, large accountancy firms are currently offering their individual business clients a 20% reduction on their bills related to electronic filing of annual accounts (which tries to meet the 25% reduction objective of the administrative burden formulated by the Dutch government). Following this strategy intermediary parties can become helpful partners in the implementation of qualitative and cost effective eGovernment services.

A successful introduction of B-to-G electronic data exchange services asks for the right balance of governmental efficiency benefits, intermediary services, and the reduction of the administrative burden of individual businesses. The factors influencing these adoption strategies are hardly understood yet. We will elaborate and empirically test our theoretical model further. We are currently investigating the implications of legal enforcement of electronic tax filing in the Netherlands. Since the government will probably benefit most from the increased efficiency the legitimacy of the legal enforcement of electronic data exchange might be(come) questioned. In this respect the government should have a thorough understanding of the innovation adoption mechanism before taken bold and irreversible steps.

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Internet Services for the underprivileged

Computer courses for the elderly and unemployed at a residents' meeting room

Harri Oinas-Kukkonen and Kaarina Hakala
University of Oulu, Dept. of Information Processing Science
Rakentajantie 3, FIN-90570 Oulu, Finland
Harri.Oinas-Kukkonen@oulu.fi, Kaarina.Hakala@oulu.fi
http://www.tol.oulu.fi/~hok

Abstract. Accessibility means that the use of services should be open to all, to people of all kinds and in all situations. This study in barriers to Internet use for the elderly and unemployed is based on material gathered from persons attending a computer course run by the City Council at a residents' meeting room in Oulu, Northern Finland, through interviews carried out before and after the course and observations made during it. Half of the participants were making e-transactions regularly a year after the course, the most common types being the paying of bills and the sending of e-mails to relatives. It is evident that Web pages provide far too much information at one glance for the elderly to digest, that the basic concepts of the Internet and the metaphorical terms associated with the user interface are by no means obvious, and that the illogicalities of services can easily discourage elderly people from using them. The general accessibility instructions place emphasis on the problems of people with poor eyesight, but surprisingly, none of the people interviewed suffered from the small size of the print on Web pages and nobody complained that their eyesight was a hindrance. Another surprising observation was that using the Internet was mostly regarded as preferable to visiting an office. The elderly people were in their own opinion skilled at using a mouse and at moving rapidly between Web pages, but observations suggested that they had considerable problems with using a mouse and lacked the boldness to move back and forth between pages. The sites that they visited were predominantly Finnish ones. There were also great variations in the degree to which these people felt that they were a part of the information society.

1 Introduction

Business is being conducted with the public authorities more and more often through computer networks, but there are many people, especially among the elderly and unemployed, who have never had any instruction in using a computer either at school or in their work and may experience all kinds of barriers to using the Internet,

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for instance, on account of their age or for other reasons. If they wish to learn some of the relevant skills, they have to do so either on their own or through courses.

Residents' meeting rooms are a means by which the local council in a town or city can support residents' associations or other forms of local democracy. At the time when this research was carried out Oulu City Council had ten such rooms that were equipped with computers, and computer courses were held in these from time to time in addition to all the other activities. The majority of people attending these courses were either retired or unemployed and were therefore unable to make use of computers or courses provided by an employer.

Heller et al. [1] report that persons aged 60 years or over mainly use the Internet to find health information, plan journeys or else write e-mails, while Sankari [2] is of the opinion that the elderly find computers handy but challenging tools to work with and are well prepared to manage without them. A computer can nevertheless be useful for maintaining social contacts, pursuing hobbies and avoiding alienation from society. Tuorila and Kytö [3], in their study of the use of the Internet and the negative consequences of the transfer of services to this medium, note, interestingly, that one perceived drawback is the effect on health of the resulting decline in physical exercise, partly as even the moderate amount of exercise involved in looking after one's own affairs in public offices etc. is in danger of being rendered unnecessary. Mäensivu [4] lists the technical barriers experienced by senior citizens as including the complexity of Web sites, their coloured backgrounds and the smallness of the lettering on them. The gaining of access to such pages was also a source of problems. Technical barriers that might be assigned to the category of usability include use of the mouse, especially double clicking, while psychological barriers include uncertainty, fears and poor language skills.

The growth in the proportion of the older age groups among the adult population has given rise to a need for strategies and sets of instructions for achieving better Internet accessibility [5]. Accessibility is closely linked with the issue of usability [6, 7]. Some researchers define accessibility to comprise technical accessibility and usable accessibility [8]. Universal accessibility means accessibility by all, or accessibility by most [9]. The needs of the older age group are often overlooked in matters of information technology [1, 10], although various sets of planning and accessibility instructions have been developed [11-14], also to the blind people [15]. The main question to be addressed in this paper is whether the elderly experience problems in using the Internet, in addition to which some consideration will be given to whether courses held in residents' meeting rooms can offer a solution to the challenges posed by the modern 'information society'.

2 Methods and framework

A background for this work was created by holding meetings in summer 2004 with the Oulu City Council coordinator for local democracy, its project leader for development services, the deputy head of its library services and the provider of computer support for the IT services department, in order to become acquainted with the activities arranged through the residents' meeting rooms and the situation in the City of Oulu regarding computer transactions. Visits were made to eight meeting rooms and interviews were held with social workers and adults who happened to be there at the time.

The actual gathering of data was based on five computer courses of 24 h each held by one of the authors at the residents' meeting rooms in the Oulu suburb of Puolivälinkangas in spring 2004 and one shorter course in autumn 2004. Personal observations were recorded covering some 100 h during these courses. Participants in the courses were also interviewed at two stages.

The first stage of interviews involved people attending the basic course in 2004, recording the expectations and initial level of knowledge regarding computers of 27 people who had put their names down for this course. All of them were retired on the grounds of either age or incapacity to work, or else they were unemployed. Only one respondent was at work, and she was therefore excluded from the material. One limitation on the findings may be that the people attending a course in a residents' meeting room do not represent a typical cross-section of the retired population. The fact that they had entered for the course suggests that they have an interest in computers, and many of them actually owned one or were thinking of buying one. The participants were divided into five groups of 5–6 persons each. Some of them dropped out during the courses and others attended irregularly.

A second set of interviews, this time by telephone, were conducted a year after the course, for the 12 participants who could be contacted at that stage. The people interviewed were aged 48–74 years (mean 66 years, standard deviation 8 years). The oldest of the original participants, aged 77 years, had dropped out. There were eight women and four men, including two married couples, and their level of education varied from junior school (four persons) to a university degree (two). Three had received a vocational school education, two had attended a commercial college and one had a middle school education. The participants had been retired an average of 10 years (range 0–15 years), two were on a disability pension and one was about to retire on a disability pension but had been partially unemployed for a long time. Five of those interviewed had been quite unaccustomed to using a computer a year earlier, although three had since bought one. By 2005 there were only three people who could be said to be unfamiliar with a computer. These were all women and included two of the participants who had only a junior school education. Two of these people had a computer of their own but had not used it very much. Altogether 11 participants had their own computer, seven had an Internet connection and two of the latter had broadband, while the others were contemplating it. The one person who did not yet own a computer, a widow living on her own who had difficulties with technical devices, reported that she intended to buy a laptop computer and broadband connection in the near future. Conversations with the participants suggested that expense was not a plausible barrier to acquiring a computer for any of them, although the cost of broadband caused them to think for a moment.

The three key dimensions for studying the barriers of internet usage by the underprivileged include psychological, physical and technical barriers (see Figure 1). The psychological barriers comprise learning and attitudes, and the technical barriers comprise issues related to the user interface and the Web usage and transactions.

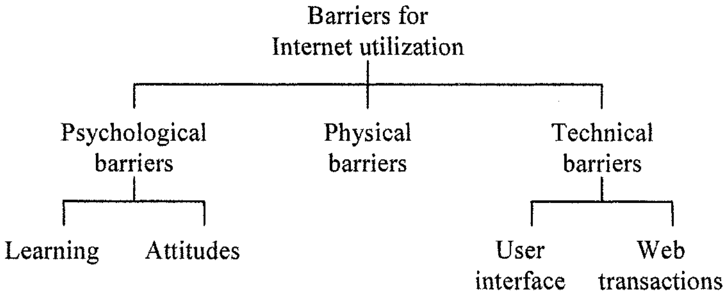

Fig. 1. Barriers for Internet utilization.

3 Results

3.1 Observations

The people taking part in the course had had little or no opportunity to use a computer previously, and most of them were hesitant about it. They were not prepared to do things for themselves and were frightened of jamming the machine. Some of them had a computer at home and were worried about it being ruined by a virus. They had had all kinds of problems with it, including losing the icons for opening programs and being unable to install antivirus programs. They had entered for the course out of interest, and also to some extent in order to pass the time.

Learning. The participants' expectations regarding what they would be able to learn from the course were initially fairly poor, the foremost doubt in their minds being their ability to remember things. Some of them dropped out, which is not unusual for courses that are free of charge (a nominal fee was charged towards the end of the course to cover the cost of coffee and cake during the breaks).

Attitudes. The older participants were well motivated and attended regularly, arriving in good time, and would have been willing to stay for longer. Handouts were distributed and many people made notes on these to help them to practice at home. They were also able to get free advice after the course was over if they came to the meeting room at a certain time. Some would come simply to play patience, while others preferred to ask for advice by e-mail.

Physical barriers. The size of lettering did not seem to present a problem, and when one person asked for the writing to be made larger the result seemed to be less satisfactory, as it caused increased use of the scroll bar.

As there were usually two participants to a computer and they were all very close together, a considerable amount of noise arose, which made it difficult to hear the instructions. One person was in any case hard of hearing and dropped out of the course after a couple of lessons, being unable to follow the teaching. One 77-year-old had poor eyesight and the words on the screen had to be so large that it was necessary to use the scroll bar continuously. This person was incapable of using the mouse, however, and the instructor had to put her hand on top and move the mouse for her and tell her when to press it. On her own, she would move the mouse in an uncontrolled fashion and press it almost all the time, so that a whole host of windows would appear on the screen. This person similarly dropped out after two lessons. In such cases of highly limited ability one would need a professional teacher for the handicapped or some form of private instruction.

The user interface. There were many *mouse problems.* It was difficult to understand when one had to double-click, when a single click was sufficient and when it was necessary to click the right-hand button. It was also difficult to keep the mouse on the pad, and it would easily stray to the edge of the table, so that it had to be lifted up and moved. It was also hard to click the desired point on the screen, as the mouse would move as it was being clicked, giving the wrong selection and causing confusion. The computer mouse at laptop proved much easier to use, and the participants learned this very well on the one occasion when they tried it.

Web transactions. The first thing to be taught was use of the *e-mail.* Only two participants had an e-mail address, and it was soon realized than one of the drawbacks with providing a free e-mail address is that the pages are apt to be full of advertisements, which clearly disturbed some people, especially since clicking on an advertisement could sometimes cause it to fill the entire screen, so that the user could not escape from the situation. It was almost always difficult to find the fields in which users should enter their own email address and password. A brief illustrated guide to using the e-mail was printed out for each participant, but its use still caused problems for most of them. Their addresses were formed on the "firstname.surname" principle, but they were virtually unable to learn that the letter "ä" had to be written as "a" and "ö" as "o". One participant, a 72-year-old man, never managed to write his address properly at the first attempt and always had to have the instructor beside him to advise. He was not put off by this, however, but took it all very calmly and good-humouredly. Access to this e-mail was hampered by the illogicality that it was not necessary to write the second part of the address, "@operator.fi", on the first page, but if you made a mistake in either the address or the password at that point, you had to write the address on the next screen with the latter part as well. In practice the participants almost always found themselves in this situation, and about half of them tried to write their email address in the URL address field. In the exercises the instructor would carry on an e-mail correspondence with the participants, asking them to reply, but only a small number managed to do so. The sending and receiving of attachment files was an interesting topic but too complicated for beginners.

Some of the group had previously learned to type, so that the use of the keyboard, particularly for *word processing*, did not cause as many problems for them as for the others. Those who had not used either a keyboard or a typewriter before nevertheless wrote slowly and often spent a long time looking for individual keys. The majority managed in the end to produce a whole page to conform to the model document, which gave them great satisfaction.

The greatest amount of time was spent on learning to use the *Internet.* The pages usually had a large amount of material on them, and it seemed that most people began reading them in the manner of a book, from left to right and from top to bottom, being unable initially to glance at a page and extract the essential things from it at once. Similarly they could not muster the courage to move on to new pages or turn back to previous ones. Surfing for one's own interest and pleasure began to succeed only towards the very end of the course. There were only two men who would set out boldly to find information on the sports pages on their own initiative, and one woman who would surf the pages on dogs; the others would wait for the instructor to guide them. If a page contained more material than would fit on the screen it would be necessary to use a scroll bar, but this would often go unnoticed and its use would sometimes be hampered by deficient mouse skills.

Use of the Google *search* engine did not seem to be of interest as far as finding information was concerned, but the participants were happy to use it to find pictures, which they learned to import into documents of their own.

Use of the Web to conduct *transactions* was also taught, particularly the completion of forms. This was very successful when the tabulator was used to move among the necessary fields. Similarly the participants were able to appreciate that the information would not be passed on until they had approved it. This exercise seemed to reduce their general fear of the Internet.

3.2 Interviews

Learning. Although there had been much talk in the coffee breaks about participants' lack of confidence in their abilities to learn or remember things, the interview material suggests that they had no doubt in the end that they had learned a lot. On the other hand, some people were more worried about the learning abilities of others of the same age. Most of them were of the opinion that everybody should be able to use the Internet and that instruction should be available free of charge.

One 73-year-old woman wrote:

*"**I have learned surprisingly many things** on the course at the Puolivälinkangas meeting room that I had been wary of before. The most interesting things of all were being able to use the public library services via the Internet, to practice paying bills and to learn word processing. I now intend to buy a laptop computer for myself and I will certainly want to use it for bills, for typing, for processing pictures and for ordering air tickets etc. **It will make these things quicker and improve the quality of life.** It might even give me more free time."*

Most of the people interviewed agreed that things had to be repeated many times before they were learned properly, and six of them said that they had taken this course more than once.

People had had all kinds of problems with their own computers in the intervening year: there had been viruses, the computer had "jammed", there had been large amounts of e-mail spam, etc. One interviewee said that use of the Internet had been hampered by the slowness of the modem, and others were of the opinion that it was affected by their own poor skills and various problems with the computer. Nevertheless, all of them said that they had a friend or relative who could help them in technical matters. Three people relied on their grandchildren for this, six on their children or a son-in-law, and the remaining three on their sister's husband. One person claimed that she had had difficulties after her sons had made "improvements" to her computer.

Attitudes. It could be concluded from the interviews that using a computer had not been a source of anxiety for the participants. In fact very little prejudice against this could be perceived. The youngest respondent (49-year-old woman who had been on a sickness pension for 10 years) had, in her own words, been "in a panic" at the beginning of the course, but now used her computer a lot and reported that her husband had complained that she was "always sitting at that thing". She had bought a computer and subscribed to a broadband connection during the course. She earlier wrote:

"I saw a notice here at the meeting room about a computer course that was starting, and decided to put my name down for it. I thought that in this computer age ***I would need a computer in the future****. I had been interested in learning word processing and in using e-banking and e-mail. It was hard at first, as I had never touched a computer in my life before, but the instructor was so skilful and patient with me that the idea gradually caught on. Now I am quite at home with e-mail and* ***write to my sister in Norway almost every day****. So far I have only practiced with the banking program and I haven't yet paid any real bills. Now I am thinking about a computer of my own."*

There were great variations in how well people felt that they were part of the information society. For example, one person who had not been able to identify with it in 2004 reported being very much involved in it now, in spite of not having used a computer at all since the course ended.

All the respondents expressed great interest in the Internet, except for one woman who had been on the course together with her husband, who was accustomed to using computers to some extent, as they had one of their own, although admittedly without any Internet connection. They had sat together on the course, with the wife using the computer and her husband beside her. The instructor was of the opinion that the wife learned things very well, but she claimed afterwards to have been the worst student of all. She was interested in handicrafts, however, and so was very nimble at using a mouse and a keyboard, and although she was not especially interested in the Internet, she admitted that when visiting her daughter she asks her to find out information from it.

Physical barriers. Although almost all the interviewees wore spectacles (nine had bifocals and two reading glasses) no one regarded eyesight as a problem. Two people mentioned that their neck became tired after using a computer, which may at least in part be connected with vision problems, as the need to look through the lower parts of bifocal lenses forces one to strain the neck upwards. The instructors noticed that this affected most of the people on the course, but they themselves treated it as a natural thing or as only a short-term discomfort, so that it did not prevent them from taking part.

Surprisingly, there was scarcely any comment that the writing on the computer screen was too small. One person even wanted to make it smaller, and only one tried to enlarge it. Although there are means for making the written parts of displays clearer, e.g. by altering the font, removing background pictures, etc. the participants' skills were not up to this, and only two reported having changed the font size themselves.

The people who found the writing too small were among the oldest participants. One was suffering from the beginnings of cataract and another from retinal degeneration, but the third had no ophthalmological disease. One of these people had enlarged the print, but had also suffered from time to time from the mouse cursor "disappearing" from the screen. Altogether there were five people with an ophthalmological condition (cataract, retinal degeneration or glaucoma) but this had evidently been fairly well correctable with spectacles. One person complained that his bifocals were a nuisance as they meant having to stretch the neck upwards to see the screen [cf. 16]. He had tried to rearrange the positions of the chair and table and had asked an optician about reading glasses, but was of the opinion that they were too expensive for computer use alone.

The user interface. The average participant would seem from the interviews to have liked using a computer in spite of not finding it at all easy. Sending and receiving e-mails and surfing the Web had been fun and both a mouse and a keyboard were regarded as easy to use. Similarly it was felt to be easy to read things on the screen. The elderly participants had nevertheless failed to notice certain things that had been apparent to the instructor, e.g. the fact that the majority of people had difficulties in using the mouse, whereas only one person mentioned this as a problem.

One 69-year-old woman reported:

*"Now that I have started this computer course it seems that **I am having trouble with using the mouse**. I don't always manage to point it at the right spot, and I can't always "pull" it as the instructor asks. The keyboard is rather awkward in its box, but that isn't too much of a problem on a short course like this. Many new things have come up, and I hope I will remember them on the next course. **There are also lots of tiny details to learn** that are easily forgotten if you don't use them regularly. I don't have a computer of my own, so my computer use is restricted to this course. Technical things are not my strong point, but fortunately the teacher was usually on hand to help. Time passes quickly when you try to learn new things, and you have to be careful not to delete the whole of your work by accident with only a tiny click of the mouse. There are lots of "finer points" that it would be nice to learn to use. – – Two hours at a time is suitable enough for learning something new, but as the lessons are just once a week, you easily forget some of the things you learned the last time. **I hope I will learn enough from this to manage with the digital TV when it comes in.**"*

There was great uncertainty about surfing the Web. As many as 10 of the interviewees regarded the whole Internet as highly or mildly confusing, and it emerged from conversations that the Web pages were too full of detail, so that it was difficult to find what one was looking for. More than half of the respondents were disturbed by animations, while some said straightforwardly that they paid no attention to either these or advertisements. Opinions of the degree to which they understood what they found on the Internet were variable: almost all the respondents said that they had found themselves on English Web pages by accident, but only two had even a moderate command of that language.

Although the first enquiry had suggested that no one had any trouble with using a mouse and that only the right-hand mouse button and the double-clicking technique caused difficulties, the instructors observed that there were far more problems. These were evidently only realised in personal conversations. Even so, eight respondents to the later enquiry still denied that it was difficult to aim the mouse at a particular spot, in spite of the fact that five of them had some defect in the hand with which they operated the mouse, including three with a very serious disability.

Web transactions. Surprisingly, it was agreed that in principle transactions carried out on the Web were preferable to visiting offices personally (nine people were either entirely or partly of this opinion), although the one advantage with the latter, it was claimed, was that it gave one exercise. Five people were now in the habit of paying their bills by computer and three hoped to be able to do so in the future. Some used their bank's payment service, some the bank's own automatic system and some went to the office in person. No one claimed to visit a bank to pay their bills. One person used the computers in the residents' meeting room or in the public library for this purpose. Three respondents had ordered tickets via the Internet, either alone or with help, and two of them had also bought goods that way and the third on one occasion. All of the interviewees were very cautious, and even fearful, when it came to financial matters, however. This was not a fear of doing something irreversibly wrong, however, as the people claimed to be quite bold in their surfing of the Internet. Only four of them had a password for the public library's Internet pages, however.

Although the Internet was felt to be an interesting thing and many people said that they regretted having used a computer so little, they were nevertheless of the opinion that they could easily manage without the Internet. They all led busy lives and were involved in many other activities. Three claimed to make extensive use of the Internet. One claimed to be addicted to Chat. The most important uses of the Internet were said to be: banking (six respondents), e-mail (three), timetables (one) and chatting (one). It is often assumed that elderly people look for health information on the Internet [cf. 1], and Becker [17] points out that special attention should be paid to the accessibility of health information and services, but only four of the people interviewed here had been interested in this aspect, whereas four had used it to look for food recipes as well. Altogether 11 people maintained that they had derived some benefit from using the Internet, while one person saw no benefit in it but was nevertheless applying for a broadband connection. Like most of the respondents, he had made little use of it since the end of the course, but said that he had used it with his sons to find sports results and spent about one hour a week on the net.

Overall, the respondents reported spending 0-10 hours a week on the Internet, with an average of 2 hours. Three had not used it at all since the end of the course. Seven made use of e-mail, even though the whole group had been taught how to use it and provided with addresses. It may be that the e-mail service concerned was sufficiently difficult to work with that it had not inspired people to continue using e-mail.

4 Conclusions

It can be concluded from the above that a half of the participants were regularly conducting Web transactions a year after the course had ended, the main functions being the paying of bills and the sending of e-mails to relatives. The advantages of both are clearly and rapidly to be appreciated. All in all, these elderly people wanted to learn new things and were eager to make plans regarding the future.

The interview results suggest that these people were in no doubt about their ability to learn new things when they came to the course but were more uncertain whether they would be able to remember things. They did not in general regard either a computer or the Internet as a source of anxiety as such, but simply the technical aspects involved in these, e.g. in the installation and updating of programs, or in virus problems and their control. In practice every one of the participants had a relative or friend who could help in these technical matters. The fear surrounding the use of the Internet also seemed to be reduced by experiences of using it successfully, e.g. upon discovering that the data in e-transactions will be sent on to the recipient only when the sender has approved them.

It is clear that Web pages all too often contain far too much information at one glance for an elderly person to cope with, and scanning through it to extract what is essential will not necessarily work, even though the familiar newspaper metaphor may be understood well enough. Many people are distracted by animations and advertisements, and many common concepts connected with computers and the Internet that are familiar to most people, such as www addresses, e-mail attachment files, fields for passwords and the like, are not necessarily intuitively obvious. The same is true of many user interface metaphors, such as the moving and double-clicking of a mouse, the keyboard and scroll bars on the screen. Illogicalities in Web sites, e.g. in navigation possibilities, can also easily throw elderly people into despair to the extent of ceasing to use the service in question. At the same time their skills are not usually up to such tasks as altering browser settings (e.g. to obtain a larger font or eliminate background pictures).

Rather surprisingly, the interviewees did not feel that they had suffered on account of the smallness of the print on Web pages, nor did anyone regard their eyesight as detracting from computer use. This is an interesting observation, since the instructions for ensuring the usability of computer systems place especial emphasis on problems of vision. One may ask whether the instructions need to be revised or whether it is that elderly people are not prepared to demand better facilities in computers. Another surprising finding was that e-transactions were regarded as preferable to visiting offices in person.

Certain contradictions arose between the observations and the facts reported by the elderly people themselves. They may well have imagined that they were skilled at using a mouse or at browsing through the Web, but observations suggested that the mouse caused considerable problems and that they were not bold enough to surf the Internet and return to where they had started. This situation only altered after a considerable length of time. Similarly, they would not admit to a fear of doing something that was irreversibly wrong, although observations suggested that this was frequently the case. It is quite natural, of course, not to perceive difficulties like this oneself even though they may be apparent to others.

The Web pages that these people visited were mostly Finnish ones, and it must be admitted that a poor command of English is a considerable barrier to operating on the Web. Altogether, there were great variations in the extent to which people felt that they were part of the information society. For example, one interviewee who had claimed to be poorly integrated into the information society at the beginning of the course had a feeling of being part of it in the interview a year later in spite of not having used a computer at all in the meantime. All told, these elderly people did not appear to attach as much importance to the Internet as is generally assumed in information society strategies.

Computers installed in residents' meeting rooms can provide pensioners and others with an easy introduction to computing. The threshold is lowered by the fact that the meeting room is close at hand and the atmosphere there familiar and homely. Courses are arranged nowadays in most meeting rooms of this kind in Finnish towns and cities, and continuous help and advice is available. Most people need more than one course, however, just to rid themselves of their unfounded fears and gather the necessary basic information. Most of the present respondents had had more than one course and said that they still needed more.

It would be interesting to further study how much use the elderly and unemployed really make of Internet services, and what is the impact of different information system functionalities (e.g. sitemaps and navigation routes) on their accessibility. There are estimations that as many as 30% of elderly people need computer services to be more accessible than at present [18], but it remains to be seen whether the provision of such services that meet the accessibility requirements actually increases their use by elderly people.

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Combining Critical Success Factors and Life Cycle Model to Enable Evaluation of e-business models

Helsinki School of Economics, Information System Science
Aleksi Horsti
aleksi.horsti@kesko.fi

Abstract. Electronic business models (e-business models) are a relatively new and growing research topic within Information Systems Science. The purpose of the paper is to combine critical success factors (CSFs) and life cycle model literature as ways to evaluate e-business models. The study draws empirical data from a survey among leading Finnish companies. In the survey, 104 respondents assessed 20 CSFs gathered from management literature as well as the importance of each CSF at different life cycle stages of an e-business model. Theoretically, the observations give evidence on the changing importance of various CSFs at different stages of an e-business model's life cycle. Primarily, the risk level and effectiveness of e-business model were recognized to distinguish CSFs in the life cycle model. In addition, the customer type (either B2B or B2C), the position in the value chain, and the service or product-orientation seem to affect which CSFs are essential at the various stages of e-business model's life cycle. Managerially, the different weightings of the importance of CSFs in the various stages of an e-business model's life cycle reflect the practical implications of the paper. The results also suggest that different CSFs are crucial at each stage of a life cycle. The results are likely to be useful for the venture capitalists and entrepreneurs in planning and making decisions regarding the long-term scenarios for e-business models.

1 Introduction

Electronic business model (e-business model) research is a relatively young field within information systems science (ISS). When discussing e-business models, the role of information technology in producing opportunities for competitive advantage is seen relevant [36]. During the last few years, the increasing interest in business models has created a need for academic research including definition, taxonomy, description, evaluation, and other relevant topics enhancing the understanding of

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business models. However, several academics have defined the term business model [see e.g. 1, 3, 37, 40, 42]. Some of them have presented a categorization of structural components or the building blocks (i.e. taxonomies) of business models [3, 17, 27, 37, 42]. In addition, lately an interest for evaluating the business models has grown and it has become a relevant area of the business model research [30, 31].

The aim of this study is to enhance the understanding of e-business model evaluation as a part of IS research. In the paper, we draw research results from the survey data gathered from the 104 respondents of 60 Finnish companies including 104 business units. Based on the data, we have analyzed 20 CSFs and their behavior at each e-business model's life cycle stage. In addition, the paper will give managerial advices including critical success factors (CSF) to which the management should address its attention. The paper seeks to answer the following research questions:

(i) Do the set of CSFs change in various stages of an e-business model's life cycle?
(ii) Does the life cycle stage affect the importance of a specific CSF?

The paper is organized as follows. The aim of the section two is to review the literature related to e-business models, CSFs, and the life cycle model. In the third section, we present the research methodology and describe the characteristics and demographics of the survey data. In the fourth section, we analyze the survey data regarding the e-business model's life stage mappings. In the remaining sections, we draw conclusions and present the limitations of the study to which we propose avenues for further research.

2 Literature review

In the literature review, the most essential research domains are discussed. Firstly, the concept of e-business model is presented. In the second and third sections, the evaluation of e-business models is reviewed in terms of CSFs and life cycle model.

2.1 E-business Model

We can observe that originally the business model discussion was initiated by the business simulation game articles [4] in which the abstraction of business was emphasized and seen relevant. Today, the term "business model" has achieved a growing attention being one of the most discussed concepts after the Internet hype of the late 1990's. During the 1990's, business model was mainly used in the context of venture capitalists explaining some of the most unrealistic Internet business models in the daily business news. At the same time, research focusing on the term business model was about to begin.

The first ignitions of business model research were the listings and short descriptions of various generic business model types [e.g. 37, 40]. In addition, several studies adopted a specific view point in which the term business model was used to explain different market structures [27], the continuous change of business over time [25, 39], asset portfolio management [7] or the patenting of business models and unique processes [6].

Secondly, another stream of literature on business models emerged recognizing and analyzing the components and elements of a business model. Furthermore, the practical cases and empirical data were utilized for the first time enabling an avenue for convincing academic publications. Weill and Vitale [42] explored eight atomic e-business models that can be used as building blocks in multiple ways to create new e-business models. In addition, they introduced a practical way to map an e-business model within one drawing and they emphasized the evaluation of e-business models [42]. In this study, we have adopted the business model definition stated by Weill and Vitale [42]: "the business model is a description of the roles and relationships among a firm's consumers, customers, allies, and suppliers that identifies the major flows of product, information, and money, and the major benefits to participants". In addition, Amit and Zott [3] illustrated three business model constructs - content, structure and governance - basing their research on the strategic management theories and especially on the value creation. Also Afuah and Tucci [1] presented eight business model components and they recognized a need for the evaluation of business models. Osterwalder and Pigneur [30] provided four ontological pillars of an e-business model including product innovation, customer relationship, infrastructure management, and financials following the basic idea of balanced scorecard (BSC) introduced by Kaplan and Norton [19]. Hedman and Kalling [17] presented seven business model components. For the first time, the scope of management was identified as a crucial component of the business model concept. The aim of the component is to describe the dynamics of the business model over time as well as cognitive and cultural constrains that managers have to cope with. All the discussions of the business model components share the notion that a business model is an abstraction of a business identifying how a current business profitably creates value.

Thirdly, according to Osterwalder et al. [30], business model research has lately focused on the practical tools that can be used in management and in IS applications. For example, software-based tools enable the design, visualization, comparison and simulation of complex business models [30]. In addition, the evaluation of e-business models has been regarded as a relevant topic in the forthcoming business model studies [31].

2.2 Critical Success Factors

The concept of success has been studied throughout a wide range of academic literature [e.g. 9, 13, 40, 42]. The concept of CSFs was developed by Daniel [12] and refined by Rockart [37]. CSFs are the focus areas contributing most to the success of a company and to its competitive position. Therefore, it is crucial for companies to pay attention in managing these factors.

CSFs are regarded as an accepted and widely-used concept [e.g. 2, 22, 33, 34]. CSFs can be regarded as a top-down analysis focusing on a core set of essential issues [9]. However, CSFs have also been criticized by academics and practitioners. Especially among academics, the validity of the CSFs concept has been questioned, and among practitioners the complexity of the CSFs concept may finally lead into a too simplified business environment [9].

Despite its shortcomings, CSFs can be seen as a common and recommended basis for the evaluation of success within IS research: defined factors and measures are always required in order to evaluate success. Several studies have gathered empirical data focusing on evaluating the success of a particular IT system implementation [10, 23, 26]. Also information systems [13] and electronic commerce [14, 19, 20, 41] have been interest areas when discussing success.

Peffers et al. [34] developed the CSF concept by coining the term critical success chain (CSC). CSC follows the basics of a three-element model of personal constructs theory [21] including IS attributes, CSF performance, and firm objectives. According to the CSC, if the firm has an aim to enhance a system with certain attributes, the use of the system will result in outcomes that are observable as changed CSF performance, which is, in turn, required to achieve relevant firm objectives [34].

2.3 Life cycle model

The product life cycle (PLC) concept is described as the evolution of a product, as measured by its sales over time [11, 18, 24, 32]. Patton [30] went further and described that the main idea is to create a basis for planning the strategy of profitable product exploitation. According to Levitt [24] and Cox [11], different strategies are adopted at the various stages of a product life cycle. After this, different strategic actions of each life cycle stage were included [18]. Thus, these studies indicate that management has to focus on different issues in the early phase compared to the maturity phase of a product's life cycle.

Life cycle model has been widely adopted in other disciplines too. Within the IS science, the life cycle model has been used, for example, in the context of the computer-based information systems [29], systems development [28] as well as business process re-engineering [23]. According to Ginzberg [16], the implementation of information systems is not a discrete event or activity that can be evaluated or studied with simple research approaches at one point of time, since attitudes and beliefs may change over the various stages of the implementation process. Furthermore, most of the e-business model studies have adopted a static view on e-business models rather than the adoption of development, dynamics and maturity of a business model along time [8]. Hence, this is one of the first studies to introduce the life cycle model in the context of e-business models.

3 Methodology

The section discusses the study design. Also the demographics of the respondents are presented.

3.1 Data collection and sample

We gathered data for the study from various sources being the expert interviews, a literature review, the pilot testing of the questionnaire, and the subsequent survey. Firstly, we began the empirical study in the fall 2003 with qualitative research methods. We interviewed 17 managers from five e-business models representing five industries: paper, media, traveling, telecom, and logistics. The main purpose of these interviews was to identify CSFs affecting their e-business models. At the same time, a literature review was conducted analyzing previous success factor studies from the academic journal articles. However, after the interviews and literature review we had a raw listing of CSFs. Next, the number of initial CSFs was reduced by excluding the duplicates and similar factors.

Secondly, we decided to include the CSFs from the interviews and literature as variables in the pilot-test survey. The questionnaire was pilot-tested by ten chosen experts representing both practitioners and academics. Thirdly, the questionnaires were sent by mail to the respondents. In the questionnaire, a respondent was able to choose one or several life cycle stages indicating the existing relevance of the current success factor at a particular stage of the life cycle. In this study, the stages of a business model's life cycle were defined as introduction, growth, maturity, and decline following the concept of PLC [e.g. 18, 32]. In addition, common questions related to the basic demographic data were included.

In this research, the unit of analysis is a business unit, since on the company level there may exist more than one business model whereas on the business unit level it is typical to have only one business model. However, we chose a sample of 450 managers representing 450 business units in 61 companies. All the respondents were practitioners on the managerial levels of their organization, and they all had experience from electronic business. The respondents were chosen from Finnish international companies following two criteria: 1) the company is among the top 30 Finnish companies according to their revenue and/or 2) the company is listed among the top 100 on-line brands in Finland. Finally, we had a list of 450 business units from 61 companies including various industries, traditional large companies as well as some of the most successful small e-commerce and portal companies.

3.2 Demographics

The total number of responses amounted to 104 out of the 450 questionnaires, which yielded a 23-percent response rate. We received properly filled questionnaires from 60 companies including 104 business units. Respondents worked primarily (46 %) on the managerial level of the organization, or as directors (29 %). Forty-five percent of the respondents had five to nine years of valid e-business experience, while 23 percent had as much as ten years or more of e-business experience.

Most of the business units in the sample have a long tradition of using EDI in their business operations. In many traditional manufacturing business units, EDI is still seen as a crucial component of e-business. Eighty percent of the business units had started using EDI before 1993 and the Internet was used by 95 percent of the business units.

4 Analysis and results

In assessing the CSFs, we adopted the life cycle model to distinguish the importance of a particular CSF at the different stages of an e-business model's life cycle. In this section, we present the analysis and results of the study.

4.1 E-business model's life cycle

Our analysis is based on a questionnaire in which we asked respondents to choose one or more life cycle stages, including introduction, growth, maturity, and decline, at which a respondent sees a particular CSF as crucial. By allowing respondents to choose as many stages as they found relevant, we prevented unnecessary limitations from the respondent's point of view.

Table 1. Importance of CSFs in each life cycle stage.

	CRITICAL SUCCESS FACTOR OF E-BUSINESS MODEL	**E-BUSINESS MODEL'S LIFE CYCLE STAGE**			
		Intro	**Growth**	**Maturity**	**Decline**
V1	E-business related personnel is highly experienced	43 %	**76 %**	48 %	22 %
V2	E-business related personnel possesses relevant know-how and capabilities	63 %	**90 %**	45 %	26 %
V3	E-business model can be regarded as an innovative forerunner in terms of products, services and technology	**64 %**	61 %	24 %	11 %
V4	The e-business model related customer data is gathered and utilized	49 %	**70 %**	50 %	35 %
V5	E-business model related software and hardware are stabile	39 %	**78 %**	69 %	30 %
V6	E-business model related multi-channel environment is well-managed including both the traditional and electronic channels	35 %	**68 %**	55 %	23 %
V7	Systematic risk management minimizing the vulnerability of e-business model is regarded relevant	54 %	**68 %**	53 %	35 %
V8	E-business model related management accomplishes well networking and partnering relations	48 %	**76 %**	49 %	23 %
V9	The quality of products and services	40 %	72 %	**73 %**	34 %

	in e-business model is good				
V10	Products and services in the e-business model are easily accessible and usable	52 %	77 %	58 %	22 %
V11	E-business model related operation and products / services offered have a strong brand in the market	48 %	**69 %**	47 %	15 %
V12	E-business model related customer needs are identified and understood	51 %	**79 %**	59 %	35 %
V13	E-business model's offering is targeted and customized	42 %	47 %	**55 %**	27 %
V14	E-business model related management is committed	64 %	**69 %**	41 %	27 %
V15	Management has valuable capabilities in managing the e-business model	57 %	**70 %**	36 %	30 %
V16	E-business model's operations and processes are cost efficient	22 %	52 %	**71 %**	**47 %**
V17	Decisions regarding the competitive strategy of e-business model are evident being either cost leadership or differentiation strategy	27 %	**72 %**	66 %	22 %
V18	E-business model's customers are satisfied and loyal	32 %	70 %	**75 %**	45 %
V19	IT operations and security in terms of software and hardware are reliable from internal point of view	58 %	71 %	**78 %**	50 %
V20	IT operations and security in terms of software and hardware are reliable from external point of view	64 %	**78 %**	71 %	53 %
	ALL VARIABLES	**44 %**	**70 %**	**57 %**	**31 %**

In investigating all the variables at the e-business model's four life cycle stages, results indicate that the growth stage is at the center of interest (70 %) and on the contrary the decline stage (31 %) gets the least attention. In reviewing specific CSFs, we discover that *The innovativity of e-business model* (V3) is the most emphasized in the early stages of an e-business model's life cycle. In the growth stage of the life cycle, *The capabilities of personnel and management* (V2, V15) are tested in an e-business environment where competition becomes challenging for any e-business model. An e-business model also has to show its competitiveness in terms of *The ease-of-use of products and services* as well as in *The fulfillment of customer needs* (V10, V12). In the maturity phase, *Customer satisfaction and loyalty* (V18) are stressed. In addition, customers are seeking *A reliable offering with high quality* (V9) in which the role of *Targeted and customized offering* (V13) is becoming essential. In the decline stage of an e-business model's life cycle, the most essential factor is

Cost efficiency (V16). As expected, *The reliability of IT operation and security* (V19, V20) seems to be relevant during all stages.

We continued the analysis by reviewing the combinations of each life cycle stage markings (see Table 2). Altogether, the respondents had 15 options from which to choose a proper combination of life cycle stages that they regard relevant for a specific CSF. This way, we were able to identify the number of the life cycle stage markings for all the 20 CSFs. Due to the large number of options, we aimed at focusing on the most essential combinations by grouping them into the four groups: G1 - Introduction & Growth, G2 - Growth & Maturity, G3 - Maturity & Decline, and G4 - All the life cycle stages. In addition, we excluded the options (i.e. Options: 5, 8, 9, 10, 11 and 13) having less than 21 markings (see Table 2, the sum of V1-V20 column). Hence, out of the 15 options, nine were taken into account in the groupings (G1, G2, G3 and G4) for the further analysis.

Table 2. Frequencies of life cycle stage mappings.

Option	Intro	Growth	Maturity	Decline	Group*	Sum of V1-V20
1	X				G1	190
2		X			G1	359
3	X	X			G1	295
4			X		G3	279
5	X		X		0	8
6		X	X		G2	199
7	X	X	X		G2	99
8				X	0	13
9	X			X	0	20
10		X		X	0	13
11	X	X		X	0	11
12			X	X	G3	92
13	X		X	X	0	3
14		X	X	X	G4	118
15	X	X	X	X	G4	356

*) Value labels: G1=Introduction&Growth; G2=Growth&Maturity; G3=Maturity&Decline; G4=All stages

4.2 Correspondences between life cycle stages and variables

In order to illustrate the situation between the 20 variables and four life cycle stage groups, we decided to use correspondence analysis (Figure 1). The variables are adequately plotted (Sig. 0.000) in the two-dimension correspondence analysis explaining 85.5 % of the variation. Dimension 1 explains 56.4 % of the variation. On the first dimension, *The innovativity of e-business model* (V3) is plotted far left whereas *The reliability of IT operations and security* (V19, V20) on the right. Evidently, the risk level of the e-business model seems to become the most essential dimension to categorize all the variables in the correspondence analysis. Dimension 2 explains 29.1 % of the variation in which *The capabilities of personnel and management* (V2, V15) are plotted on the top of the matrix and *Cost efficiency* (V16) and *Targeted and customized offering* (V13) on the bottom. We regard that the efficiency of an e-business model seems to spread the variables along the Dimension 2.

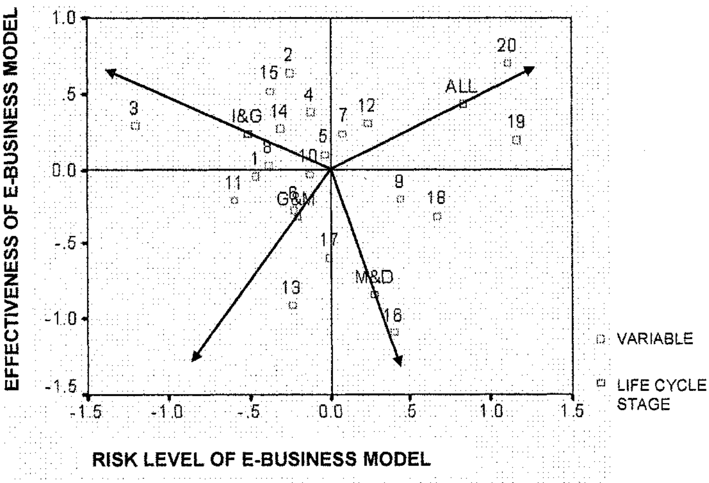

Fig. 1. Correspondence analysis.

According to the correspondence analysis, we can derive the following results. *The innovativity of e-business model* (V3) and *Capabilities of management* (V15) are crucial in the introduction and growth stages. Furthermore, *Chosen competitive strategy* (V17) is stressed in the growth and maturity stages and *Cost efficiency* (V16) in the maturity and decline stages. Finally, *The reliability of IT operation and security* (V19, V20) are significantly emphasized during all the stages of the life cycle.

4.3 Combining e-business model's background with life cycle stages

In the earlier sections, we discussed the four groups formed based on the life cycle stage including Introduction & Growth (G1), Growth & Maturity (G2), Maturity & Decline (G3), and All the life cycle stages (G4). We were also interested in comparing the groups against the characteristics of the respondent's e-business model. In order to distinguish the various life cycle stages, we excluded the G4 from the analysis. The analysis was accomplished with One-Way ANOVA.

Firstly, we examined the customer type of the e-business model being either B2B or B2C. The respondents representing B2C-focused e-business models see that *risks should be managed* (V7, V19) earlier in the life cycle compared to the representatives of B2B-focused e-business models. The result could be explained by the notion that generally the risk management is more enhanced in the B2B-focused e-business models, since both the transacting companies have to manage their risks. On the contrary, IT security and reliability have to be considered with the B2C-focused e-business models earlier compared to the B2B ones, since most of the consumers are not always aware of the data security related matters.

Secondly, we examined the variances between the e-business models having an offering that includes either products or services. The analysis demonstrates that *Customer satisfaction and loyalty* (V18), as well as *Advanced and well-managed multi-channel environment* (V6) are likely to be more crucial variables for the product-oriented e-business models earlier in the e-business model's life cycle compared to the service-oriented e-business model.

Thirdly, we studied e-business model's life cycle stages by analyzing the position of e-business model in the value chain. We followed the categorization made by Benjamin and Wigand [5]. The early phase of the value chain is a producer, the middle phase is a wholesaler, and the final phase is a retailer. For the producer-type of e-business models, *Advanced and well-managed multi-channel environment* (V6) with *Satisfied and loyal customers* (V18) is more relevant in the early stage of the e-business model's life cycle compared to the retailer-type of e-business model. The results show that the producer-type of e-business model typically is a product-oriented e-business model with B2B customers. In addition, the producer-type of e-business models need to *target and customize their offering* (V13) earlier compared to the retailer-type of e-business models, since the B2B-type of customers are likely to require targeted and customized offerings more compared to the B2C ones that are seeking mainly standardized offerings.

Table 3. Analysis of One-Way ANOVA

Variable	Grouping criteria	N	Mean*	F	Sig.
V7	B2B	49	2.02	3.92	.052
	B2C	16	1.69		
V19	B2B	37	2.14	3.66	.062
	B2C	11	1.55		
V6	Product oriented	30	1.43	5.67	.020
	Service oriented	52	1.88		
V18	Product oriented	23	1.61	8.83	.004
	Service oriented	44	2.25		
V6	Producer	32	1.41	3.81	.026
	Wholesal./Intermed.	13	1.92		
	Retailer	37	1.92		
V13	Producer	36	1.67	2.67	.075
	Wholesal./Intermed.	14	1.86		
	Retailer	40	2.15		
V18	Producer	25	1.60	8.41	.001
	Wholesal./Intermed.	12	1.83		
	Retailer	30	2.47		

*) Value labels: 1=Introduction&Growth; 2=Growth&Maturity; 3=Maturity&Decline

5 Discussion and conclusion

This research presents evidences that CSFs seem to be different in the various stages of e-business model's life cycle. The two main dimensions to categorize both CSFs and life cycle stages are the risk level and the effectiveness of an e-business model. Some of the CSFs are likely to be stressed in the early stages of the life cycle whereas others are essential in the latter part of the life cycle. In addition, the business environment (e.g. customer type and position in the value chain) seems to affect CSFs that are selected as crucial. Hence, these interesting results enable us to derive both the theoretical and managerial implications.

The theoretical contribution of the research can be divided into three issues. Firstly, we have combined the CSFs and the stages of life cycle for the first time as a way to evaluate e-business models within IS. Both of them are well-known and recognized in several academic studies [2, 8, 34] despite the recognized shortcomings [9]. Secondly, in synchronizing the CSFs and the stages of a life cycle model, it gives us an opportunity to underpin the characteristics of an e-business model's life cycle as well as to gain an understanding of e-business models. Thirdly, the customer type (either B2B or B2C), the position in the value chain, and the service or product-orientation seem to affect what CSFs are chosen to be essential in the different stages of e-business model's life cycle.

The managerial implications are clear. Results regarding the importance of various CSFs in each stage of an e-business model's life cycle may offer practical insights for the managers. It is crucial to understand that CSFs will change when an e-business model matures. In other words, the focus areas are different in the early stage of e-business model's life cycle compared to the latter parts. The results may also be useful for the venture capitalists and entrepreneurs evaluating or planning new e-business models in the long-term.

Like most survey studies, this study is subject to limitations. Firstly, the sample consisted of only Finnish firms operating in local and international markets. Hence, a larger sample including companies and their business models from other countries would give a richer picture of the subject matter. Secondly, although we sent out an equal number of questionnaires to large companies (top 30 Finnish firms), the number of responses received from the companies varied. For example, we received nine responses from the Finnish Post and only two from Nokia. This is a typical challenge in all the studies utilizing the survey as a primary data collection technique.

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A Secure e-Ordering Web Service

Despina Polemi, Spyridon Papastergiou
University of Pireaus, Informatics Department,
80 Karaoli & Dimitriou Str, 185 34, Pireaus, Hellas
{dpolemi,paps}@unipi.gr,
http://thalis.cs.unipi.gr/~dpolemi

Abstract. The electronic order (e-Ordering) service as an e-business process allows the true business-to-business secure collaboration by giving the opportunity to salesmen and purchasers to execute trustful processes of electronic trading opening new markets. The W3C working draft "Web Service Architecture (WSA) Requirements" and a set of EU Directives impose several security and privacy requirements that the e-Ordering implementations have to satisfy in order to achieve a secure transaction. This paper presents a set of these requirements and describes an e-ordering system (TOES) that address them based on eXtensible Markup Language (XML), XML Cryptography, Public Key Infrastructure (PKI), Web Services Policy Language (WSPL) and Web Services. The proposed e-Ordering service TOES is open, secure, interoperable, and affordable respecting the EU legislation.

1 Introduction[16]

One of the most important aspects in electronic business is the establishment of trustful, legally accepted cross border transactions via electronic means encouraged by various European Union (EU) Directives. The EU Directive on electronic commerce (2000/31/EC) [13] is fundamental in cross border e-business in the European continent, the Directive on electronic signatures (1999/93/EC) [12], the Privacy and Electronic Communication Regulations (97/66/EC) [9] that clarify the principles that are applied in the e-commerce's processes in order to achieve a secure and trustful transaction.

The electronic Ordering (e-Ordering) as an important process in the electronic trading has to respect the existing legal framework and to satisfy the security and privacy requirements that are imposed. This is caused by the fact that the orders may contain business data (e.g. VAT code) or private data (e.g. ordered items) that should

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not be revealed or modified. So, they should be trustful documents requiring all four dimensions of security (confidentiality, integrity, authenticity, non repudiation).

The contemporary e-Ordering implementations vary in terms of the underlined technologies. The existed systems can be discriminated in two types: The ERP inclusive systems that manage the sources within and beyond an enterprise. These systems are not affordable for Small and Medium Enterprises (SMEs), blocking them from entering B2B profitable applications (e.g. e-procurement). In addition, although they satisfy several security requirements, they neither achieve interoperability nor take into account privacy issues. The second type, are customized solutions offering e-Ordering as an autonomous service. Existing systems of this type ignore various security and privacy requirements.

The purpose of this paper is the presentation of the security and privacy requirements of e-ordering services driven by the EU legislation and Directives, as well as the proposition of an open, affordable and scalable e-ordering architecture (TOES) that satisfy these requirements. TOES [22] is built using open technologies, such as eXtensible Markup Language (XML), XML Cryptography, Public Key Infrastructure (PKI), Web Services Policy Language (WSPL) and Web Services.

The rest of this paper is organized as follows. Section 2 provides the fundamental security and privacy requirements of e-ordering. Section 3 describes in detail the e-ordering system architecture and its components. Section 4 provides an assessment of TOES. Finally Section 5 provides conclusions and directions for further research.

2 State-of-the art and requirements

In this section we present the security and privacy requirements of the e-Ordering services [18], [22] as implied by the W3C working draft "Web Service Architecture (WSA) Requirements" [5] and by the EU legal framework.

2.1 Security and Privacy Requirements

The e-Ordering systems have to satisfy certain fundamental security requirements:

- ✓ AR006.2.1: *Authentication of origin.* The confirmation of the source that sends the orders is a critical issue of the ordering exchange process and its identity needs to be proven.
- ✓ AR006.5: *Integrity of the content.* During transmission or storage time, the orders should be protected from unauthorized (intentionally or accidentally) modification or their replacement.
- ✓ AR006.6: *Non-repudiation of origin and receipt.* The ordering exchange can not been denied neither from the sender nor from the recipient.
- ✓ *Long lasting integrity.* The electronic signatures of the orders should remain valid over long periods.
- ✓ AR006.4: *Confidentiality and privacy.* The orders should be readable by the designated recipients.
- ✓ *Integrity of the sequence of the orders.* The avoidance of missing orders.

✓AR006.1: *Availability.* The e-ordering service will be able to be used at any time from the enterprises.

✓*Secure Electronic Storage.* Primary requirements, such as authenticity, integrity and readability should be guaranteed throughout the storage period of the e-ordering documents [11].

✓*Legal Compliance.* All e-ordering implementations have to be compliant to a set of regulations and directives that are defined from the legal framework of EU member states e.g. Digital Signature Law [12], Privacy and Electronic Communication Regulations [9], Electronic Commerce Directive [13], Electronic Storage Directive [11], Protection of Privacy [14], Free movement [10].

Privacy [21] has an important role in the e-Ordering service and is discriminated in two directories. The first one concerns the privacy of the information that is published in an untrusted UDDI. The requirements of this category are the following:

✓ *UDDI Privacy.* The e-Ordering service can be published to an untrusted Directory where the (existed or future) user can invoke it [15].

✓*Requestor Privacy.* The Web Service requestors' query information should be protected [15].

The second direction has as primary scope to facilitate the interaction and strengthen the interoperability of the participants. These requirements are described as follows:

✓AR0020.1: The WSA must enable the expression of a Web service's privacy policy statements.

✓AR0020.3: The WSA must give consumer access to a Web service's advertised privacy policy statement.

✓AR0020.5: The WSA must enable privacy policy delegation and propagation.

✓AR0020.6: Web services must be allowed to support interactions with anonymous parties.

The above requirements impose restrictions that e-Ordering systems have to consider.

3 TOES: A Secure e-Ordering Service

In this section we will present the standards that are adopted by TOES in order to address the requirements from Section 2.1. Furthermore, we describe the proposed e-Ordering service architecture, the entities that are involved in the service, the procedures and all the necessary steps that these entities have to follow in order to complete an e-Ordering transaction.

3.1 Adopted Standards

The proposed system utilizes XML and Web Services (Simple Object Access Protocol (SOAP) [7], Universal Description, Discovery and Integration Protocol (UDDI) [17], Web Services Description Language (WSDL) [16]) as the basic technologies for the formulation and transfer of messages within the platform. The choice of these technologies is based on the achievement of interoperability and security.

The message format integrated in the system uses the XML Common Business Library version 4.0 (xCBL 4.0) [8], which is a set of XML building blocks and a document framework that allows the creation of robust, reusable, XML documents to facilitate global trading. Furthermore, xCBL has been also adopted as the used schema for the e-Order documents that are stored in a XML database. The use of XML for formatting the e-order document, allows the use of XML digital signatures and the integration of timestamping tokens to the document ("*X*ML *Ad*vanced *E*lectronic *S*ignatures XAdES") [6]. The selection of xCBL is based on its maturity level of completeness and clarity that gives the possibility to a system to be parameterized properly in order to be used in different cases.

The WSDL has as basic objective to represent the functional aspects of the e-Ordering Service. Specifically, it is used to describe the interfaces of a service and how to invoke it. Thus, TOES uses Web Services Policy Language (WSPL) [20] in order to represent all non-functional attributes of the offered Service.

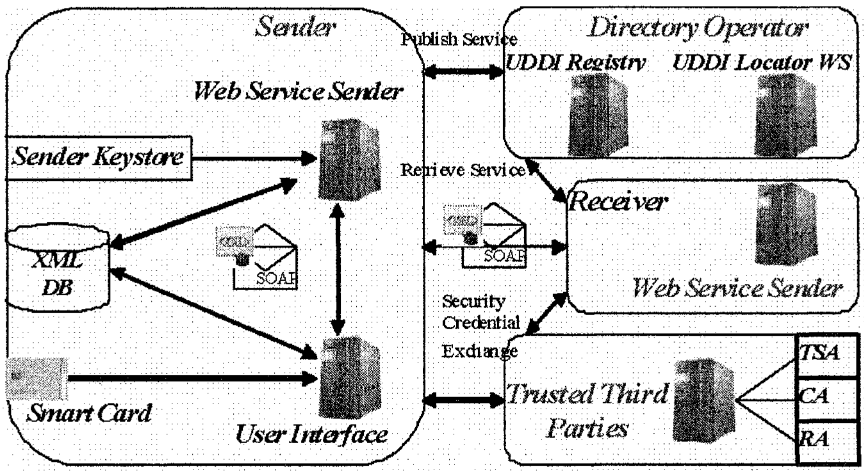

Fig. 5. System Architecture

3.2 Service architecture

Figure 1 depicts the four major entities that take part in the e-Ordering process. The two major entities that participate to the transaction are the Sender that initiates the process and the Receiver that receives the order. A detail description of these entities is the following:

a) *The Trusted Third Parties (TTPs)*: The Trusted Third Parties that are required in the proposed architecture are a Certification Authority (CA) and a Registration

Authority (RA), and a Time Stamping Authority (TSA). The Certification Authority (CA) and the Registration Authority RA offer the PKI services of registration, certification and revocation status information with OCSP [2], while the Time Stamping Authority (TSA) offers standards based time stamping services [4].

b) *The Sender*: The Sender is an organization (e.g.central point of sales, telecomm provider, stores) that hosts TOES architecture. The Sender deploys the e-Ordering service, publishes it in the UDDI Registry and defines a specific privacy policy that corresponds to the used mechanisms of the e-Ordering service. It also communicates with the Trusted Third Parties to get the proper security credentials.

c) *The Receiver*: The Receiver is an organization (e.g. store, private user) that hosts TOES architecture or a similar one. The Receiver retrieves the e-Ordering service from the UDDI, it is configured to understand the messages and defines a specific privacy policy that corresponds to the used mechanisms of the e-Ordering service. It also communicates with the Trusted Third Parties to get the proper security credentials.

d) *Directory Operator*: The Directory Operator Entity is composed of the UDDI Registry, and UDDI Locator WS. The UDDI Registry is an untrusted directory where Web Services can be published, while the UDDI Locator WS makes possible the discovery of the UDDI in which a Web Service has been published.

Furthermore, Figure 1 depicts the three major components i.e. User Interface, Web Service Sender and XML Database of TOES architecture. These components are described in details as follows:

i) User Interface: The User Interface gives the possibility to the user to create, manage and send orders. In order to achieve this, it communicates with six entities: the User card to sign the orders, the CA to request certificate status information [3], the TSA to request time stamps in order to produce XAdES signature [3], the XML database to retrieve order's information, the Web Service Sender in which the orders are sent, the UDDI Registry to publish the e-Ordering Service.

ii) Web Service Sender: The Web Service Sender communicates with five entities: the User Interface that sends the orders to the Web Service Sender, the XML Database to store orders and receipts, the Sender Keystore to receive sender certificate and receiver certificate, the Web Service Receiver, which receives the orders, the UDDI Registry to retrieve the URL of the Web Service Receiver.

iii) Native XML database: The XML database [1] communicates with two entities: the User Interface, which retrieves orders' information and the Web Service Sender, which stores orders and receipts.

3.3 e-Ordering processes

The Sender and the Receiver of the order, before, initiate the e-Ordering process, have to accomplish a set of actions which are divided in three phases.

The first phase includes the definition of the Privacy Policy of the Sender and the Receiver. The second phase constitutes the communication with the UDDI Registry for the publication and retrieval of the e-Ordering service. In the second phase the Sender and the Receiver have to communicate with the Trusted Third Parties for acquisition of the security credentials.

Phase1-Privacy Policy: The Sender and the Receiver have to define the necessary Privacy Policies using the Web Services Policy Language (WSPL). Each of the Privacy Policy documents is signed using the qualified certificate of the corresponded party. The major objective of the defined Privacy Policy [19] is to convey conditions on an e-Ordering interaction between two Web service endpoints. All information provided in the Privacy Policy is aimed to describe the capabilities and requirements of the Web Service entities.

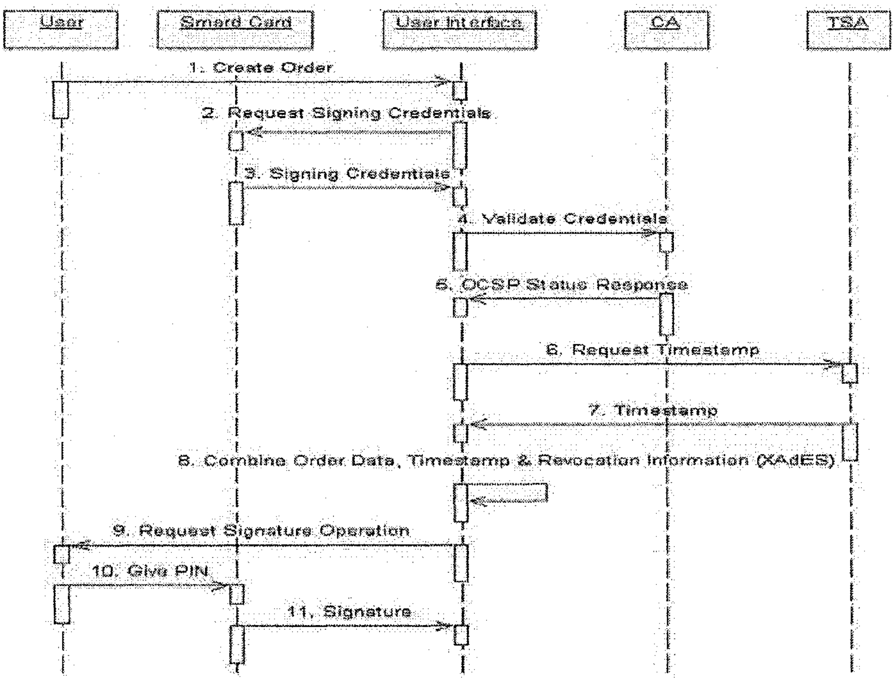

Fig. 2. Sequence diagram for the e-Ordering process (Actions 1-11)

Phase2-Service publication and retrieval: The Sender produces the WSDL document and uses a standard hash function to a subset of the e-Ordering service information that the Sender wants to publish to the UDDI Registry. The Sender's information that remains as clear text corresponds to the contact information, the URL of the WSDL document and the URL of the Privacy Policy document. All other information such as Web Service properties and private data (e.g. VAT code) are hashed. Then the Receiver searching for a service with certain properties generates a query specifying all the conditions on the properties as hashed values. The UDDI Registry returns to the Receiver the URL of the Sender's WSDL document. Now the Receiver has the description of the Web Service in order to configure its service to be able to receive and send SOAP message according to this description. Furthermore, the Receiver produces the WSDL document that corresponds to its service and publishes its service to the UDDI Registry following the same way.

Phase3-Set up security Credentials: The Sender and the Receiver take part in the Registration and Certification procedures as demanded by the Certification Practice Statement of the TTP, and setup the acquired security credentials, in order to achieve a secure communication. Moreover, they have to define the necessary signature policies that will be referenced while producing and validating XAdES signatures, as described in the XAdES standard [3].

When the Sender and the Receiver have accomplished the aforementioned phases, they are ready to initiate the ordering process. The necessary steps to complete this process are illustrated below:

Step1: Access User Interface and Create Order Document (Figure2: Action 1)

The e-Ordering process is initiated by an employee of an organization who accesses a User Interface using a browser. The User Interface enables the user to complete the necessary order's data. The data input is automatically checked for prevention of errors and is used to create the order document.

Step2: Sign Order Document (Figure2: Actions 2-11)

The User Interface transparently gathers the time stamps and revocation status information data from their respective sources. Then, the XAdES signature is formulated based on the cryptographic primitives in the smart card, the user's certificate and the order data. At the end, the order document is signed using the qualified certificate of the user which is located in the smart card.

Step3: Dispatching Order to Sender's Web Service (Figure3: Actions 12-23)

The signed order document is packaged in a SOAP message and is dispatched to the Sender's Web Service. The Sender's Web Service extracts the order, queries the UDDI Locator WS in which UDDI Registry the Receiver has published its Web Service. The query is based on the VAT prefix of the Receiver that corresponds to the country code. When the Sender's Web Service receives the UDDI Registry URL, it queries the Registry in order to receive the Privacy Policy's and the WSDL's documents of the Receiver. All search criteria of the query such as VAT code are hashed. The Sender's Web Service retrieves the Receiver's and the Sender's Privacy Policy, verifies the digital signatures of the documents and merges the two Policies in order to produce a third one and checks the merged Policy in order to decide if it is acceptable and thus the e-Ordering transaction can be accomplished. Then, the order is packaged in a new SOAP message in which the Sender's Web Service applies the acceptable Policy, employing the WS Security extensions.

The Sender's Web Service retrieves the Receiver's WSDL document parses it and retrieves the URL of Receiver's Web Service.

Step4: Receipt of Order at Receiver's Web Service (Figure3: Actions 24-29)

The protected SOAP message is dispatched over HTTP to the Receiver's Web Service that receives the order and follows a fully automated process that requires no human intervention. The SOAP message containing the orders are decrypted with the Receiver server's private key and the validity of their WS Security extensions digital signature is verified, so that the point of origin is validated. Then the e-Order document itself is extracted. Validation of the embedded cryptographic information firstly requires communication with a CA for verification of the credentials that were used to sign the e-Order as well as verification of any timestamp that was included in the document. Finally the XAdES signature is validated.

Step5: Storage of Order at Receiver's XML Database and Dispatching a Receipt (Figure4: Actions 30-31)
The Receiver's Web Service stores the e-Order and a receipt in the Receiver's XML Database. From now on, the e-Order is available for parsing and further processing by the Receiver's users. The Receiver's Web Service dispatches the SOAP receipt, referencing to the received order, and containing the status of the whole process. The SOAP receipt is signed by the receiver's server.

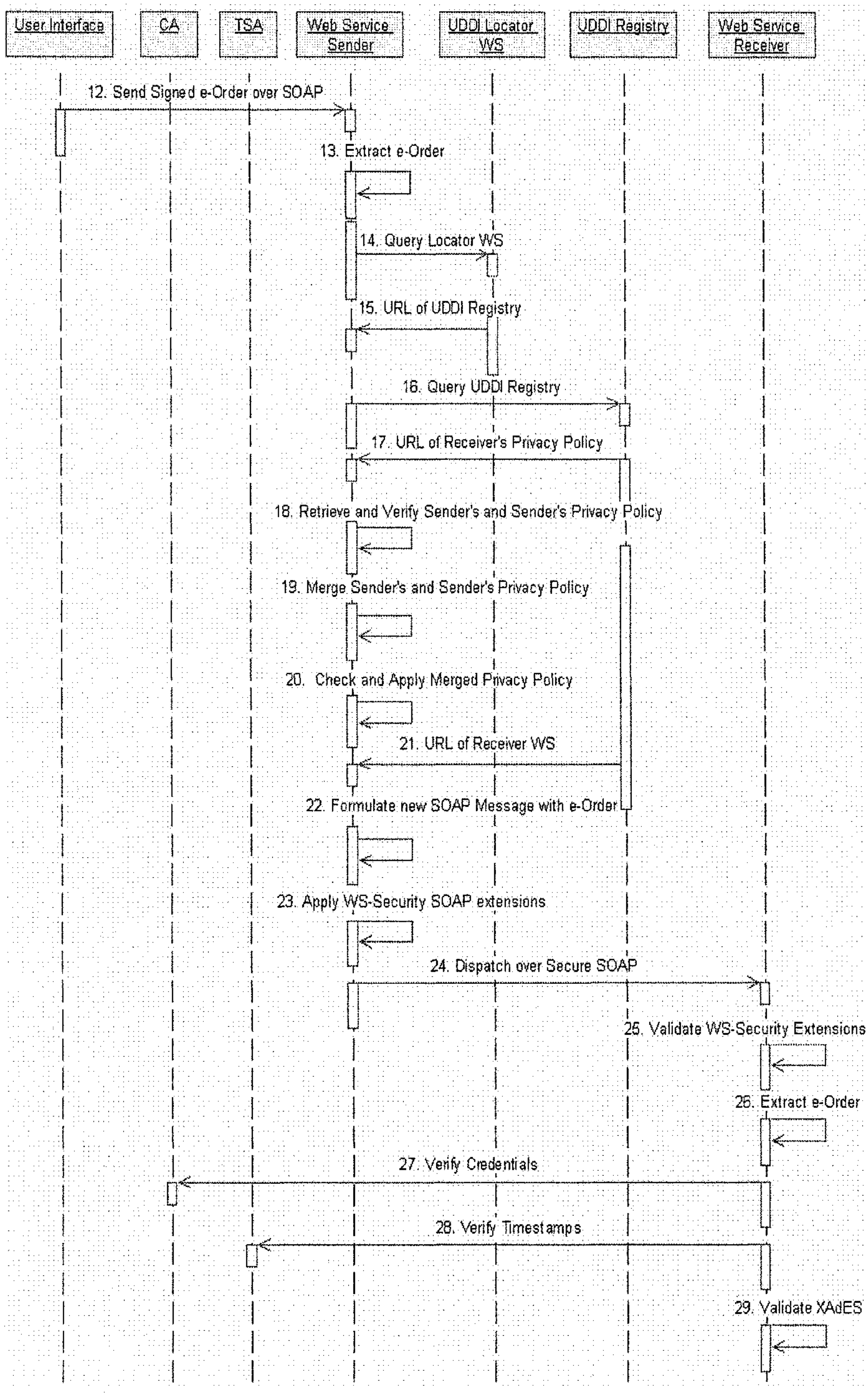

Fig. 3. Sequence diagram for the e-Ordering process (Actions 12-29)

Step6: Storage of Order at Sender's XML Database (Figure4: Actions 32-33)

The Sender's Web Service receives the signed SOAP receipt and it stores it in its XML database along with the sent order.

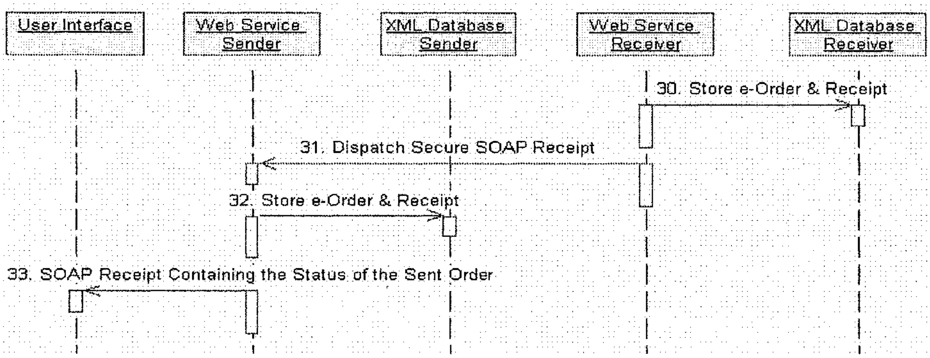

Fig. 4. Sequence diagram for the e-Ordering process (Actions 30-33)

4 Assessment

The fundamental purpose of TOES is to address the requirements described in Sections 2.1 deploying a trustful platform, applying the following countermeasures:

Security Requirements

- *Authentication of origin:* using XML digital signatures in combination with tamper resistant cryptographic modules such as smart cards.
- *Integrity of the content:* using a cryptographic hash function, that provides message integrity checks, as part of the digital signature process.
- *Non-repudiation of origin and receipt*: using digital signatures and time stamping.
- *Long lasting integrity:* using ETSI TS 101 903 that produced ETSI to define XML formats for advanced electronic signatures. A XAdES electronic signature offers also non-repudiation based on a predefined signature policy.
- *Confidentiality and privacy*: using XML Encryption as specified in the W3C Recommendation and the Web Services Security recommendation for encryption in SOAP messages.
- *Integrity of the sequence of the orders:* imposing a tight sequence issuance scheme by having a reference number embedded in each order.
- *Availability*: Web Services are published in registries.
- *Secure Electronic Storage*: the XML orders are stored with the original format in which they were received. Furthermore, the combination of XAdES and a native XML database guarantees the secure long-term archiving of e-orders.

Privacy Requirements

- *UDDI Privacy:* using hashing techniques to a subset of published data so they can not be revealed.
- *Requestor Privacy:* searching for a service with certain properties, generating a query specifying all the conditions on the properties as hashed values. As a result, the untrusted Directory can not infer the search criteria.
- AR0020.1: the privacy policy is expressed using WSPL.
- AR0020.3: the privacy policy is published in a UDDI Registry.
- AR0020.5: the privacy policy is used in order to convey conditions under which the e-Ordering Service is provided.
- AR0020.6: retrieving the privacy policy from UDDI Registry anonymously.

Performance

TOES achieves particularly satisfactory performance via the adoption of Digital Subscriber Line (DSL) technology. The use of XML and Web Services, as the basic technologies for the formulation and transfer of messages within the platform, expands the size of data several times over. The increase of the data size is translated into more storage, transmission and processing time.

Furthermore, a major factor that affects the performance of the TOES is the choice of the proper algorithm for the encryption of the SOAP messages. Secret key encryption is much faster than public key encryption, but secret keys do not scale as well as public keys. So, in order to achieve higher performance the adopted process is the following: a one-time generated secret key is used for the encryption and the decryption of the data, using a symmetric algorithm (triple-DES). The generated secret key is encrypted using a public key algorithm (RSA-V1.5) and the encrypted key is embedded in the SOAP message.

Benefits

The main anticipated benefit by adopting TOES is the significant operating costs reduction, which involves the minimisation of the workload required for handling paper orders, as well as the expenses involved in printing and delivering them and without purchasing expensive ERP solutions.

TOES service provides a suitable, friendly interface to the authorised user for inputting the necessary data for the order fields that have been defined, in an XML document. A native XML database ensures that the XML orders are stored exactly in the original format in which they were received for any future audit.

TOES is a stand alone, secure e-ordering solution based on open source technologies that can interoperate with existing ERP systems. It achieves to satisfy the requirements that have been posed in Section 2.1, respecting the EU legislation.

Cost

TOES is an affordable solution. SMEs do not have to invest in expensive ERPs in order to offer e-ordering and they do not need dedicated employees that are required to have a specific education background, while the system does not pose additional training and managing requirements.

TOES architecture can be offered as an outsourced service by an Application Service Provider (ASP). In this case, the user organizations (e.g. SMEs) do not have to deploy any infrastructure directly related to TOES. The costs of the ASP for deploying of the TOES are kept low due to the use of open source software (such as

Exist [1]) and are limited to the operation costs. The price policy that must be followed is the essential key factor of the success in order to develop the small, medium and large-sized enterprise market. Table 1 demonstrates a sufficient price policy to maintain such an emerging market.

Table 5. ASP Price Policy

Orders	Price/ Order
0 – 500	3,50 €
500 – 1000	3,00 €
1000 – 2500	2,50 €
2500 – 5000	2,00 €
5000 – 7500	1,80 €
> 7500	1,80 €

5 Conclusions and Future Work

In this paper, we presented the TOES architecture. The proposed system is a secure tool for enterprises which desire to send and receive electronic orders via the Internet in a trustful manner, satisfying the posed security and privacy requirements.

Our future research plan is to expand TOES to several directions, with the fundamental objective to enhance the functionality and interoperability features of the proposed architecture addressing two more requirements: mobility and automated negotiation of the functional parameters of the e-Ordering service.

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“Liquid” Electronic Marketplaces

Ioannis Chamodrakas, George Kontolemakis, Panagiotis Kanellis,
Drakoulis Martakos
National & Kapodistrian University of Athens, Department of Informatics
and Telecommunications, Information Systems Laboratory,
Panepistimiopolis, 157 84, Athens, Greece,
{ihamod,kontolem,kanellis,martakos}@di.uoa.gr,
WWW home page: http://mis.uoa.gr

Abstract. “Neutral” electronic marketplaces fail because their structure and mode of operation does not allow for the effective accommodation of multiple business models that could serve the interests of a critical mass of adopters. We propose a fresh approach for the creation of economically viable “neutral” electronic marketplaces showing that this can be accomplished through the ability to transcend taxonomical classifications with a generic agent-mediated ontology and, simultaneously, through the provision of flexible and active decision support. Taxonomies may stifle innovation by imposing artificial boundaries through categorization schemes and levels of abstraction. The proposed architecture addresses this issue underlying a “liquid” e-hub that may mutate from one taxonomical classification to another.

1 Introduction

The phenomenal growth of Internet-based information services and infrastructure in the recent years has provided a new technological basis for enabling and expanding the electronic execution of commercial transactions both on a business-to-business (B2B) and on a business-to-consumer (B2C) level. According to the Economic Review of the Federal Reserve Bank of Kansas City in the second quarter of 2004, B2C e-commerce sales grew at an annual rate of 34 percent from 1999 to 2003 while, between 1999 and 2002, B2B e-commerce sales grew at an annual rate of 5.5 percent in the United States [1].

Electronic Marketplaces were mainly single-vendor sites at the onset of the e-Commerce revolution but since the end of the nineties they have increasingly played the role of an aggregator that merges potentially thousands of vendors and customers either as B2C virtual malls or as B2B electronic hubs. Kaplan et al. have introduced in [2] a well-referenced taxonomy that classifies B2B e-hubs based on 4 dimensions: what businesses buy (i.e. horizontal vs. vertical – operating supplies vs.

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manufacturing inputs), how businesses buy (i.e. systematic sourcing vs. spot sourcing), source of value creation (i.e. aggregation vs. matching), and bias of e-Hubs (i.e. neutral vs. biased). Notwithstanding the short history of electronic marketplaces, several studies have identified a number of key success factors including: development of a critical mass of transactions, maintenance of a balance among the conflicting interests of participants, maximization of participants' benefits and implementation of features that create advantage and loyalty [3]. Albeit the substantial growth of the e-Commerce sector, some analysts have noted that many "neutral" e-hubs are shutting down because of an insufficient number of adopters [3].

This paper endeavors to propose a novel approach for the creation of economically viable "neutral" e-hubs based on the success factors that have been identified in the literature. Our approach is twofold:

- On the one hand, based on the work of Kontolemakis et. al [4], we suggest that "neutral" e-hubs must be characterized by openness and flexibility with respect to other taxonomical classification dimensions in order to achieve and sustain a sufficient volume of transactions in an unstable market environment as well as to be capable of maintaining a balance among the participants.
- On the other hand, we advocate the provision of intelligent services that will assist buyers and sellers in the course of their decision making processes as a feature that will help to enhance their satisfaction and loyalty taking into account what Herbert Simon noted as early as 1971: "What information consumes is rather obvious: it consumes the attention of its recipients. Hence a wealth of information creates a poverty of attention, and a need to allocate that attention efficiently among the overabundance of information sources that might consume it." [5]

2 "Neutral" e-Hubs: Viability Issues

Kaplan and Mohanbir [2] have identified bias as an important dimension along which an e-Marketplace is described. "Neutral" e-Hubs have been defined in their paper as marketplaces that do not favor buyers over sellers and vice versa (in opposition with "biased" e-Hubs). "Neutral" e-Hubs are true "market-makers" attempting to aggregate many buyers with many sellers. By definition, e-Marketplaces of this type face a "chicken and egg" problem: buyers will not participate unless an adequate number of sellers exist and vice versa.

E-Hubs are categorized to ones that work under pre-negotiated contracts (systematic sourcing) and to ones that function under direct negotiation (spot sourcing). For the first, the conditions are not favorable for small participants since they cannot achieve the same terms and discounts as large users who buy large quantities through the E-Hub. For the second, the conditions are not favorable for large clients since even if they buy a lot from the E-Hub they sometimes during the auction may end up buying to a steeper price than a small business. Accordingly, an E-Hub offering both spot and systematic sourcing may help to avoid the appearance of phenomena that relate to the 'chicken-and-egg' problem. Thus, "neutral" e-hubs require two-sided liquidity.

One of the main obstacles in the evolution of current and future E-Hub implementations is that not all companies are eligible to participate in them no matter how big or small they are if they don't abide to the 'laws' of the E-Hub that controls what to present and how to present it. This stems from the fact that every company has different types of products and services and a different customer base to deal with. Even if they have the same product categories, they may present them differently to their clients emphasizing on special attributes that they only amongst the other hub participants choose to provide (such as a 3 year guarantee plan, etc.). In addition, the taxonomy differentiates E-Hubs to those that deal with manufacturing and to those that deal with operating products. Simply stated, if a company transcends these categories in the physical world, it cannot do it in the virtual.

In addition, we are accustomed to 'seeing' two main types of information systems - B2C *or* B2B. Usually, a system that fall into either one of these categories is largely autonomous without blending in some of the functionality of the other one. Virtually every hub or marketplace created focuses on either B2B or B2C business transactions. An integration of both categories would yield a generic e-hub that caters for all stakeholders across the process flows and covers every step of the way from production to consuming. It is important to note that the taxonomy proposed by Kaplan et al [2] only covers B2B E-Hubs. By importing the "C" parameter to an open and generic E-Hub renders any differentiation – and hence any taxonomy – that distinguishes between B2B and B2C categories largely artificial. The usual method market makers employ for attracting participants is the offering of ancillary services that provide additional value [3]. We propose an integrated approach to face the above issues according to the success factors that, as we mentioned in the previous section, have been identified by several studies as most important:

(1) Development of a critical mass of transactions
(2) Maintenance of a balance among the participants
(3) Maximization of participant benefits
(4) Implementation of features that create advantage and loyalty.

We argue that factors (1) and (2) may be satisfied if the architecture of an electronic marketplace permits mutation from one taxonomy classification to another: support of both vertical and horizontal markets (what businesses buy), support for both systematic and spot sourcing (how businesses buy), support for both aggregation and matchmaking as sources of value creation.

Furthermore, as we mentioned above, we argue that factors (3) and (4) may be satisfied with the provision of flexible and "active" decision support mechanisms that will assist buyers and sellers in the course of their decision making processes, promoting their satisfaction and loyalty by helping them maximize their turnover. Software agents play a crucial role in order to achieve this transcendence of the taxonomy. Their characteristics like situatedness, autonomy, intelligence, social ability, reactivity and pro-activeness would help an "active" DSS to monitor the user actions and proactively provide advice, provide negative and positive critique to the actions of the user, give explanation for its feedback if requested, adapt its feedback to the user profile, based on knowledge captured about the domain and the user profile, handle different business models and present them to the interested user.

A sample listing of current operating "neutral" marketplaces that are financially healthy simultaneously by serving customers in diverse industries and by providing intelligent services assisting buyers and sellers in their decision making processes (e.g. spend analysis, supplier assessment, etc.) is shown in Table 1 [6].

The research described in this paper proposes an agent-based architecture for an open and truly flexible "liquid" electronic marketplace that may mutate from one taxonomy classification to another [2, 4] with emphasis on an agent-based active DSS system that handles different business models.

Table 1. Successful "neutral" e-marketplace examples

Name	*Intelligent Services*	*Industries/Segments*
Ariba	Supplier Discovery/Assessment, Sourcing Decision Support, Spend Analysis, Bid Optimization	Consumer Products, Energy, Financial Services, Healthcare, High Technology, Manufacturing, Pharmaceutical, Public Sector/Education, Telecom, Transportation
Emptoris	Supplier Discovery/Assessment, Sourcing Decision Support, Spend Analysis, Bid Optimization	Financial Services, Telecom, Retail, Energy, Technology Hardware, Healthcare, Capital Goods, Food and Drink, Media, Pharmaceutical, Other
Verticalnet	Supplier Discovery/Assessment, Sourcing Decision Support, Spend Analysis, Bid Optimization	Consumer Goods, Healthcare, Manufacturing, Retails, Services/Media
Global eProcure	Supplier Discovery/Assessment, Sourcing Decision Support, Spend Analysis, Bid Optimization	Retail, Manufacturing, Financial Services, Consumer Products, Energy, Entertainment, Food, Gas, Public Sector, Publishing, Real Estate, Transportation, Other.
Perfect Commerce	Supplier Discovery/Assessment, Sourcing Decision Support, Spend Analysis, Bid Optimization	Chemicals, Retail, Energy, Financial Services, Food, Health, Hospitality, Manufacturing, Technology, Transportation

3 Proposed E-Marketplace architecture

In Figure 1, we show how the three basic components of an E-Market (Ontology, Negotiation, and Decision Support) come together and interact defining as a whole the functionality of the system. The first component is the Generic Product Ontology which is an ontology created so as to cover every possible product or input combinations which can be stored in the systems database. The second one is the Negotiation Agent, who is responsible for managing the negotiation process between the buyer and seller using ontology attributes and for reaching a mutually acceptable promise which is then fulfilled. The third one refers to flexible and "active" decision support system. Flexible, in the sense, that it will accommodate all the diverse needs of the actors in the context of taxonomy classification transcendence and "active" in the sense that it will act proactively to support the decision making processes of the actors (in contradiction with the traditional "passive" Decision Support Systems that required from their users to possess full knowledge of their capabilities and exercise initiative, something that has been criticized since the late eighties [7, 8]).

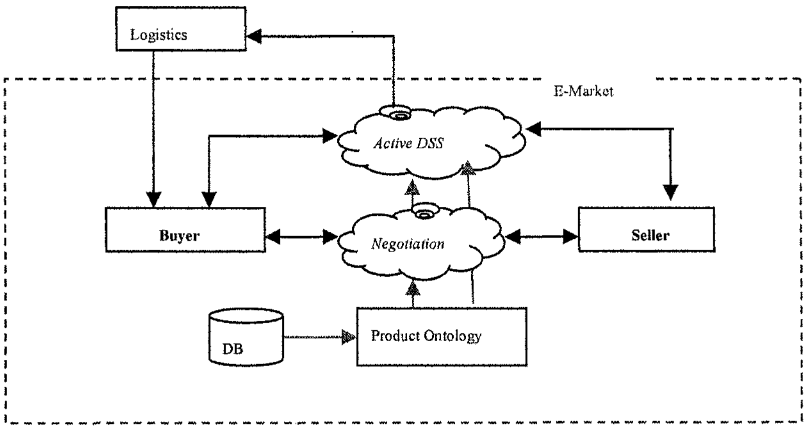

Fig. 1. Generic and Agent-Mediated E-Marketplace Architecture

4 Ontology design

Our research falls under the design-science paradigm in information systems research [9] where knowledge and understanding of a problem domain and its solution are achieved by engaging in the actual process of building the desired artifact and applying or putting it into use. Two instantiations of the final product have been created and are being tested in a laboratory environment. These are the generic product ontology and the negotiation part of the E-Hub as described in the following paragraphs. The Decision Support System is the next instantiation to be presented in this paper and the final prototype will be created out of the testing of those three.

A flexible and generic E-Hub architecture can mutate from one taxonomy classification to another. In order to achieve this, a generic and thus reusable product ontology is deemed necessary and was created. We have expanded and build upon the model presented in [4] so as to cover every aspect of a modern electronic hub with the addition of 2 components that interact with the DSS presented in the following section whilst striving to keep it as simple and hence as reusable as possible. In Figure 2 the expanded product model is depicted. The **Identifier** is the

ID of the product along with the characteristics that define it. The **Physical** property corresponds to one material when we talk about manufacturing inputs or to a collection of raw materials or other products so that when synthesized an operating input is created. So both manufacturing and operating products are supported by the ontology. The **Functional** property refers to the possible applications of the product, i.e. what this product is used for best. The **Presentational** property is related to the manner and form in which the product is represented to the user. This can be in a form of an image, video [10] or any other 3D-representation. As described in [11], the latter is accomplished by creating a 3D model from images taken as inputs. The **Product Category** property provides the vendor with the ability to classify his product into a broader category. To each category specific properties can be assigned that are derived from the product and are called Special Attributes. The **Special Attributes** property includes alternate characteristics or meta-attributes of a product. This property contributes to producing a flexible system since additional product attributes are not predefined by the ontology, but can be created at run-time by appropriately configuring the Product Category. This property in conjunction with the physical one provides an ontology of such generality and with any special characteristics providing the flexibility to the user to promote his product or service in any way that he see fit. **Strategy** is a property that helps the user to define his deal-making tactics based on the products' negotiable attributes. The **Domain Model** varies according to the taxonomy classification of the e-Hub and type of product. A product belongs to at least one domain model and it is treated as a part of this model following the rules and tasks according to the domain model stored in the database. The **User Model** comprises of user attributes and user preferences represented in terms of hard and soft constraints corresponding to a specific product so that a matching of product-user can be effectively achieved.

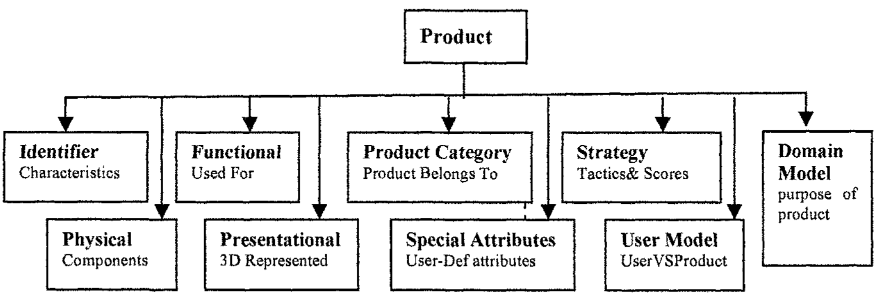

Fig. 2. Generic Product Ontology

5 Decision support

The dominant approach adopted for human decision making in traditional DSS by the research community has been Simon's phase model [7, 12, 13]. Decision making is perceived in this model as a choice from a number of alternative options to achieve the best outcome from a set of all possible consequences. This model incorporates three phases – Intelligence, Design, Choice – that are used both to describe and explain the decision making process and as a roadmap for building DSS supporting each of the phases [14]. The Intelligence phase is defined as the identification and listing of a subset of all the alternatives which the decision maker will consider; the Design phase is defined as the determination of the consequences of each of the identified alternatives, i.e. the calculation of the pay-off function; finally, the Choice phase is defined as the comparison of the efficiency of the consequences of each alternative resulting to a selection among them. Sprague and Carlson [5] formulated a set of tools as the building blocks for DSS according to these 3 phases: (1) storage, manipulation and access of data tools, (2) tools supporting fitting this data into formal models, and (3) tools incorporating methods and algorithms used to "solve" models in order to reach a decision.

The old-fashioned way of business points out that when a customer becomes a regular client of a shop, the seller offers him better conditions in terms of price, time of delivery, etc. Current E-hubs offer either systematic or spot sourcing according to pre-negotiated or not contracts. With the help of the active DSS system and the agents in it, the spot sourcing oriented E-Hub can easily be mutated into systematic sourcing for a specific buyer. This, for example, can be accomplished when the customer buys a lot from a) a specific seller that can provide him with better terms relating, for example, to price, etc. and b) from not a specific seller but from the same hub where for example having met predefined sales levels, better prices quotes can be offered regarding fulfilment services, etc. The advisor agent of the proposed DSS architecture (Figure 3) keeps track of the buyers' movements and acts accordingly.

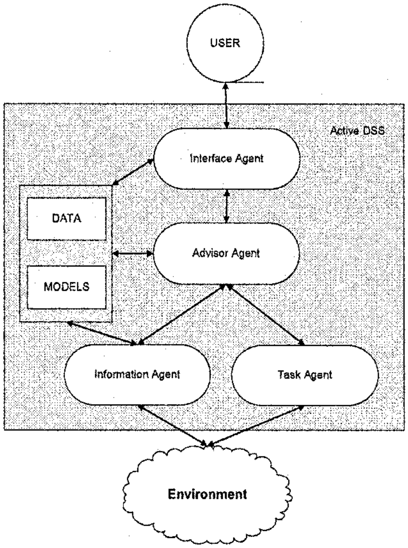

Fig. 3. Decision Support Mechanism Architecture

For the first case the agent informs the seller for the specific customer and proposes him to contract the customer with better terms. If the seller agrees, the discount is applied every time the two sides come to a mutually accepted agreement through negotiation. This mechanism favors the vendor in the sense that he receives all the orders and the buyer in the sense that he enjoys better terms. If the contracts that take place consider a discount percentage on the upper or lower limit of the negotiation ranged space attributes and the negotiation is still used then the buyer will still receive lower prices. But if something unexpected happens causing the product's negotiable attribute (usually price) to rise, then the seller would have a chance to apply hard utility factors and functions on the product in the negotiation part of the E-Hub that will enable him not to loose money and to keep his client happy since he/she will still buy cheaper than the others.

For the second case, the task agent informs the corresponding logistics department for the discount in shipping fees as well as the buyer through the interface agent for the discount taken place. Every time the task agent places an order for the specific client it sends the shipping company the reduced fee that should be retrieved from his/her account. This favours the buyers since the E-Hub lowers its transaction/fulfilment costs. Sellers can also be favoured in this E-Hub. When a specific seller completes a lot of transactions he may enjoy a reduction in the rental space of the marketplace. Here the information agent keeping track of all the transactions within the marketplace can decide whether a specific seller can enjoy a reduction in the rental space of the marketplace. This decision is taken by considering not only the value of the goods sold but also the frequency of sales. If the reduction is decided, the seller is informed and a new contract must be signed for the changes to take effect. So the proposed architecture could prompt us to classify it as neutral but offering at the same time the flexibility to become forward, reverse or biased – hence liquidity.

In the context of B2B electronic commerce a Business Transaction Model (BBT) may help the decision maker to move from the abstract goal of profit maximization to specific, tangible sub-goals, by splitting the process in concrete stages, namely: (1) Partnership Formation (i.e. to find collaborators), (2) Brokering (i.e. matchmaking buyers and sellers), (3) Negotiation (i.e. to find agreements), (4) Contract Formation (i.e. to legally contract), (5) Contract Fulfillment (i.e. delivery and payment), (6) Service Evaluation (i.e. transaction feedback). He et al. argue in [15] that only stages (1), (2) and (3) involve complex issues related to decision making, information search and matchmaking and, thus, are candidates for the employment of agent technology facilitating decision support and automation. Based on this analysis, we argue that a "neutral" e-hub striving to be economically viable should provide intelligent decision support in each of these stages. We should also note that the "Service Evaluation" phase may produce valuable data that could be employed by a DSS for the "Intelligence" phase of the subsequent decision making processes. Silverman et al. have identified in [16] the existence of data warehouse technology that may be used by suppliers and aggregators in order to track customer transactions and build descriptive and predictive models of buying patterns, as well as to provide personalized customer services with the help of business rules, collaborative filtering and other matchmaking algorithms (albeit in a B2C context). In a B2C environment stages (2), (3), (4), (5), and (6) are the ones that are used by the marketplace in order to fulfill the process.

Based on the work of Angehrn and Dutta in [17] and of Vahidov in [12], we propose, a decision support architecture for "liquid" B2B electronic marketplaces that extends the traditional "roadmap" defined by Sprague and Carlson in [18] by incorporating: (1) the use of "stimulus" agents that act as advisors providing alternatives or as "devil advocates" challenging the actions of decision makers in the course of the decision making processes related to the aforementioned stages of the BBT model, (2) "situating" decision support systems within the problem environment through the use of information and task agents that will act respectively as sensors and effectors and (3) interface agents effectively employing novel methods in human computer interaction with emphasis on conversational methods to capture knowledge from the decision makers [19].

The architecture we propose is comprised of the following components: Interface Agent; Data and Models; Advisor Agent; Information Agent; and Task Agent (Figure 3).

The "**Data and Models**" compartment contains data and models relevant to decision making: (1) The Domain Model, captures knowledge of one particular domain, i.e. pharmacological ontology, or printer ontology. It comprises of a hierarchical task representation of the respective e-commerce process along with the knowledge base (rules, cases, relevant information sources) pertaining to the decision making process. These ontologies-models provide detailed description of the domain. Domain ontologies use the whole set of modeling primitives, like (multiple) inheritance, numerous slots and relations, etc. They are complex in structure and are usually constructed manually. As stated in [20] it is not feasible to think of knowledge needs of all foreseeable domain applications. Hence, in our case, the domain ontology serves as many reusable knowledge entities that can be shared across the e-market domain [20]. Each new entity is stored in the DB and relations are created with existing entities. In this way any model whether it originates from B2C or from B2B domain, from vertical or horizontal markets and so on can be stored in the ontology. The demanding task of extracting or importing domain models accordingly is left in the Information Agent component of the DSS mechanism. In this way the taxonomy of Kaplan et al [2] can be transcended since our proposed e-marketplace comprises of all possible markets stored in the ontology and used by the Decision Support Multi-Agent System accordingly. (2) The User Model, captured by the Interface Agent, comprising of user attributes and user preferences represented in terms of hard and soft constraints. User attributes are domain specific characteristics of the user (e.g. annual turnover of a company, customer salary, etc). User preferences may be modeled as a Utility Function that associates criteria with weights or as a Vector pay-off function with satisfactory aspiration levels for each criterion according to the behavioral model of rational choice introduced by Simon [21]. This will be accomplished through the use of a Constraint Satisfaction Formalism: hard constraints (limits for specific criteria beyond which pay-off become zero) correspond to the aspiration levels of the behavioral approach; soft constraints (limits for specific criteria beyond which pay-off is diminished) correspond to the preference statements in a multi-attribute utility function.

The **Interface Agent is** responsible for interaction between the user of the e-Hub and the decision support mechanism. Its aim is to capture user's attributes, preferences, objectives, hard and soft constraints in order to elicit a user model supporting the decision making process. The method employed for capturing user needs follows a conversational approach based on inference according to rules applicable in the domain model (different for each taxonomy classification of the e-Hub and/or user role). Conversations as a method for eliciting user preferences have the advantage that they provide control over the process to the user, incorporate intelligence that make easier for the user to specify his requirements in an iterative way and also may provide feedback about the progress of the process [22, 19]. Moreover, the Interface Agent is responsible to convey advice generated from the Advisor Agent to the user. In order to perform these tasks the Interface Agent accesses Data and Models. There are several issues to be taken into account in the design of the Interface Agent as far as presentation and interaction are concerned. First, it must be ensured that the look-and-feel of the advice will be aesthetically appealing and functional. Interaction design should meet requirements posed by the intent of the advice (e.g. influencing timing of the advice) as well as regarding the desired level of intrusiveness [22].

The **Information** Agent is responsible to gather information from the environment and store it in the Data and Models compartment. The Information Agent is invoked by the Advisor Agent to retrieve necessary data for decision support from an information source specified in the knowledge base. For example, it may access the Data Warehouse of the e-Hub to capture past transactions of a specific buyer after a command from the advisor agent, in the course of providing decision support to a seller.

The **Task Agent** is responsible for the execution of a user decision, e.g. to enforce a specific pricing policy after a relevant decision made by the seller in the context of the previous scenario.

Last but not least, **the Advisor Agent** which is the core of the decision support system. The Advisor Agent dynamically influences the decision making process of the user by assuming three different roles: Proposer, Proponent and Opponent. These roles are based on the scientific community metaphor introduced by Kornfeld and Hewitt [23] in machine problem solving. The proposers suggest solutions to the problem, e.g. specific product recommendations, the opponents criticize the proposed solutions while the proponents defend, explain and extend the proposed solutions. In the proposer role, the Advisor Agent provides suggestions for the decision making process according to: condition-action rules pertaining to the Domain Model and its respective task hierarchy, case based reasoning based on similarity analysis of cases stored in the Domain Model. In the opponent role, the Advisor Agent critiques the suggestions of the proposer or the actions of the user based on his/her preferences, objectives and constraints. In the same manner, in the proponent role the Advisor Agent provides positive feedback stressing the strengths of the suggestions of the proposer or the actions of the user.

This architecture incorporates agents that may:

- support each of the phases of Simon's model (Information Agent, Advisor Agent),
- provide positive and negative critique to the actions of the user allowing him/her to reformulate the problem,
- situate the DSS within the problem environment (Information Agent, Task Agent),
- employ novel methods of human computer interaction (Interface Agent).

On the other hand, it encompasses knowledge structures that may:

- support taxonomical transcendence of the electronic marketplace (Domain Models),
- support evaluation and comparison of alternatives according to both classical and behavioral theory (User Model).

6 Conclusions and Further Research

The aim of this paper has been to propose a novel architecture for the creation of economically viable "liquid" e-hubs. We have argued that this can be accomplished through the ability of a "neutral" electronic marketplace to transcend other taxonomical classification dimensions and, simultaneously, through the provision of flexible and "active" decision support that will enhance the satisfaction of buyers and sellers by assisting them in the course of their decision making processes.

We have introduced a generic agent-based e-marketplace architecture and expanded the product ontology as was introduced by Kontolemakis et al. in [4], by adding factors that support the DSS part of the proposed e-marketplace. We showed how this architecture transcends the proposed taxonomy of Kaplan and Mohanbir [2] and moved one step down by describing concepts and techniques for the design and implementation of decision support systems that operate in a flexible and proactive manner. We referred to certain principles of decision-making as presented in research literature; described how they can be employed in our context and proposed a simple and reusable agent-based architecture facilitating decision support in a "liquid" E-Hub capable of mutating from one taxonomy classification to another. Our future research will focus on the implementation of a prototype and its subsequent evaluation following the design research paradigm as described in [9].

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Rethinking e-Government Research: The 'ideology-artefact complex'

Elisabeth Davenport, Keith Horton
International Teledemocracy Centre & School of Computing
Napier University, Edinburgh EH10 5DT, UK.
email: e.davenport @ napier.ac.uk

Abstract. The authors present a framework for e-government research that draws heavily on Iacono and Kling's work on computerization movements. They build on this work by appropriating cognate studies of organizational informatics by Kling and his colleagues, and socio-technical research in the UK. From this blend, they derive a construct, the 'ideology-artefact complex'. Using empirical work (including recent case studies of their own), they indicate how this may inform e-government research. They discuss ways in which the construct may act as a bridge between two traditions of UK/European social informatics and US socio-technical research. They discuss a potential research agenda for computerization movements in e-government that focuses on three main problem areas: macro level social order, counter-movements and material realisation.

1 Introduction

The concept of computerization movements is powerful. It entails a long view and large scale approach to the study of technology while acknowledging that these are often based on cumulated micro studies; those who study computerization movements (CMs) can thus explore how observations of the local and specific intersect with de-contextualised high level versions of events. Those who work with the concept combine work on social movements with socio-technical analysis, exploring areas of interest to both traditions – such as political opportunities, mobilising structures and the framing process [1] that shape the work of technology at different levels of organisation. Kling and Iacono [2] liberate social movements from their earlier anchoring in grievance and resistance, and demonstrate that they may generate or initiate action where political (as distinct from market)

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circumstances and interests converge to create group advantage. Drawing on their own and their colleagues' earlier work of socio-technical analysis, they suggest that CMs communicate 'key ideological beliefs about the favourable links between computerization and a preferred social order which helps legitimate relatively high levels of computing investment for many potential adopters. These ideologies also set adopters' expectations about what they should use computing for and how they should organize access to it'[2].

Iacono and Kling's [3] formulation of CM resonates strongly with work undertaken in the UK by Williams and his colleagues [4] [5], which shares the long view perspective and builds on concepts such as 'social choices', 'social learning', 'technology trajectories', and the 'technology complex' that reflect the concerns of social informatics researchers. [5] We have discussed elsewhere [6] similarities and differences between socio-technical approaches in the UK, and signature concepts[17] developed by Kling for social informatics have been addressed in a recent paper. [6] The CM tradition within Social Informatics, however, is hardly recognised in the UK: a recent paper by Munir and Jones [7] reviews a number of historically oriented 'social' approaches to studying information systems and implementation; the authors suggest that no work has been done linking social movements and technology studies.

As UK researchers aware of US, UK and European traditions of socio-technical research, we are surprised by European reticence about CM, an idea that has immense syncretic and interpretive power. In the text that follows, we try to establish where CM research may enhance lines of work with which we are familiar in UK/European tradition. We address two core concepts in CM (ideology and artefact), discuss their implications for inquiry at different levels, reflect on how they are related to cognate ideas in other research traditions, and, taking e-government as an instance of a computerization movement, draw on recent experiences (our own and those of colleagues) with empirical research in this area to construct a preliminary CM research agenda for this domain.

2 Two Core Concepts: Ideology and Artefact

We argue that the concept of ideology and the concept of the artefact, and the relations between them lie at the heart of CMs, and, indeed, that they distinguish this type of movement from scientific movements (artefact and theory) or design movements (artefact and use). What kind of ideologies attract what kinds of artefacts? What kinds of ideologies produce what kinds of artefacts? In the context of CMs, ideologies are always complex (they must meet the demands of many interest groups), though what is made explicit often masks complexity. In e-government, for example, in the UK, the rhetoric of 'modernising' government is

[17] 'Five big ideas' – multiple points of view; social choices; the production lattice; socio-technical interaction networks; institutional regimes of truth.

preferred to 'privatising', or 'totalising' though the former entails an ambitious programme of outsourcing and integration that has boosted indigenous computer, consultancy and software industries, and supports high resolution profiling of citizens. Ideology mobilises resources, and shapes technology in many different ways. Current mainstream approaches to design and implementation, sustain the efficiency myth by employing standardised protocols (such as project planning templates) that smooth the lumpy texture of social life, leaving little or no room for the negotiation and adjustments that collaboration inevitably requires. [8] Many post-installation studies of technology describe 'organisational culture' as a barrier to the realisation of the benefits that technology brings. Culture is made a scapegoat, as are, thereby, the vagaries of local practice, the workarounds and tweaks that characterise technology in use, and that constitute a form of ongoing validation and development. This elision of the social is consolidated in norms for evaluation within project planning protocols, as these are rigorously constrained to address the validation of pre-scribed functions and features. Emergent and contingent localised behaviour is thus construed as problematic – the phenomenon of the 'problematization of the user', explored in depth by Lamb and Kling [9].

The power of project proposals (industrial and academic) often lies in their presentation of broad sweeping visions that are inherently untestable. The small print deals with details of formal specifications that must be realised as rules and actions with material effects. Kling [10] characterises such aspirational visions as 'utopian', and contrasts them with their often sorry effects ('dystopian') in terms of the degradation of work practice and work environments. We suggest an additional take on the term 'utopian'. It means in Greek, no place ('outopia') not good place ('eutopia') ('ou'= 'not'; 'eu' = 'goodly'). A utopian technology is thus one that has no material realisation in a place or locality: what is described in plans, contracts, formalisms, specifications, the writings of enthusiasts, come into this category. From this perspective, implementation is, de facto, bound to disappoint, a point first explored in depth by Suchman [11] almost twenty years ago. In addition, the current trend in e-government (and organisational computing generally) is to assemble components designed and validated elsewhere – these exogenous assemblages have emergent effects that are not acknowledged in the utopian planning stages of implementation. Two lines of thought emerge from this: firstly, notions of place and location ('material realisation') have been under-theorised in CM research; secondly, that we find it useful to explore the gaps between utopianism and realism at a higher level of resolution than that taken by previous analysts.

The CM framework draws its strength by recognising that ideology and artefacts are tightly coupled; technology may be better understood if this articulation is de-constructed, to reveal the assemblages and alliances that have produced and sustain that technology. Iacono and Kling [3] suggest that this association may best be described in terms of a technology action frame (TAF), a rich construct developed from the earlier notion of a 'technology frame' [12] that accounts for sense-making among disparate actors faced with a common system. Artefacts that are the focus of a TAF vary in size and scope. Pollock and Williams [13] have recently started a project, for example, that explores a formalism (the standard software package); Elliott and Scacchi [14] have for some years examined the Free Software Movement (focused on a style of coding); analysts of large 'e-programmes' (e-government, e-science, e-learning) are concerned with suites or assemblages of artefacts that have broad scope and reach. Though they differ in terms of material presence or physicality, all of these embody social choices, choices that cannot be dislocated from what we will term the ideology-artefact complex. We briefly elaborate upon this term, before exploring the area of eGovernment, as, we argue, an instance of a CM.

3 The Ideology-Artefact Complex

Ideology and artefacts are linked by a sequence of intergroup interactions and transformations (what we label the 'ideology-artefact complex') which may be explored by means of socio-technical network analysis. For example, there are often considerable differences in point of view of different social actor groups such as vendors, managers, and front-line workers. These differing points of view will shape the ongoing configuration of the complex. The notion of the STIN (socio-technical interaction network) is important here. Lamb and Kling's [9] original formulation focused on interactions with installed artefacts; we suggest that this can be extended to interactions around the 'utopian' artefact in the procurement and early design stage – for example, which often involve vendor/management, and vendor/front-line worker interactions. Attention must be paid to a further set of artefacts – the entities that are assembled into compound artefacts – or configurational technologies [15] that are characteristic of current organisational habitats. These comply to a greater or lesser extent with proprietorial interests and involve a range of brokers or intermediaries. Fleck's explication of this 'technology complex' provides a comprehensive template for observation and analysis –it does not, however, address ideology at the macro level, focusing on micro level 'constituencies' or 'interest' groups.

The politics of formalisms and categories have been amply described by sociologists of technology (e.g. [16]), though little work has been done applying techniques for social network analysis (SNA) to unpick the alliances and diffusion paths that create installations out of ideological alignments. It may be noted, however, that recent research into social movements has featured a number of SNA studies. [17]

4 E-Government

Grönlund [18] introducing a recent edited volume, describes e-government in terms of 'changes in the internal government operations that come about as IT is used for automation, cooperation, integration… [the] current spark of interest in this field is most of all due to the fact that now also external operations are transformed as information and services become increasingly available on the Internet' ([18] p. 2). In a subsequent chapter he describes a 'general trend to re-structure government operations by means of deregulation, outsourcing and competition, the advent of a cheap unifying technology standard, and the increasing use of strategic IT tools such as Warehousing, Enterprise Resource Planning, Work Management Systems, Data Mining.' (p. 24). The phenomenon clearly instantiates a number of ideological biases identified in by Kling and Iacono [2] as characteristic of a CM.[18].

According to Grönlund, e-government emerged in the 1990s; he takes the establishment of the NII in 1993 as a starting point, and traces a trajectory in Europe through the Bangemann report, to the eEurope vision laid out in 2000 and beyond. A comprehensive review of this trajectory is provided by Van Basterlaer [19], who describes these programmes as examples of 'persistent technological utopia and determinism.' (p. 4) She continues, 'the political discourse...simplifies in an exaggerated way the social reality, neglecting many differences, and erasing most difficulties. The absence of references is a way of simplifying texts and discourses.' (p. 15) However, for Grönlund, a Swede, technology is clearly the driver of e-government.

In the UK, the e-government phenomenon is best explained in terms of a privatization movement that has evolved over almost twenty years, starting with the publication of a UK government report in 1986 paving the way for the privatisation of government data, and the establishment of an industry-government nexus that has continued to expand under different party-political administrations in the UK. In addition, an uncompromising deployment of e-commerce and business models and applications has produced a service ecology dedicated to improved efficiency and quality of service; this could as easily support private as it does public administration. E-government in the UK promotes itself as process-oriented and customer-focused, and, currently, offers little scope for the direct participation of citizens in service design.[19] At the hub of the system is the managed citizen ID, an as yet utopian artefact whose smooth trajectory across seamlessly integrated systems will allow benefits to flow to citizens wherever and whenever they require them. A number of timelines for the realisation of this vision have been proposed; Modernising Government, a key manifesto published by the UK Cabinet Office [20], suggested full implementation by 2008 – though the schedule has slipped.

This brief history can explain some features of e-government development in the UK that are, on first glance, perplexing. On 16 October, 2004, for example, in a not untypical feature, the Economist [21] reported on the latest initiative, the National Health Service National Project for IT (NPfIT)[20]: 'It is a familiar tale: the government announces an ambitious information technology (IT) project, awards contracts and sets deadlines. But then the costs start to rise and deadlines pass. The

[18] Computer based technologies (CBTs) contribute to a reformed world; the improvement of CBTs will reform society; no-one loses from computerization; more computing is better than less and there are no conceptual limits to the scope of appropriate computerization; perverse or undisciplined people are the main barriers to social reform through computing – the last statement is often reworked as the 'digital divide'.

[19] It thus goes against the recommendations of analysts such as Lenk [22] who suggests that e-government and e-business are different as the former emphasises law enforcement and the regulation of society rather than the delivery of public services to individuals.

[20] This scheme is due to absorb 4% of the health budget by 2008

project is eventually completed years late, way over budget, and fails to deliver the promised benefits – or is scrapped altogether.' The week before, a respected technology correspondent [23] described the same project as an example 'RFS', or repeated failure syndrome ('we never seem to learn from the persistent trail of expensive disasters'), summarised in the Economist article as 'previous fiascos (air-traffic control, benefit cards, the Passport Office, the Child Support Agency)...' The bulk of these have involved a small coterie of large commercial firms – EDS, Capita, Syntegra, for example – who are repeatedly rewarded contracts even after formal 'correction' in the form of fines. We suggest that this behaviour is not as irrational as at first appears, if we assume that quality of service is a collateral objective, and that a privatisation ideology has a higher priority[21].

5 The Ideology-Artefact Complex and eGovernment Practice

Europe is a peculiarly appropriate field site for work on e-government as a computerization movement, as policy directives, legal compliance and technology installation are interlinked across different levels of administration; a researcher can thus follow the thread from a high level utopian policy (the 'Information Society') to a local implementation in a municipality. In the past few years the authors have been involved in a number of studies of e-government at different levels (e.g. several transnational European projects, a quality assurance agency, a social work rapid response team, a group of lawyers complying with EU standards for legal practice), drawing on a number of research bases. An early inspiration was Kling and Scaachi's 'Web of computing' (described as a 'crude framework' (!) in [2]), which allowed us to move across a range of social orders and understand pre-implementation configuration of resources and post-implementation unintended consequences of computerization in a number of contexts.

The process of collaboration on large trans-institutional projects for e-government is, in itself, a rich source of data on the interplay of mobilization of resources, opportunism and ideologies. As we note above, the structure of project proposals (as is the case in other funded research environments) is articulated in standard documentation (an online project management template) that requires proposers to place their work in the dominant rhetorical/ideological frame, and to describe the achievement of their goals in terms of prevailing workflow models. Each European project requires a mix of industry and academic partners, and, over time, networks or cliques have evolved who have learned to exploit the various preparation meetings with EC officials effectively and to co-develop compelling proposals. As Grönlund [24] has observed, EC projects tend to focus on products in the interests of portability across national boundaries, and the industry/vendor nexus is thus a powerful one in any collaborative negotiations.

[21] A further analysis may explain the relationship as a from of tacit public subsidy, unmentionable as nationalized industries are not held to be politically correct.

The outcomes of projects (artefacts) fail to realise the aspirations that are outlined in the proposal stage. Though dissemination plans are an obligatory part of proposal writing, it is rare that products emerge that are ready for any market. The important thing is the relational process that consolidates and extends ideology by bringing bright academics into the industry church, and supporting the formation of macro-level socio-technical capital [25] across projects between industry, government (the funders) and academe. This triadic formation (recognised as a major lever of science [26], deserves attention from CM researchers.

One means of understanding the work of such formations is in terms of interest and practice communities. We have described both organizational communities of practice in this context (that shape technology at work) and communities of interest that shape pre-implementation policy-making and decision-making [27]. The discourse of organizational communities defines a common agenda, but may also be a source of competitive strength where social capital or social network effects come into play. The messages from an interest group within the organization have more weight if they resonate with those of more powerful external allies (c.f. Kling and Iacono). Many large corporate contracts in e-government are awarded not on the basis of requirements analysis, but on the basis of industry ecology (a phenomenon that has been charted elsewhere [e.g. 28]).[22]

The distinction between the two types ('interest' and 'practice') of community can be elaborated using the 'ideology-artefact' axis that we describe above. The ideology of (or discourse that defines) an 'interest' community will tend to simplify the issues involved in systems implementation, and downplay risk by emphasizing the track record of those who share the rhetoric. This discourse is what the public (or external audience) will hear. The discourse of a 'practice' community, will, in contrast, focus on the artifact, the difficulties of implementation, and on ways of working around infeasible features, and of informal education in these processes for newcomers to a workplace. This process is well analyzed in studies of 'articulation' or 'invisible' work [30, 31]; the audience for this discourse is internal, though containment may be leaky, as apologetic 'officers' may share the 'work-around' with clients.

Our plotting of this dissonance between interest and practice groups resonates strongly with a number of observations of ideological complexities by Kling and Iacono [2]. They point out, for example, in one study of an urban information system ('Riverville') that the system's 'primary value was in enhancing the welfare agencies' image when they dealt with Federal funders and auditors' though local administrators 'gained substantial advantage by keeping the story of its administrative value alive even when they could not realise those dreams'. They [3] further observe that 'When new understandings become part of local discourse they often remain local, rather than being widely circulated across other organisations and social settings...It is for this reason that public discourse about new technologies and

[22] Parallel work has been undertaken in Denmark, by [29], whose ten –year study of the implementaton of traffic policy in the city of Aalborg is a good example of the approach advocated here.

the technological frames embedded in them can remain relatively stable and misrepresent actual practice for long periods of time' (p.6).

The ecology of communities of interest is partly shaped by social network effects. This means that there are likely to be a few very strong players (e.g. The EC, or the UK Government) who have links to most of the networks in the relevant field. This elitism is manifest in the small and oligopolistic market that has developed for e-government service implementation, where repeated contracts are awarded to large corporate developers whose previous contracts have not been delivered to budget, on time or to a performance standard that satisfies agreed criteria.[23] The 'winning' discourse among competing rhetorics of interest will draw its strength by association with proven players, who can offer 'integrated off-the-shelf solutions' in the form of implementation plus training and economies of scale undercut the costs of those involved in detailed local user requirement analysis.[24]

6 Conclusion

As e-government researchers, working within the social informatics domain, we believe that a research programme underpinned by the concept of computerization movements may enlarge our understanding in a number of ways. Firstly, it would integrate and consolidate a body of existing work and allow that work to be re-considered more coherently under the 'long view' perspective. The accumulation of micro studies may reveal long term patterns of interaction among interest groups and lines of ideological development[32]. Secondly, such a programme can add to what has been achieved by addressing areas that have been under-explored or overlooked. There are a number of candidate areas, and we have selected three examples for discussion below: links across the social order; counter-movements; and 'material realisation'.

Kling and Iacono [2] conclude their paper by pointing out that we still have to assemble 'a credible composite historical portrait of the links between computerization and the larger social order', a task which remains undone. Though they scope out the population for such a project, we need to find appropriate focal areas. While links can be made between e-government and shifts in the larger social order (such as remote working, or the creation of an underclass 'the digital divide') these can be explained in terms of CM other than e-government such as e-learning, or the mobilisation of the workforce [33]. We have identified at least possible lines of work. The first is to explore the new instruments of government. A case in point is the attempt to establish ID cards in the UK, for example, justified on the grounds of

[23] Under European Union procurement rules, past performance cannot be considered when awarding public sector contracts.

[24] User requirements analysis is an atavistic presence, however, in most of the approved methodologies for e-government systems development and design (it is, for example, a staple component of UK public sector (i.e. PRINCE) and EC 5th and 6th Framework projects).

protection against terrorism. The ID technology is what may be described as a 'technology-in-waiting' [34], with previous attempts to introduce such a thing having been repulsed, its opportunity may have arisen owing to the seizing of political opportunity and strategic framing. A second line of work is a longitudinal study of 'valence issues' ([1], p. 309) in government. An example (pertinent in the UK) is accountability in a system where technology supports work that is composite and distributed across private contractors. The complex population of brokers and intermediaries described in an earlier section above as bridges between ideology and artefact has resulted in an attenuated civil service whose values are primarily managerial. Links between organisational configurations of technology (the assemblage of components produced elsewhere) and the rise of this working group have not been fully explored by researchers.

A second item that we suggest should be a part of a CM agenda, is the emergence of counter-movements, which is closely linked to points raised in the previous section. Government evolves continuously through programmes of legislation that address (more or less rapidly) contingencies. Counter-movements are not explicitly acknowledged within CM work that we have seen to date, although we do see them discussed (if not labelled as such) in other areas of institution oriented research [e.g. 35]. Legislation to establish e-government to date corroborates the (somewhat pessimistic) observations of Kling and Iacono [2]: 'The movement activists, the computer revolutionaries, are working hard to make a revolution with varying success. Their visions suggest a socially conservative revolution which will primarily advantage already powerful social interests ...it is far easier for us to criticize their visions than develop a sounder sociology of alternative futures.' Though there are candidates (counter movements such as consumer rights activism, privacy watchdogs) Kling and Iacono suggest that these specialized views do not add up to a coherent alternative humanistic vision for appropriate computerization. The Free Software Movement, held by many to be such an alternative [14] is an example that is pertinent to e-government, as the adoption of Linux in several European municipalities has been hailed as a move against private monopoly, but the diffusion pattern so far does not constitute a 'movement'. As it is easier for public authorities to tinker with their installed base than migrate, it may be that counter-moves, rather than counter movements are what we can observe. These may be made not at the level of overtly mobilised resources, but in the workarounds and post-implementation adjustments from which resistance may emerge. McCarthy [36] talks of 'The everyday life 'micromobilization', or structuring that is aimed not at movement mobilization but where mobilization may be generated' (p. 141).

In addition, we note above that the press persistently questions the validity of IT investment, and that this has political consequences. The National Audit Office in the UK (a 'guarantor' of governmental transparency and accountability) is now involved at the start of projects [21] – to check, as it were, the 'realism' of what is proposed. So there is some evidence that where political expediency dictates, government may self-correct.

A further possibility line of research that emerges from a CM framework is 'material realisation', an area somewhat neglected in the original formulation. Munir and Jones [7] observe that 'the material character of technology may be seen to give it an anomalous ontological status in the context of the social phenomena this theory [social movement theory] was developed to address.' A CM line of inquiry in this area needs to be wide in scope. It might cover, for example, the geography and time-lines of the e-government-industrial complex (meeting locations, industry nodes, trade fairs) – a micro-version of this is presented in Van Bastelaer [19]. New questions, such as 'where and when does e-government happen', can be asked that allow conflicting points of view to be explored. Ideologists (back-room) may give the answer 'in the system' to our sample question; artisans (front-line workers) may say 'in a number of different places where we negotiate what needs to be done with the support of technology'. By exposing the rationale behind such conflicting points of view, CM facilitates possible ways of managing synthesis.

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Looking into the future: scenarios for e-government in 2020

Melanie Bicking, Marijn Janssen and Maria A. Wimmer
Melanie Bicking and Maria A. Wimmer:
University of Koblenz-Landau, Institute for IS Research,
Research Group eGovernment
Universitaetsstr. 1, 56070 Koblenz, Germany
Tel: +49 261 287 2646, Fax: +49 261 287 100 2646
{bicking, wimmer}@uni-koblenz.de
WWW home page: http://www.uni-koblenz.de/FB4/Institutes/IWVI/AGVInf
Marijn Janssen:
School of Technology, Policy and Management,
Delft University of Technology
Jaffalaan 5, NL-2600 GA, Delft, The Netherlands
Tel. +31 15 278 1140/ Fax. +31 15 27 83741
m.f.w.h.a.janssen@tudelft.nl,
WWW home page: http://www.tbm.tudelft.nl/webstaf/marijnj/

Abstract. Scenario building is a technique to stimulate different perspectives and images on the future. This technique allows to better predict the evolution of a certain domain beyond short-term forecasting based on the scenarios developed. The EC co-funded project eGovRTD2020 aims to develop scenarios of e-government in 2020 and beyond. The vision is to transform the EC government landscape into a coherent community, which anticipates customer needs and leverages the potential of the diversity and innovativeness of public agencies. In this paper, we give an overview of the scenario building methodology and develop a first set of scenarios using trend analysis. Four scenarios are derived showing different futures on e-government in 2020. The scenarios contain different aspects of integration, decentralization and centralization of power and governmental departments, democratizing systems and the role of individualisms and collectivism in society. The scenarios were used as a starting point for a series of regional scenario building workshops carried out across Europe. In a next stage, the scenarios will feed into a roadmapping exercise for e-government research.

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1 Introduction

Today, governments everywhere in the world face the requirements the upcoming information society entails. Public agencies are more and more requested to interlink and collaborate in different fields. ICT is being used a) to provide citizens, companies and other customers of public administration access to information and services, and b) to support their own working processes within and among government agencies at distinct level of constitution and even beyond national borders. So, much effort in e-government research is focused on providing adequate methodologies and tools to modernize governments. Thereby, the need for a holistic - technology, processes, organization and humans integrating - view has been recognized 13.

Yet, how will governments evolve beyond the next five years – e.g. till 2020? What kind of activities will the public sector be responsible for in 2020? How will the work be carried out? What kind of technology will be in use in about 15 years? And which values will become important by that time? Within an EC co-funded project, eGovRTD2020 (http://www.egovrtd2020.org/), scenarios of the future governments in 2020 are currently being developed. These scenarios will provide images of the future governments, the society and the information technology in about 15 years from now. Based on these scenarios, research activities will be identified as necessary to reach wanted future scenarios and to avoid unwanted developments.

eGovRTD2020 is co-funded by the European Commission within the 6th FP of IST. Its overall aim is to identify and characterize the key research challenges, required constituency, and possible implementation models for holistic and dynamic governments in Europe and around the world in 2020 and beyond. The vision of eGovRTD2020 is to transform the EC government landscape into a coherent community, which anticipates customer needs and leverages the potential of the diversity and innovativeness of public agencies. These project objectives shall be reached by first developing future scenarios of e-government in 2020 thereby going beyond the traditional foresight studies that address the next couple of years. From there, a research roadmap shall be derived to streamline the activities towards the intended future. With the identification and recommendation of key research in the next future, eGovRTD2020 shall contribute to the development of an eGovernment research that helps the EC to become the world leading knowledge society.

This paper introduces the scenario building methodology and it presents the initial list of scenarios derived from the state of play using trend analysis. In the following section, we present the scenario building methodology. Thereafter, the main developments from the state of play are clustered into two key dimensions (uncertainty and impact) resulting in four different scenarios. We conclude with a discussion of the limitations of these findings and introduce the subsequent research steps within the project.

2 Scenario building methodology

2.1 Background

Recently, scenario building has been recognized as a technique to predict and shape the innovation process. It is a technique to stimulate different perspectives or images on the future of a certain area in order to allow better predictions for evolution. There are many different methods of scenario development (see e.g. 2, 7, 9, 11).

Scenario building methodologies received a significant boost when organizations, such as the Shell and the RAND Corporation, turned the simple 'what if' exercises performed by national armies into fully-fledged future research methods 11. Gibson 6 found that in the 1960s and 1970s a general sense of certainty existed about where we were going and how to get there. However, the lesson learned is that nobody can just drive to the future on cruise control. During the twentieth century, we witnessed a more down-to-earth approach to look into the future. Consequently, the scenario method became more mature (e.g. 9, 11).

In general, scenarios are an integral description of various information aspects of a context in non-formal, narrative way 3. Scenarios are being used in distinct contexts, and with different purposes, form, content and lifecycle. A discussion over various scenario usage contexts can be found in 12. In our context of predicting the future beyond short-term forecasts, scenarios depict different - sometimes contradictory or paradoxical - perspectives or images on the future [8]. They are used to sketch an uncharted landscape of the future. Handy [8] argues that only if we understand these different, contradictory and paradoxical perspectives or images on the future we will eventually be able to find roadmaps to deal with desired and unwanted outcomes. Based on the insights from visionary views, concerted and focused actions can be derived to positively or negatively impact future developments.

To develop valuable future scenarios, a scenario development process and a supportive framework for the scenario description are prerequisites. These are introduced in this paper.

2.2 eGovRTD2020 scenario development process

In the eGovRTD2020 project, the following procedure is used to derive scenarios and to integrate the results:

1. *Trend analysis*. Developments were identified in the state of play report 5. Based on that, an initial set of scenarios was derived. These scenarios provided the starting point for conducting a number of regional workshops;
2. *Regional scenario workshops*. Expertise, political visions and circumstances vary among countries. To capture typical elements and to ensure diversity, a number of regional workshops are being conducted (several in Europe, one in North-America) to produce a diverse set of scenarios;
3. *Validation workshop*. The set of scenarios is validated and grouped into clusters of developments, and visionary sketches. The result is a consolidated set of

views on the future e-governments in 2020. These consolidated scenarios provide the input to develop the research roadmap in a later stage.

The paper at hand presents the findings of the phase one – a first list of scenarios derived from the state of play by conducting a trend analysis – and the methodology for the workshops in phase two.

It is important to note that scenario building does not pretend to fully predict the future. The technique facilitates the development of images of the unpredictable future by identifying complementary and/or contrasting alternatives. In our context, a scenario describes a coherent set of visions and archetypal images on a possible future. Scenarios are neutral: they are neither good nor bad futures. Consensus about developments or visions is neither necessary nor wanted. Scenarios may differ one from the other: even extreme opposite scenarios can – and should – be developed. In case of extremely opposing ideas or contradicting visions, scenario axes should be determined to bring the extremes into relation.

2.3 eGovRTD2020 scenarios based on trend analysis – exercise one

The scenarios developed in phase one concern only the next couple of years, as these are derived based on extrapolation of current developments. This approach is called *trend analysis*. A trend has already started and can therefore be identified 11. The scenarios derived thereby investigate the type(s) of future(s) to which these trends may lead. We stress that these scenarios do not reach out till 2020. Even scenarios that may reach out till 2020 are not completely independent: They are biased and might not even capture the future, since every expert participating in such scenario building exercises reflects on his or her past and current knowledge of actual developments and from there extrapolates his or her view on potential futures. When building scenarios, one must be aware of the fact that this implicit bias can never be turned off fully. However, it is important that during the scenario building exercises the environment is relieved and neutralized from past and current states that could then be just projected to the future.

The trend analysis was conducted by performing the following five steps:

1. *Identify the main developments.* This step is characterized by divergent thinking, where developments are not necessarily in concert with the truthfulness, coherence or verifiability. The developments are derived from the state of play conducted in the first phase of the project 1, 5;
2. *Classify the developments.* This step concerns the clustering of the developments using an uncertainty-impact matrix. Those developments likely to result in different scenarios are being identified. In this trend analysis, we aimed at having two variables in order to get a maximum of four scenarios: uncertainty and impact. This step is characterized by convergence and attempts to reveal the variables resulting in contradictory scenarios. We are aware of the fact that the scenarios from the regional workshops will lead to a multidimensional set we will have to cope with (these will be available in deliverable D 2.1 5);
3. *Organize developments.* The developments classified as having a high uncertainty and high impact are clustered into a limited number of key topics.

These key topics are the variables of the scenarios. Similar kinds of developments are clustered to one same topic;
4. *Derive concerted scenarios*. The variables, or key topics, result in a number of scenarios. For the sake of clarity we developed 2*2 scenarios according to the uncertainty-impact matrix. Each scenario is given a typical, easy-to-recognize, and understandable name and the main characteristics for each scenario are added.
5. *Develop scenario stories*. The last step aims at enabling communication of the scenarios to non-involved and non-experts. An easy to read and understandable sketch or story is made of each scenario.

These steps were taken to derive the scenarios described in the next chapter.

2.4 The eGovRTD2020 scenario description framework

Scenarios shall help to imagine the future of e-government in 2020. Since the future is all encompassing, a structured framework was needed. Dym et al. 4 state that the researchers' creativity extends in ways of systematically asking, presenting and viewing elements and developing domain taxonomies as the process unfolds. The lower-level elements relate to the phenomenon under study and attribute to the deeper understanding of the phenomenon itself. For each element, multiple known and unknown alternative answers exist, regardless of being true or false. The elements intend both to disclose the alternative known answers and to generate the unknown possible ones. As such, the elements are characteristics of divergent thinking, where the elements attempt to diverge from single ideas towards a coherent vision that can be created from them.

In 13 and 14, Wimmer developed a holistic reference model for e-government capturing the main elements of e-government. Based on this model, a supportive instrument capturing the essential elements to guide the scenario description of the future was developed 1. It is aimed at guiding the scenario building process and it helps to discuss and develop the scenario(s) along the elements eGovRTD2020 wants to investigate the future of governments and society in their usage of ICT. This scenario description framework identifies four aspects of relevance: customers and contextual environment, governments, technologies, and economics. The eGovRTD2020 scenarios shall describe images of these aspects and their interactions. Consequently, the supportive scenario framework contains the following elements:

- Customers and contextual environment
  - Society - e.g.: How will the society look like? Which role will individuals and communities play? Which attitude will individuals, groups and the society have towards governments?
  - Political system and climate - e.g.: Which societal and democratic values will be important? Which governance value will be important? Which role will transparency, privacy, security, enforcement of laws, compliance to laws and constitution, political system, etc play?
  - Economical climate - e.g.: What employment will exist? Which types of labor will exist? Which age composition and labor force will exist? Which position / role will the country / the EC have in the world?

- Governments and their services
  - Government, administration, polices and law - e.g.: Which roles will governments perform? Which role will European, national and local level of governments play? What relationships will exist with citizens and business?
  - Kinds of services Governments will be providing and customers will be consuming – e.g.: What kind of services will governments provide in 2020?
  - Mode of participation of stakeholders in the democratic processes – e.g.: Which stakeholders will play a role? Who will participate and how? What impact and power of decision-making will certain types of stakeholders have?
  - Government Environment - e.g.: What roles and activities of interest groups will impact government activities? What role will NGOs and private parties play in government service provision and in participation in policy making?
- Technology developments
  - ICT available – e.g.: Which kind of technology will be used in 2020?
  - Interaction modes via ICT – e.g.: How will stakeholders be interacting with this technology in order to provide/consume public services and to participate in political processes?
  - Purpose of ICT usage in interacting with governments – e.g.: For which services and/or intentions of participation will the stakeholders use these technologies for interaction with governments in 2020?

The scenario template ensures that both, e-government aspects (endogenous) and the environment (exogenous) are taken into account. It is used to build the scenarios presented in the next chapter.

3 Building scenarios using trend analysis

3.1 Identifying the main developments

To investigate the state of play in eGovernment research, desk research was chosen. The various partners of eGovRTD2020 analyzed research initiatives, research activities, as well as research programs and strategies in their countries and neighborhoods 5. The analysis of relevant material was aimed at identifying current research programs and strategies for eGovernment in Europe and worldwide. Also, projects identifying eGovernment research trends were studied. The results are documented in the state of play report 5. The developments identified there are summarized in table 1.

3.2 Classifying the developments

For the purpose of deriving scenarios, those developments having a high uncertainty and high impact on the future have to be identified.

Table 1. Classification of developments

High impact	• Ageing of workforce and society • Importing skilled people • Centralizing agencies and sharing services • Web 2.0; Web logs, Wikipedia and so on • Natural language processing and translation • Sensor technology • Use of only open source software • Use of simulation, animation and gaming in policy making • Integration of ICT-health sector • Distance therapy and medicare, and selling of drugs • Surveillance technologies to ensure security • Constant and sustainable monitoring and surveillance for law enforcement and crime mapping • Communication between social workers • Use of geographical information • Information accessibility for those who need massive amounts of archival and real-time information • Development of separate networks to deal with low Internet reliability, security and governance problems • Use of legal systems for automatic jurisdiction	• Individualizing of the society • One citizen super file, privacy and information availability for prevention of crime and terrorism • Convergence of nanotechnology, cognitive science and ICT • Privatization of social systems and health care • Integral approach towards IT governmental projects • Globally regions grow more and more together which will lead to new governmental structures and cooperation across borders and wider landscapes • Slow adoption of legislation to facilitate newest e-government opportunities • Software developments coordinated at central level • Government functions and roles performed by private sector (security, health, insurance) • Customization and standardization of service provisioning • Cooperation among member states • Harmonization of policies and rules and standardization of security and tax systems • Industry activity will decrease in certain geographical regions • Use of knowledge and divide in high and low skilled and rich and poor • Social exclusion of skilled, non-skilled, rich and poor; and disabled people
Low	• Understanding user needs and developing a user centric eGovernment approach • Semantic interoperability of systems • One-stop shop • Broadband adoption • Integration data, voice and video • An inclusive information society by e-learning, lifelong learning, integration of work and learning, and development of public services considering limited skills of some user groups • Ambient intelligence • Infrastructure containing all kinds of services including security, privacy, authorization and payment • Availability of standards, data and process models • Proactive service delivery	• Use of private parties and public-private partnerships for service provisioning • Use of private parties as channel for service provision • Governmental agencies and private companies work together for ICT dissemination • Centralized citizens, health and criminal records • All government communication will be dealt with using the Internet • IT expenditure is increasing • Policy Participation tiredness • Government as director of IT efforts
	Low	High **uncertainty**

The rationale is that developments having a high uncertainty and high impact result in contradictory and alternative futures and thus feed into different scenarios. Developments having a high impact and low uncertainty result in one type of future. Developments having a low impact (independently of the level of uncertainty) do not influence the future. We mapped the developments derived in the state of play in a two-by-two matrix as depicted in table 1. The developments used to identify various scenarios are indicated with the grey cell.

3.3 Organizing developments

The developments depicted in the grey-colored cell of table 1 (high uncertainty and high impact) were clustered into categories to identify the main topics. The developments related to each other were merged into key topics having a high impact. The purpose of this step is to end up with only a limited number of principal variables, from which we would be able to derive general characterizations of the scenarios. The first key aspect we identified is whether the European countries are able to create a harmonized and unified Europe. In particular, the uncertainty comes from the difficulties in reforming public administration, coordination of ICT efforts and standardization and harmonization of policies and rules. The second key uncertainty refers to the role of humans in the society. This scenario is derived from societal developments such as the divide between low and high skilled, rich and poor, individualization and so on.

3.4 Deriving eGovRTD2020 scenarios based on trend analysis

The two key uncertainties just described are combined in order to create the four scenarios as depicted in figure 1. The vertical axis focuses on public responsibility on top, and on private responsibility on the bottom. The horizontal axis shows the ability to integrate on the left versus a regional focus on the right. In a fragmented Europe, a big gap exists between policy makers (politicians) and policy execution (public sector employees). In a liberal Europe, most responsibility is left to the persons. In a clustered Europe, several regions cooperate, and governments have a large public responsibility. In social Europe, one unified Europe will have a strong and well-developed social system. To complete the scenarios, the main characteristics for each scenario were identified and placed in figure 1.

The four scenarios represent internally consistent and plausible pictures of possible futures, and they provide contrasting alternatives of the future. The scenarios are different in each of the aspects of the scenario framework described in section 2.4, as societal values and the integration and arrangement of the political and administrative systems vary. As a result, it is likely that in each scenario the need for e-government research varies. However, it is also likely that certain e-government research is needed in all scenarios likewise. The roadmapping activity of the eGovRTD2020 project will elaborate the certain needs of research in eGovernment for the various scenarios.

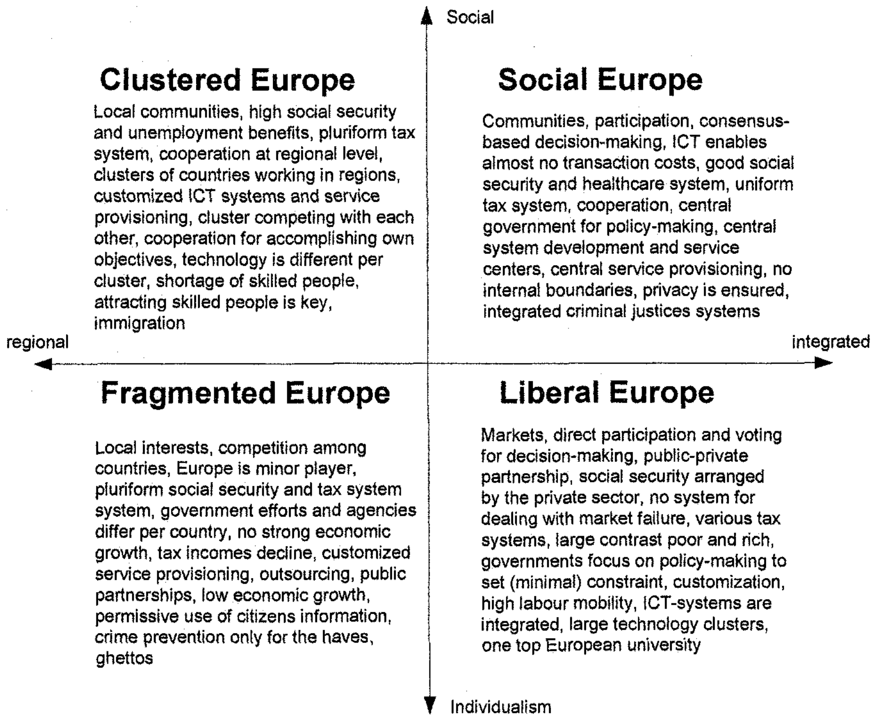

Fig. 1. Four scenarios based on political and societal dimensions

3.5 Developing scenario stories

The development of scenario stories completes the trend analysis and is being used as input for the scenario building workshops. Without stories, scenarios are difficult to communicate and understand by people who were not involved in the process and/or who are not expert. Scenario stories are difficult to develop as a scenario story should contain enough information to describe the essential elements of the possible future and should be short enough to enable communication and understanding without constraining people's mind. In a scenario, it is not always possible to unequivocally select developments that are consistent with the characterization in the sketches. In our research, the following four stories were derived:

1. Social Europe: In a social Europe, harmonization has succeeded, national sovereignty is limited and we have one integrated public administration taking responsibility for its citizens. A well-developed social welfare, security and healthcare are ensured by governments, the *good big brother*. Transaction costs are close to zero. One large super file exists for each citizen, which is used for prevention from crime and terrorism. Solidarity with the most vulnerable groups is maintained. System development and public service provisioning is centralized in large data centers and interoperability and standardization has succeeded. Local

governments focus primarily on citizens' participation and customization to the local situation.
2. Liberal Europe: The public sector retreats and leaves it up to the market to provide security services, unemployment benefits, healthcare and so on. European governments concentrate on their core tasks, provide only pure public services and set policies for privacy, insurance and so on. Large technology clusters exist and European top universities are created researching particular topics such as nanotechnology. Citizens are not inclined to participate in policy-making and take care of their own welfare. Democracy is synonymous with voting. The negative side of the coin is that governments fail in adequately dealing with market failures, and especially disabled can hardly participate in society, i.e. a big digital divide exists.
3. Clustered Europe: This scenario combines public responsibility with little cooperation among regions. Autonomous countries cooperate in clusters having similar objectives. The main objective of cooperation is to gain efficiency benefits, and cooperation is primarily for accomplishing their own selfish objectives, innovation is fragmented and investments in ICT have a local nature. The labyrinth of policies, organizations and information systems are able to communicate with each other to ensure public safety. There is a shortage of skilled people and a large divide between the skilled and non-skilled and also between rich and poor. Each geographical cluster focuses on different technology developments.
4. Fragmented Europe: Local interests dominate, hardly any harmonization and integration exist, and there is a pluriformity of social, security and healthcare systems. Most of the functions and roles are performed by private parties and public-private partnerships. Countries compete with each other, and have a limited degree of cooperation. Tax incomes decline under the competition among countries. Most countries are unsuccessful in modernizing their public administration. There is only a light degree of governmental intervention and permissive use of citizens' personal data exists. Crime prevention is only accessible for the rich. Ghettos strictly separate the haves and have not. Europe is a minor player in the world and economic growth is limited.

All four scenarios describe a coherent and consistent set of visions on a possible future of government and society in 2020. The future will be likely a combination of elements captured by each scenario. Research actions should be derived from these scenarios to make sure that the wanted aspects will come true and negative aspects will be avoided. For example, the big brother dimension of the social Europe scenario can be avoided by ensuring research and implementation of mechanisms to meet the requirements of ensuring privacy and of preventing the misuse of information for other purposes. Also mechanisms need to be developed to avoid copying and misuse of an entire system and its data by dictators like Saddam Hussein.

4 Conclusions

E-government is complex and multifaceted. Its future is difficult or even impossible to predict. Therefore, scenarios are used in the EU-co-funded specific support action eGovRTD2020 to capture contrasting perspectives on the future and to allow better development of a research roadmap. In this paper, we introduced the eGovRTD2020 methodology for deriving scenarios aimed at sketching possible futures of e-government in 2020.

Based on the methodology, first scenarios have been depicted using trend analysis. From the trends, two main categories of key uncertainties were identified, (1) the level of political and administrative integration and (2) the allocation of public or private responsibility in society. Based on these key uncertainties, four scenarios of potential futures were developed to contrast the variety in their key aspects.

Since the future cannot simply be viewed as a continuation of the past, regional workshops with experts from governments, ICT industry and research are being conducted to gather further scenarios. Though the scenarios presented in this paper are based on the extrapolation of developments, they are suitable for structuring and identifying relevant aspects and they provide the basis for the scenario workshops.

The next steps after the scenario building workshops are to conduct a gap analysis, i.e. to identify weaknesses, problems and needs of future research in order to reach wanted futures and to avoid unwanted ones. Based on these results, a sequence of roadmapping workshops will be carried out to develop a research plan for e-government paving the way for the future. The research roadmap shall guide strategic bodies to launch proper e-government research programs. In this way, key research challenges and the required constituency shall be identified and characterized, as well as possible implementation models for holistic and dynamic governments in 2020 and beyond shall be developed.

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Analyzing Strategic Gaps of Digital Divide Projects Based on the Balanced Scorecard

Chien-Chih Yu, Hsing-I Wang
Chien-Chih Yu and Hsing-I Wang:
Dept. of Management Information Systems
National ChengChi University, Taipei, Taiwan
ccyu@mis.nccu.edu.tw
Hsing-I Wang:
Dept. of Information Management, Overseas Chinese Institute of Technology, Taichung, Taiwan
hsing@ocit.edu.tw

Abstract. Academic researches, government reports, and international organization surveys have indicated that outcomes of many digital divide projects fail to accomplish their strategic goals, and so that more exertions of strategic management in the government project planning process are expected. In order to ensure the achievement of bridging digital divides, governments need to be aware of their absence and weakness in strategy formulation and implementation in addition to simply launching projects towards strategic visions and objectives. However, the literature shows little help for the governments to detect the shortcomings of their strategies and to identify gaps between strategic objectives and performance measures. The goal of this research is to propose generic strategic gaps models based on the balanced scorecard framework for identifying and analyzing the strategic gap situations. Both horizontal and vertical strategic gaps regarding project efforts for reducing digital divides will be determined and discussed. The proposed approach and analysis models are then applied to the case of Taiwan for demonstrating their feasibility and usefulness.

1 Introduction

Digital divide (DD) is the product under the fast development of information and communication technology (ICT) and the digitalized economy. The existence of DD

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may reflect the loss of digital opportunities, the existence of poverty, the lack of fundamental and information literacy, the shortage in medical care system, as well as the encounter of other social problems [1]. Research findings, government reports and surveys conducted by well-known international organizations have indicated that the outcomes of projects for reducing digital divides are inconvincible and more exertions of strategic management in the project planning process are expected [1,2,3,4]. From the theoretical view of decision making, any strategic gaps between the strategic goals and actual project outcomes should be redeemed. Apparently, governments need to be aware of their absence and weakness in strategy formulation and performance measurement activities beyond simply initiating programs to bridging digital divides. Unfortunately, the literature shows little help for governments to detect the shortcomings of their strategies and to identify gaps between strategic objectives and performance measures.

Recognizing the facts that the links between strategic objectives (SO) and actual performance of DD-related strategies are weak, governments need a strategic framework and performance measurement tools for guiding and supporting DD strategy formulation as well as performance measurement tasks. The balance scorecard (BSC) and the strategy map (SM) introduced by Kaplan and Norton have been considered as effective approaches to specify strategic objectives and to measure performances in the public sector [5,6]. However, both Chan (2004) and Griffiths (2003) pointed out in their researches that as a fairly new management tool, more studies on the role of the BSC in the strategic planning and performance measurement of government projects are needed [7,8].

In light of the aforementioned problems and the needs to reveal DD strategic gaps, this paper aims at proposing generic strategic gaps models based on the BSC framework for identifying and analyzing strategic gaps of DD projects. Both horizontal and vertical strategic gaps regarding project efforts for reducing digital divides will be determined and discussed. In the following sections, we first illustrate in section 2 why it is appropriate to incorporate the strategic gap analysis into the development of the BSC. In section 3, steps of locating DD strategic gaps are explained. In section 4, four generic models of DD strategic gaps are proposed. A case study that investigates the DD strategic gaps in Taiwan is described in section 5 to demonstrate how a nation could utilize the generic models to determine its DD strategic gaps. The final section contains concluding remarks and the direction of future studies.

2 The Strategic Gap Analysis, the BSC and the Strategy Map

Initially, a strategic gap is the measure of the inadequate fit between the organization and its external environment. Strategic gaps are generally derived from the gap analysis which depicts the imbalance situations between an organization's goals and capabilities, as well as threats and opportunities [9]. Strategies are determined in the strategic planning stage which focuses on setting objectives, allocating resources, generating alternatives, as well as evaluating effectiveness against constraints and threats in the organizational environment [9,10]. Any inadequate fit in strategies should be located in advance and bridged during the planning and assessment phases.

In 1980s, the traditional strategic gap analysis focused mainly on extrapolating the differences between the desired future position of the organization and its current position [11]. Among various approaches, the SWOT (strength, weakness, opportunity, threat) analysis is a frequently adopted tool in the process of strategy formulation. However, it is found that the SWOT analysis does not serve sufficiently in detecting or diagnosing the logical links and strategic gaps between strategies; and very few firms adopt the SWOT analysis in their later stages of planning and analysis [10]. The balanced scorecard has been indicated as probably the most adopted tool in strategic management discipline in the last decade [12]. The BSC has evolved to become a performance measurement and strategic management tool for translating strategies into actions. The BSC aims at providing the precise and balanced information about four interrelated organizational perspectives including financial, customer, internal process, as well as learning and growth respectively. Strategies, being the core elements of the BSC, are generally viewed as a set or series of activities that will lead the organization to its expected future positions [6]. In every BSC perspective, strategies are illustrated in terms of strategic objectives and a set of performance indicators that are responsible for measuring the accomplishment of these objectives. However, some previous research findings suggest that the BSC alone cannot form a holistic strategic management system, and there is a significant need to connect the BSC concept to other management tools or systems for enhancing the BSC capabilities [10,13].

Previous research works have also suggested the need of a mechanism to show the path from strategies to visions, and to show the network of the interrelationships among strategies [6,12]. The strategy map by all means stands as the best choice since it clarifies the bond of present and future positions of an organization by illustrating the cause-and-effect relationships between strategies [5]. On the other hand, the BSC complements the strategy map by providing the targets, initiatives, and measures to gauge success on the strategic objectives [6]. The BSC and the SM are therefore constructive tools for organizations to conduct strategic planning, control and diagnosis. Nevertheless, in the literature, the quintessence of the strategy map has been constantly overlooked.

After learning the importance of identifying strategic gaps during the process of strategy formulation, it is expected that the strategy map and the BSC may provide guidelines for efficiently and effectively conducting the strategic gap analysis. And in turn, the strategic gap analysis may help the BSC to link objectives with performances more closely and successfully. Therefore, for improving the weaknesses of separate existing technologies, we illustrate in this paper a first attempt to incorporate the strategic gap analysis with the strategy map based on the BSC framework to determine strategic gaps in the strategy formulation process.

3 Steps of Locating Strategic Gaps from the Strategy Map

The gap analysis based on the strategic map will basically adhere to the BSC framework. By organizing the BSC perspectives in a top-down manner, all identified strategies with strategic themes and strategic objectives within each perspective can be lined up horizontally. Under this arrangement, the strategic gap analyses can be performed both vertically (to examine the gaps between strategies across perspectives) and horizontally (to examine the gaps between strategies within each perspective) [14]. Determining strategic themes is the first major constituent of the BSC approach. There might be hundreds of strategies in relation to bridging digital divide; however, some of them may aim at the same purpose. Therefore, they can be rephrased by a few strategic themes that are simple and easy to understand [15]. Strategic objectives would then be listed to clarify the meaning and the purposes of a strategic theme. Furthermore, strategic objectives should be able to be translated into actual actions and the outcomes of these actions are measurable. The four steps to locate strategic gaps from the BSC-based strategy map are (1) identifying the strategic themes, (2) specifying the strategic objectives, (3) determining the horizontal gaps, and (4) determining the vertical gaps. In the first step, main strategies of a BSC perspective can be clarified through identifying three to five strategic themes [16]. The ideal strategic themes represent strategies that are critical to an organization to move toward its expected position. The current strategic themes, however, are the strategies the organization follows at present. In the second step, strategic objectives are extracted from the themes for specifying the intentions and expected gains to be derived from the strategies. Each strategic theme may imply more than one objective, meaning that it may need to take more than one action to successfully implement the strategies. Similarly, strategic objectives are separated into the ideal and the current ones. The ideal and the current strategic themes/objectives are all listed on one table for the convenience of horizontal comparisons. The third step is to review all the strategic themes (STs) and strategic objectives (SOs) so that the horizontal ST and SO gaps could be located. During the analysis, we could locate two types of horizontal ST gaps. If the integrity of current strategies can not efficiently lead an organization to its mission and vision or to reverse the inferior status, it implies the missing of some important strategic themes, then a TYPE I horizontal ST gap (HSTG-I) is marked. If a strategic theme is considered not clearly defined, a TYPE II horizontal ST gap (HSTG-II) should also be placed on the corresponding cell. For instance, if there is a TYPE I horizontal strategic theme gap in theme 2 of the perspective 2, HSTG-I-P2T2 is placed in the corresponding cell; otherwise, the current theme is accepted. If a strategic theme is proposed but some of its objectives are not clearly specified, and consequently, no actions can possibly be taken to accomplish these strategic objectives, then the corresponding horizontal SO gap (HSOG) is marked. The last step is to determine the vertical gaps that reveal the gaps between interrelated strategies across different perspectives. Before proceeding to the vertical strategic gaps analyses, two strategy maps should be constructed to demonstrate the logical links of the themes/objective across perspectives. Once a strategic theme/strategic objective is found not linked to the interrelated strategic themes/strategic objectives across different BSC perspectives, corresponding vertical strategic gaps are then marked. The vertical strategic gap shows that it would be difficult to streamline and connect strategy outcomes among perspectives. Accordingly, vertical gaps resulted from the broken links between strategic objectives in different perspectives will downgrade the effectiveness of the strategies.

Two types of vertical strategic theme gaps could be located as well. If a strategic theme in a perspective is found not linked to any strategic theme in the upper perspective, a path that could intensify the effects of this strategic theme and smooth the road to the vision is missing, this TYPE I gap is marked VSTG-I. It is then the government's responsibility to redeem the theme and initiate a new theme so that the broken link could be repaired. On the contrary, if a strategic theme is found not supported by any strategic theme from the lower level perspective, it may not get enough resources to continue the implementations of its action plans, a TYPE II gap is marked VSTG-II. It is important to note that once a ST gap is found, it indicates the need to add a new theme to the strategy map. The links to and from this new theme should be carefully established so that the logical path would not be broken again. In locating the vertical SO gaps, if the outcome of a strategic objective has too few or no effects on actions and/or outcomes of interrelated strategic objectives on the upper/lower level perspectives, then corresponding VSOGs are located.

4 The Generic Models for Determining the Strategic Gaps of DD

In this section, this research generates four generic models to pave the way for countries to locate and to determine the types of their own strategic gaps of DD. For measuring and evaluating DD, four dimensions selected include *ICT, Equal Opportunities, Information Society/E-Readiness* as well as *National Competitiveness* that were proved indispensable to measure and evaluate the status of DD [17]. By further incorporated the DD model with the BSC, a DD-BSC framework, containing four perspectives *Beneficiary, Governmental Functions and Process, Nation-Wide Learning and Growth,* and *Financial Perspective* respectively, is presented for guiding the strategy and performance management of DD [18]. In the initial stage, we first gathered critical strategies of reducing DD from countries that have been acknowledged by their efforts and performance on digital economy, ICT diffusion and information society readiness. These countries include Finland, Denmark, Sweden, United States and Japan. Strategies of South Korea were also referred for its strong attempt to convert DD into digital opportunities. In addition, DD related strategies suggested by well known international organizations (such as OECD, APEC, G8 and European Union) and famous research reports (such as Bridge.org, EIU, World Papers) were also collected. The strategies were then generalized and categorized. In the following, steps of determining the strategic gaps of DD are delineated in detail.

4.1 Determining the strategic themes and specifying strategic objectives.

Strategies collected from selected countries and organizations are compiled, and then generalized strategies are presented and grouped with associated strategic themes. Furthermore, strategic themes are mapped to the four BSC perspectives according to their characteristics. In summary, strategic themes that are in favor of people and the results of the actions are considered increasing the use of the ICTs, would be classified into the Beneficiary perspective. In the Governmental Functions and Processes, strategic themes should focus on improving the performance of government by means of the construction of e-government. In the Nation-Wide Learning and Growth perspective, the purposes as well as the functions of strategic themes are recognized focusing on fostering the formulation of knowledge economy and on improving overall capabilities. Finally, strategic themes categorized in the Financial perspective are grouped due to their main duties for supporting and controlling all activities in other BSC perspectives. As a result, there are six strategic themes in the Beneficiary perspective, namely infrastructure, user satisfaction, new technology, information literacy, policy & regulation, and partnership. In the Governmental Functions and Processes, three themes extracted are E-Strategies, service and E-leadership. In the Nation-Wide Learning and Growth perspective, themes are awareness, capabilities and knowledge innovation. Themes in the Financial perspective include capital, resources and budgeting. The strategic objectives are extracted based on the original intentions of the strategies. They are listed if clearly defined and received a common view across countries.

The ideal themes/objectives listed in table 1 are extracted from selected countries, they suggest a unified approach for reducing DD and show potential means for leveraging performance on national competitiveness. The current themes/objectives however, are specific to some countries. Table 1 actually contains two generic horizontal gap models, the HSTG on the left half and the HSOG on the right.

4.2 Determining horizontal and vertical gaps.

To locate and to determine the types of HSTG/HSOG for a specific nation, the government or users should first collect the current strategies of the nation and placed them into a proper theme of a perspective. Or, the government or users could name a new theme that is unique to the nation. Two HSTG and three HSOG examples are shown in table 1. For a specific nation, assume that the strategic theme "E-Leadership" in perspective 2 is missing, implying that the nation is possibly not able to present any strategy of moving toward "E-Leadership", then TYPE I horizontal gap (HSTG-I-P2T3) is located. Since the missing theme will cause the absence of clearly defined objectives in reengineering governmental process, the horizontal SO gap is also determined and labeled with HSOG-P2T3O1. The second example indicates that the associated strategies could not clearly show the meaning or the functions of "Information Literacy", a TYPE II ST gap (HSTG-II-P1T4) is located. Apparently the existence of HSTG-II-P1T4 will also cause a gap in the objective, and the gap is marked HSOG-P1T4O1.

Before analyzing vertical DD strategic gaps, both ST and SO strategy maps are composed. Two generic BSC-SM models for locating DD-related ST and SO gaps are shown in figure 1 and figure 2. After the vertical trace of the strategic themes in BSC-SM, we located two vertical ST gaps in figure 1 based on two facts: firstly, the links between strategic objectives and performance measures of DD-related government strategies are weak, and secondly, no guidelines as well as benchmark exist for directing the strategic planning process. Apparently two new themes, including "Performance Evaluation" and "Benchmarking" should be added to the

BSC-SM. The OECD suggests that "Performance Evaluation" is to be conducted by the government and its objective is to "Establish measuring and monitoring system". "Performance Evaluation" should be determined as having both the type I and II vertical ST gaps because it is a new theme, and the government should link it to the themes at the upper level perspective so that the path to the vision will not be broken. In addition, the government should also locate enough support from the lower level perspective to signify this new theme, and should provide baselines for conducting the performance evaluation. Besides, these baselines should be amended periodically to ensure the growth and improvement. Hence, "Benchmarking" is placed in the Nation-wide Learning and Growth perspective and determined as having both the TYPE I and II vertical ST gaps. The objectives of "Benchmarking" are "Establish guidelines and standard" and "Retain competitiveness and capabilities". Figure 2 also demonstrates a VSOG which indicates that the outcomes of the strategic objective "Cultivate outstanding manpower" are not strong or efficient enough to

Table 1. The generic model of DD-BSC horizontal strategic theme/strategic objectives gaps

Strategic theme		Strategic objectives	
Ideal	Current	Ideal	Current
		Beneficiary	
Infrastructure	Infrastructure	Foster ICT adoption Increase ICT usages	Foster ICT adoption Increase ICT usages
Users Satisfaction	User Satisfaction	Meet universal needs	Meet universal needs
New Technology	New Technology	Increase ICT usages	Increase ICT usages
Information Literacy	HSTG-II-P1T4	Improve users' literacy	HSOG-P1T4O1
Policy and regulation	Policy and regulation	Remove all barriers Amend outmoded regulations Build users' confidence	Remove all barriers Amend outmoded regulations Build users' confidence
Partnership	Partnership	Form alliance	Form alliance
		Governmental Functions and Processes	
E-Strategies	E-Strategies	Provide e-services	Provide e-services
Service-S	Service	Provide better qualities Improve government efficiency	Provide better qualities Improve government efficiency
E-leadership	HSTG-I-P2T3	Reengineer governmental process Cultivate outstanding manpower	HSOG-P2T3O1 Cultivate outstanding manpower
		Nation-wide Learning and Growth	

Awareness	Awareness	Analyze strength and weakness	Analyze strength and weakness
Capabilities	Capabilities	Upgrade R&D capabilities Improve users literacy	Upgrade R&D capabilities HSOG- P3T2O2
Knowledge Innovation	Knowledge Innovation	Encourage new patent Inspire new ideas	Encourage new patent Inspire new ideas
		Financial	
Capital	Capital	Allure foreign capital Establish incentive system Improve investment environment	Allure foreign capital Establish incentive system Improve investment environment
Resources	Resources	Integrate all resources	Integrate all resources
Budgeting	Budgeting	Control budget	Control budgeting

support other objectives in the Beneficiary perspective. The government should review the actions taken and make admissible corrections.

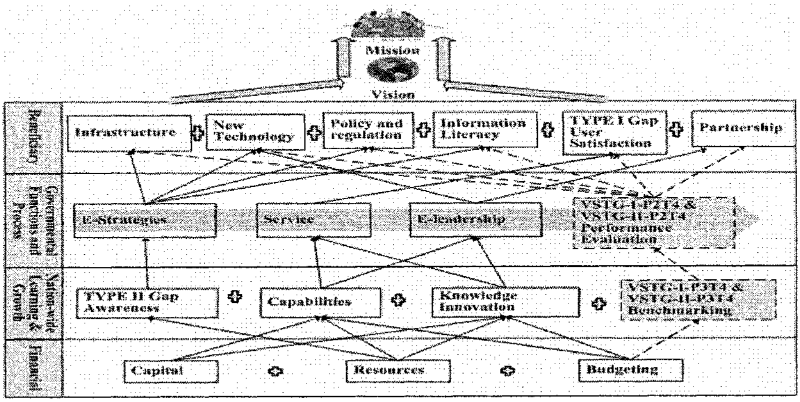

Fig. 1. The generic model of BSC-SM vertical strategic themes gaps

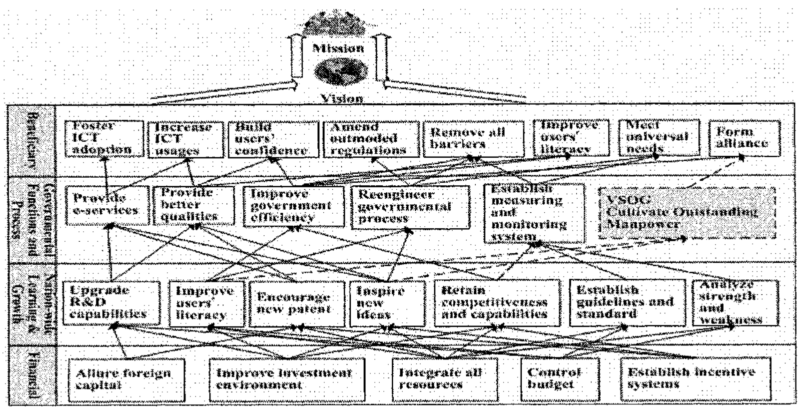

Fig. 2. The generic model of BSC-SM vertical strategic objectives gaps

5 Case Study – Analyze DD Strategic Gaps of Taiwan

In this section, we apply the four generic strategic gap models to Taiwan to demonstrate the utilization of the proposed models and approaches. Upon applying the generic models of strategic gaps to a specific nation, all the ideal themes and objectives listed in table 1, figure 1 and figure 2 are included to assure the completeness of the model. For extracting current strategic themes/objectives that are specific to Taiwan, we first gather strategies from all available resources including policies and strategies of various divisions in the central government, e-government white papers, resources on web pages of all levels of governments, the annual reports

Table 2. Horizontal DD strategic gaps of Taiwan

Perspective	Ideal ST	Current ST	Ideal SO	Current SO
Beneficiary	Infrastructure	Infrastructure	Foster ICT adoption	Foster ICT adoption
			Increase ICT usages	Increase ICT usages
	Users Satisfaction	HSTG-I-P1T2	Meet universal needs	HSOG-P1T2O1
	New Technology	New Technology	Increase ICT usages	Increase ICT usages
	Information Literacy	HSTG-II-P1T4	Improve users' literacy	HSOG-P1T4O1
	Policy and Regulation	Policy and regulation	Remove all barriers	Remove all barriers
			Amend outmoded regulations	Amend outmoded regulations
			Build users' confidence	HSOG--P1T5O3
Governmental Functions and Processes	Partnership	Partnership	Form alliance	HSOG-P1T6O1
	E-Strategies	E-Strategies	Provide e-services	Provide e-services
	Service	Service	Provide better qualities	Provide better qualities
			Improve government efficiency	HSOG-P2T3O2
	E-Leadership	HSTG-II-P2T3	Reengineer governmental process	HSOG-P2T3O1
			Cultivate outstanding manpower	Cultivate outstanding manpower
	Performance Evaluation	HSTG-I-P2T4	Establish measuring and monitoring system	HSOG-P2T4O1
Nation-wide Learning and Growth	Awareness	HSTG-I-P3T1	Analyze strength and weakness	HSOG-P3T1O1
	Capabilities	Capabilities	Upgrade R&D capabilities	Upgrade R&D capabilities
			Improve users' literacy	HSOG-P3T2O2
	Knowledge Innovation	Knowledge Creation	Encourage new patent	HSOG-P3T3O1
			Inspire new ideas	HSOG-P3T3O2
	Benchmarking	HSTG-I-P3T4	Retain competitiveness and capabilities	HSOG-P3T4O1
			Establish guidelines and standard	HSOG-P3T4O2
			✓ Establish distinguishing features	HSOG-P3T4O3
Financial	Capital	Capital	Allure foreign capital	Allure foreign capital
			Improve investment environment	Improve investment environment
	Resources	HSTG-II-P4T2	Integrate all resources	HSOG-P4T2O1
			✓ Promote cross-nation cooperation	HSOG-P4T2O2
	Budgeting	HSTG-II-P4T3	Control budget	HSOG- P4T3O1
			Establish incentive systems	Establish incentive systems

of the task force of digital divide, as well as the reports published by numerous DD-related seminars or colloquiums. After analyzing the strategic themes and strategic objectives of Taiwan, we have located four TYPE I and four TYPE II horizontal ST gaps, and seventeen HSOGs (as shown in table 2). In the table, "Users Satisfaction", "Performance Evaluation", "Awareness" and "Benchmarking" are indicated HSGT-I gaps due to that they are missing in the strategies collected. For "Information Literacy", "E-Leadership", "Resources" and "Budgeting", the meanings and the functions of these strategies are not clearly defined, and therefore HSTG-II gaps are placed. Taking "Information Literacy" as an example, the Ministry of the Interior and the Ministry of the Education are responsible for improving information literacy, however, according to the members in the task force of digital divide, the focuses of the related strategies are considered too narrow and the objectives focus mostly on improving the operations instead of solving problems. Therefore, HSTG-II-P1T4 and HSOG-P1T4O1 are placed in the corresponding cells. "Build users' confidence", "Form alliance", "Meet universal needs", "Improve government efficiency", "Reengineer governmental process", "Encourage new patent", "Inspire new ideas" and "Retain competitiveness and capabilities", "Establish measuring and monitoring system", "Analyze strength and weakness", "Establish guidelines and standard" as well as "Control budget" are marked the HSOGs due to the lack of explicit representation of relationships between themes and their objectives, and the lack of definite directions to accomplish the objectives. The objectives (with check mark) "Establish distinguishing features" and "Promote cross-nation cooperation" are important for Taiwan due to the geographical and economic situations, but the RDEC (Research, Development, and Evaluation Commission, Executive Yuan) report indicates the needs of more specified objectives and concrete actions. In addition, the results of "Integrating Resources", which are projects initiated by the Ministry of Transportation and Communications, are considered ineffective and the objectives need to be amended. Therefore, HSOGs are marked for these three strategic objectives. Although eight HSTGs are located in the case of Taiwan, no new theme has been added. The generic model of BSC-SM VSTG is transposed entirely to the case of Taiwan but no such gap is located.

Three VSOGs are determined as shown in figure 3. "Establish distinguishing features", "Promote cross-nation cooperation" are marked VSOGs for reminding the government of establishing logical links between Nation-wide Learning and Growth and Governmental Functions and Processes perspectives, as well as between Financial and Nation-wide Learning and Growth perspectives. "Integrate all resources" is marked a gap since the objective is not strong enough to support objectives in the upper level perspective.

6 Concluding Remarks and Future Studies

In this paper, four generic strategic gap models and steps for determining DD project-related strategic gaps based on the BSC and SM are proposed. Totally speaking, this research presents some important contributions in the following aspects: (1) delivering a guideline for understanding, conducting, and managing the strategy formulation process, (2) providing an adaptable method and procedure for locating horizontal and vertical strategic theme as well as strategic objective gaps, and (3) providing a generalized DD strategy framework for positioning a specific country and for comparing multiple countries regarding DD status and efforts. By adopting the proposed approach, the government will be able to comprehend weaknesses and shortcomings in strategy development via locating strategic gaps, and to go a step further by taking corrective actions. A case of Taiwan is used to test and validate the generic strategic gap models and the strategic gap analysis process. The result of the case study has proved the proposed BSC-SM based strategic gap analysis approach to be practically efficient and effective. In the future research works, more field experiments and validations will be conducted. In addition, gap analysis issues and methods focusing on determining gaps between strategic objectives, performance indicators, and actual outcomes will be further explored.

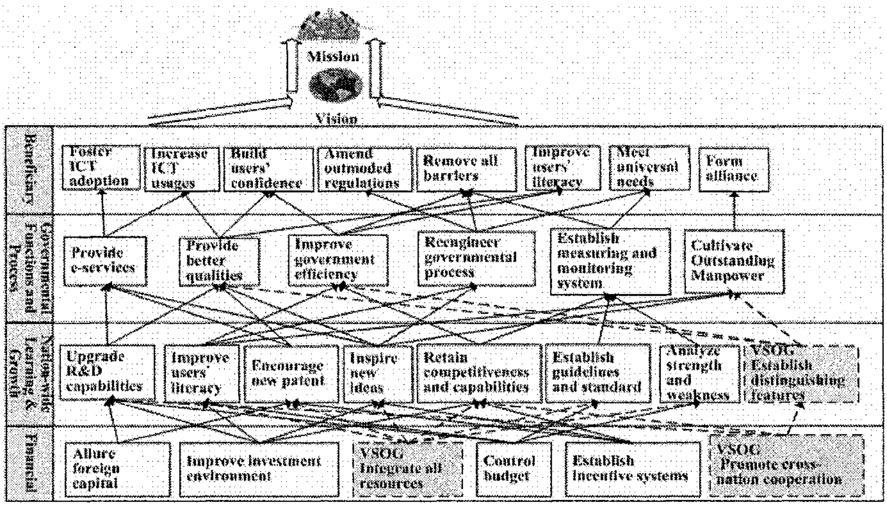

Fig. 3. The BSC-SM model of vertical strategic objectives gaps of Taiwan

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Development of the GEA within the G-to-G system of the Iranian e-government: Views, experiences, and visions

Behrouz Zarei, Hosseinn Sharifi
Behrouz Zarei
Management School, Tehran University, Gisha, Tehran, Iran
, Tel: +98 21 88003575 bzarei@ut.ac.ir
Hosseinn Sharifi:
University of Liverpool Management School, Chatham Building, University of Liverpool, PO Box 147, Liverpool L69 7ZH, UK, Tel.: 0044-151-7953622, Fax.: 0044-151-7953666,
sharifi@liv.ac.uk

Abstract. Acknowledging the necessity of utilizing the new electronics, information and communication technologies the movement toward implementation of e-government in Iran has recently received the attention of the authorities and policy makers. Achieving this end needs first providing a clear definition for e-government in Iran, to encompass its specific cultural, social and political characteristics, and also its actual and potential grounds for science and technology. It is argued that Government to Government (G-to-G) as a major part of the e- government consists of various components including the Government Electronic Administration (GEA) which will provide foundation required to monitor and support G-to-G system in particular and to enhance the capacity of government policy making in general. This paper addresses the efforts made toward development and implementation of Iran's GEA, the experiences gained, and the visions and views on its future developments.

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1 Introduction

Internet has changed the way organizations, communities, and individuals work, learn and interact. Governments regardless of their political systems realize the necessity and importance of modernization in order to meet requirements of global competitiveness. E-government is one of the alternatives for this modernization undertaken by many counties. It has attracted the attention of politicians, scientists, and statesmen of the world in the recent years and many countries have devoted considerable efforts and resources for its implementation (Hwang et al, 1999; Slaton & Becker, 2000; Wimmer 2002).

Academics have suggested various definitions for e-government. Whitson and Davis (2001) have defined e-government as "implementing cost-effective models for citizens, industry, federal employees, and other stakeholders to conduct business transactions online". Tapscott (1996) defined e-government as an ''inter-networked government'', and Nadler and Tushman (1997) emphasised that technology is only ''one of the structural materials''. Sprecher (2000) considers e-government as a technology to help simplify and automate transactions between governments and constituents, businesses, or other governments. Burn and Robins (2003) explain e-government as governments' efforts to provide citizens with the information and services they need, using a range of information and communication technologies. Luling (2001) defines e-government as ''online government services, that is, any interaction one might have with any government body or agency, using the Internet or the World Wide Web''. Taking a more comprehensive view, Aicholzer and Schmutzer (2000) saw ''e-government covering changes of governance in a twofold manner: (1) transformation of the business of governance, i.e. improving service quality delivery, reducing costs and renewing administrative processes; (2) transformation of governance itself, i.e. re-examining the functioning of democratic practices and processes''.

E-government can be classified from various aspects. For instance from the view point of delivered services, it can be divided to *delivering electronic services* to citizens and businesses with the aim of providing online services, *electronic democracy* with the aim of setting up the electronic polling, and *electronic administration* with the aim of providing support for policy and decision makers and facilitating team works with operational and experts levels. E-government may be divided into three major elements from the perspective of interactions between government, business, and citizens: Firstly, Government to Government communication (G-to-G), including agencies intercommunication, and communications between the governments. It also includes, as its sub-system, the Government Electronic Administration (GEA) for facilitating and supporting the process of policy making and administration for the country through application of information and communication technology (ICT). Secondly, Government agencies' communication with citizens (G-to-C) including government and all if its affiliated agencies communication with citizens in non-commercial (public) sector. Thirdly, Government agencies communication with Business sector (G-to-B).

Although, all these elements share many common aspects, they are different in terms of objectives and key issues. For instance, in G-to-B, issues such as electronic payment is of high importance while for citizens, availability and access to such communications for prevention of information gap is of more importance. In G-to-G, issues such as improvement of processes and quality of decisions are critical. However, issues such as security are particularly emphasized in all functions.

Despite so many efforts to clarify the e-government, various countries use this term to express different concepts. For example, USA employs this concept to facilitate easier access to government information and services via modern ICT technologies, and to improve the quality of services leading to public satisfaction (e-government strategy). China's definition follows the US, except for the promotion of democratic participation (Zhang, 2001). In New Zealand it is used as a means for automated communication inside the government and government to public, enabling citizens to receive needed information, establish interactive services, and to have cheap, easy and effective interactions with their representatives (Jenkins, 2002). Other countries have also interpreted this term differently, but it is recognized as a key strategy to attain competitive advantage in the twenty first century and a core means for reforming the governments. There is, however, a common theme among all these interpretations which is to set the orientation of all sectors of the society on a customer–based direction.

Hence, from a conceptual point of view, e-government can be considered as a major weapon for leaping to a new performance level (break through performance as opposed to incremental improvement), including reducing the operations cycle time, responding to impatient and hasty citizens in receiving quality, low cost and immediate services, and also satisfying the government staff who themselves suffer from the shortcomings of the current administration systems. Also e-government can be accounted as a tool for improving decision-making and a totally new way of thinking out of which change of processes, providing online services, and providing convenient services to citizens could be expected. It should be argued, thus, that only the use of new information technologies in inefficient organisations cannot be considered as e-government, since it has reverse effects by magnifying pitfalls and creating new and more problems.

The next section of the paper briefly discusses the history of G-to-G in Iran, followed by elaborating its concepts, requirements, and dimensions and how GEA has emerged. Section 4 then focuses on GEA benefits and services followed by introduction of main components of GEA and finally, reviews the implementation challenges in the Iranian environment.

2 Background of G-to-G system in Iran

Although, the concept of e-government is relatively new in the literature of Iranian administration and management, the application of information technology to enhance the efficiency of operations, and implementation of Executive Management Information Systems dates back to more than fifteen years ago. Some attempts in this regard can be highlighted as follows:

- 1984-5: Networking Information management system of the Prime Minister office with a few major organisations using mainframe systems.
- 1992: Replacing personal/mini computers with mainframe systems. Applications such as the Cabinet's meeting information system were set up.
- 1993: Developing information systems for monitoring national projects with high priority, controlling essential processes, and installation of the President's MIS.
- 1993-4: Conducting extensive information needs analysis for the government which led to the recognition of a private communication network, later called *Government Network.* As a result it was also concluded that government agencies lacked access to sufficient, timely, structured, and coherent information, and in some cases they tend to resist sharing their information.
- 1995: Implementation of IT-based solutions in the process of verification and decision-making on the proposals referred to the Cabinet. Also efforts were made to study and understand the applicability of decision models in the Cabinet's meetings, and also finding ways to change the passive attitude of the Cabinet in response to the proposals. As a result it was concluded that access to the information distributed in different agencies is vital to the government and the Cabinet.
- 1997: Installing an experimental private network with the prime goal of safe and quality communication between Ministries and the Cabinet.
- 2001: Communication between Ministers and Cabinet proved insufficient, and the need for extension to other levels of government, whose information was decisive for the cabinet, was identified. As the result, in 2001 the government network plan (now known as GEA) was initiated which is intended to play as the infrastructure of the Iranian G-to-G. The network having born out of a need, and not merely an imitation, is expected to enjoy a natural growth and keep its efficiency until the need is satisfied.

G-to-G system of Iran, originated from inside the government's administration area as its commencing point and heart, has been defined around three axes: *Needs*, *Problems*, and *Possibilities/Facilities*. Needs have played the most important role in the formation of the Iranian G-to-G. The Cabinet and the President office's needs for information produced in government agencies, from one side, and the agencies' real need for digitised information services at national, regional and international levels from the other side, are the most important factors justifying the G-to-G. In addition, problems such as inefficient management of operations, lengthy government decision processes and dissatisfied customers, and waste of scarce resources have been important factors leading to the realisation of the need for G-to-G. Also, available facilities, and managerial, cultural, and financial restrictions have been effective in shifting the idea of e-government into what is now presented as G-to-G and GEA.

3 Concepts, requirements, and dimensions of the Iranian G-to-G

The main objective of the G-to-G system is to digitize the internal operations and communications of the government organizations and staff. It endeavours to improve government performance quality through elimination of agencies' physical boundaries, information sharing, strengthening the organisations, reducing costs and expenses, and improving the effectiveness of the management systems. It also includes information flow within domestic organizations as well as communication with foreign governments. Therefore, conceptually, G-to-G is central ring of linking strategy, process, organization, and technology so as to provide effective procedures to perform timely operations, and make more information available easier. In other words, G-to-G can be defined as a way for fundamental transformation of government through providing timely services (NZ E-Commerce Strategy, 2000), and as a comprehensive model which can be used to reinvigorate the government's operations processes (Sprecher, 2000).

The G-to-G, as a tool for coordinating various sections of the government, was identified as the most significant element among other elements of the Iranian e-government. Main reasons supporting the choice of G-to-G are as follows:

Ineffectiveness of the government's body: Successful implementation of e-government requires effective coordination of the government with citizens and businesses through ICT applications. This, however, must be led by enhancing the efficiency and effectiveness of the government's administration system itself. Otherwise, the result will be further deterioration in the satisfaction of two other sectors. The significance of this point becomes more apparent considering the fact that Iranian government plays the central role in the initiation and implementation of major functions in Iran. Therefore, it will be essential to view the G-to-G system as the medium to renovate the government structure and improve its effectiveness.

Controllable nature of the government: Building up the e-government requires extensive integration of functions and activities which needs intense planning and control. The centralised nature of the Iranian government provides grounds for this purpose, while other two elements of the e-government are much less controllable.

Larger share of government in the national economy: The government owns and controls the major part of the national wealth and resources and, therefore, considerable improvements shall be expected from the development of the G-to-G system.

Dependence of other e-government elements (G-to-B/C) on G-to-G: Other elements of the e-government will fail in the absence of a well-organised and tuned G-to-G. In other words, the preparation of public and business sectors for joining and using the e-government will not lead to the expected results if the government is not prepared for this purpose.

Motivated organizations with low readiness: The penetration of the ICT culture in the country, and hence government agencies, has attracted the interest of government agencies to use IT solutions. This willingness can be considered as an opportunity. However, the risk associated with adopting this technology without careful plans could cause further inconsistency, redundancy, and waste of resources if not properly directed. For example, Finland experiences show that failing to observe this opportunity can impose extra expenses (E-Government Strategy). This issue is a strong reason for organizing these efforts in the G-to-G framework.

G-to-G and GEA being situated on the critical path of the e-government: The government status-quo seems to be vast and complex. For example, business processes of the government are massive in number and complicated in structure, with extensive interactions with other processes. Most of these processes are interdepartmental, many of which are rusty and out of form. Therefore, the development of G-to-G system will be a highly time consuming process, while it is expected to be much less in other elements of the e-government due to their smaller size and limited domains. This means that establishment of the Iranian e-government has to start from building the G-to-G system.

Alignment of the G-to-G with the government policy-making strategies: Success of recent government policies in reducing its realm of ownership and responsibility, and playing its logical role as the policy maker, entails strong tools and also effective means to ensure achieving the projected policies. Failure of traditional methods and approaches has widely been experienced in the past. It is clear that without access to accurate and timely information and in the absence of powerful control tools, achieving the government's goals would be somehow impossible. Establishment of the Iranian G-to-G system will play a key role in assisting the government to accomplish this task.

Creating competitive advantage for the country: In terms of international competition, achieving a sustainable competitive advantage in various political and economic dimensions requires a modern, flexible, efficient and effective government. Realisation of these characteristics is subject to the government's ability in rapid and accurate decision-making, and intelligent and sensible diplomacy at international level. The G-to-G system (and GEA in the centre) will contribute to this objective.

The position of GEA in connection with other elements of the e-government and also with its main users is shown in figure 1. On the left side of the figure, the interaction of G-to-G with other sections of an information community is demonstrated. The largest circle represents the national communication network. Within this network, e-government is situated in its broadest view which includes all interactions with business, citizens, and foreign governments. Within this section, is situated GEA as a component of G–to-G which targets the top administration of the country. Four main groups of GEA users are also shown on the right pyramid.

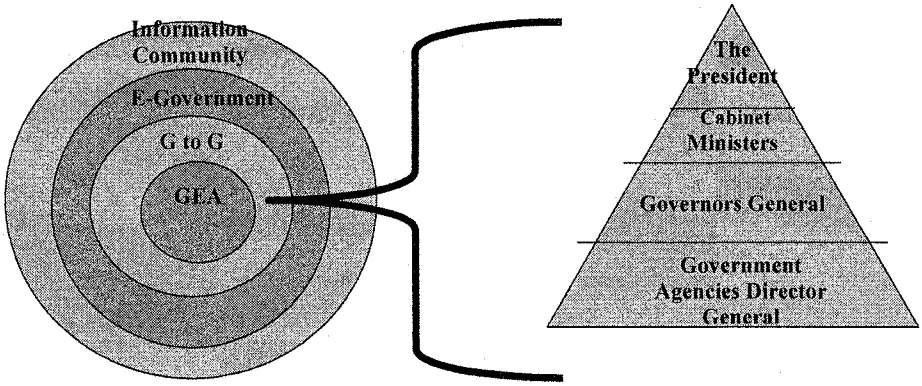

Fig. 1. Relation of G-to-G system with Information Community and e-government

It is worth explaining that GEA is the part of G-to-G which represents only the internal relationships and interactions of the government managerial body. A schematic of this concept is graphically shown in figure 2.

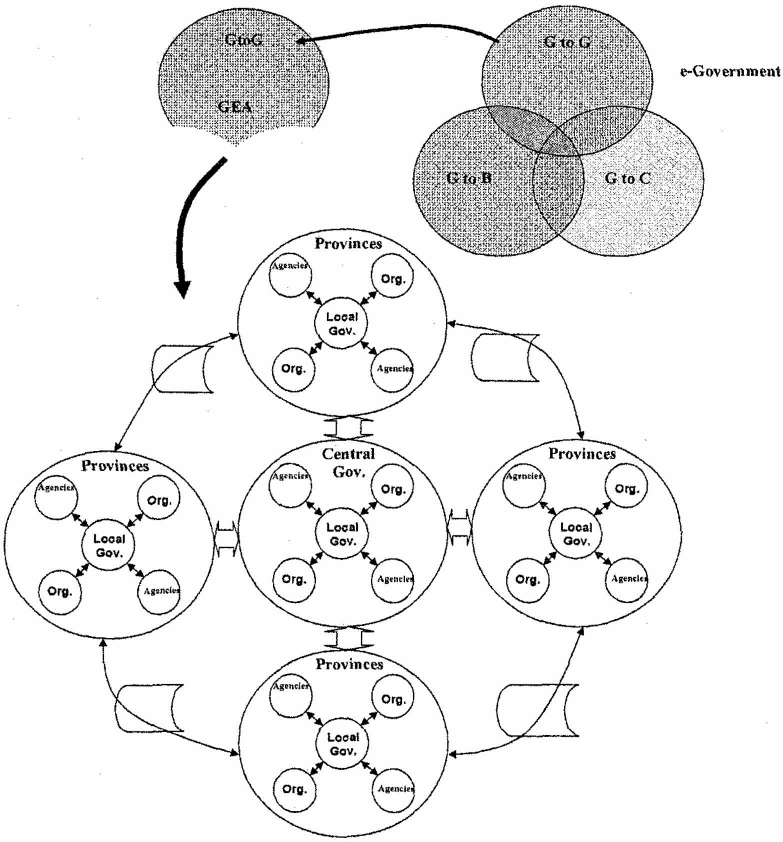

Fig. 2. E-government and its divisions including G-to-G and government Administration.

4 GEA services and benefits

GEA in Iran is expected to bring a unique and exceptional way for revolutionising the country's administration system. In the same time, success of this movement faces difficulties and risk. This is due to a number of reasons such as severe lack of information in general, the existing resistance against dissemination of information for security reasons, distortion of information during its flow in the administrative hierarchy, delays in access to information for decision making purposes, widespread incoherency of functions, and finally disruption of operations and tasks due to functional structure of the government. These all will lead to public dissatisfaction.

Therefore, with respect to the presented definition and understanding of G-to-G system in Iran, and the reasons supporting its decisiveness the following services are expected from GEA.

Government integration and reduction in cycle time: The existing inefficiencies of the government agencies go much further considering the inefficient communications and interactions among agencies. The agencies are generally functioning as separate islands which not only result in weak coordination among them but also cause unbalanced growth of the government's different organisations and plans. Most of the existing dissatisfaction of the government customers is seemingly caused by inefficient government processes. For instance, a customer to receive a certain service has to move through several inter-organizational inefficient and inconvenient processes. GEA will bring about faster communications among the government agencies. This will also have considerable effects on the quality of services through creating virtual connections between agencies and improving inter-organizational processes. Also since paper work forms a considerable part of the government operations, GEA can have a serious effect on this matter and remarkably improve the efficiency and effectiveness of agencies.

Government's employees involvement: The organisational structure of the government and it management has created some kind of gap between top and middle level management with skilled and expert human resources. A feeling of being treated as marginal and not considered or involved in the process of decision-making exists within the expert body of the government especially those working out of the capital. GEA can help remedy this feeling and establish a cooperative atmosphere through providing access channels for experts and skilled employees to the policy-makers and vice versa.

A potential for sharing experiences: Considerable expertise, talents and experience exist inside the government which are not being utilised properly. This purpose is attainable through sharing, aggregating, organising, and directing the existing potentials. This, however, would not be achieved with the very slow and imperceptible current operations of the government agencies. GEA can play an effective role in managing the existing knowledge and expertise within the country through compiling and sharing experiences. In effect it can, in long term, lead to a positive environment of competition among agencies for better utilisation of their human resources.

Preparing grounds for fundamental improvement of government in a bottom-up process: Previous experiences in improving the administrative systems of the country through top-down approaches have by no means proven successful. However, GEA implementation, which incorporates operational processes, can therefore be used as a starting point for the government processes improvement. In this approach, GEA can be used to identify redundant and ineffective processes, and to reduce the operational complexities through a bottom-up approach. Beside that, achieving objectives such as renovation of the government organisations' structure are expected from GEA.

Increasing access to information and transparency of operations: GEA can considerably enhance the volume and quality of accessible information for the government. Having characteristics such as speed, security, convenience, and access of management levels to information, GEA has sufficient capabilities to facilitate management by information. This can resolve many existing administrative and operational ambiguities resulting from lack of information in the executive body of the government. This service may also assist insertion of managerial controls in various levels, and also the evaluation of individuals and agencies' performance. Facilitating further control at macro level including the development and implementation of major projects and plans in various sectors would have positive effects on achieving a balanced economic growth.

Benefiting more from decision support systems: Decision support systems are playing significant and growing role in governments' operations. These systems are basically based on information from different sources including experts. GEA assists the managers in accessing the required data and also sharing the models for supporting their decisions. This issue becomes more critical in making strategic decisions.

Improving policy making capabilities: Successful implementation of the government's recent policies in reducing the government's ownership and direct control, and instead improving its abilities in making policies require government's strict steering and overseeing. Lack of these controls could result in blocking these plans and would lead to further inefficiencies in the country's administration systems. GEA can be used as a basis for data aggregation used for monitoring the operations, and conveying comments and ideas from the bottom line of the administration to the top. The result would be policies developed based on real operational data rather than outdated reports.

A foundation for e-commerce in the country: The world-wide revolutionary developments in information technology and its extensive applications in business and trade have changed the traditional concepts, learning and methods of doing business. One of the main potentials of GEA is providing grounds for electronic trade in government sectors. The efforts made in this regard so far such as development of the Electronic Trade Law are necessary but certainly not sufficient. Developing GEA is a major step in this way to provide the required foundations and preparing the government sector to join the inevitable future form of the trade system in the country. The formation of e-commerce with the support of GEA will also be effective in the growth and expansion of IT services market in the country and development of expertise in this area.

5 Components of GEA

Based on the discussions made so far, seven prime constituents could be specified for GEA: Network and hardware, content, training, security, rules, procedures and regulations, and organizing and management of the network. These components are briefly described in the following:

Network and Hardware: Establishing electronic communication between government agencies requires their willingness to join the network, and feeding and updating their information onto it. Prerequisite of the agencies to trust the network is a secure, fast, attractive and economic network. In this network the government agencies are linked to communication centres through leased private lines and the centres are also linked to other centres using private networks of optical fibres to form provincial network. One of the communication centres of each provincial network will be connected to the capital (Tehran) forming the national government network. This will enable the agencies to be positioned in provincial and subsequently the national networks. These equipment should not be considered just as a physical medium, but a means for drawing attentions toward a new wave of IT-based revolutionary programs for improving efficiency, participation in decision making, bringing effects to the administration of the country at various levels of management, and shifting organizational culture to a more active and dynamic status.

GEA Content and the priorities: Expectations from government physical network would not be achieved without defining and providing its content. Based on some criteria such as; operations speed, level and volume of accessible information, security of information, and distribution of information to and from top executives to other layers, the content of GEA is divided into five groups:

1. The agencies' web pages aimed at making their information available to others.
2. Basic software such as mailer aimed at enabling the agencies to start using the network and establishing communication and interaction.
3. The decision support systems aimed at processing and analyzing the generated information and providing reports to decision makers. Systems such as IT Readiness of agencies, core processes analysis, and control room system for senior level decision makers are being developed in this context.
4. Integration systems and efforts including providing systems architectural design and integration standards.
5. Managing the government information databases and banks, and transferring them to GEA.

At the best case it would be expected that the agencies develop their own contents using approved standards. However, at the current circumstances they expect to be supplied for systems and applications by some central organizations. This indeed is in contrast with the purpose of GEA. To address this problem an extensive training program is developed to enable the agencies in learning how to approach, start, plan, develop, and supervise their needed systems and stay aligned with the rest of the government body.

Training: Implementing GEA, as mentioned above, will be materialized through development of contents on the bed of hard communication network built for this purpose. The content in turn includes systems and software which is anticipated having major impacts on the structure and performance of the government body. Reforming or re-engineering of the government and its agencies' processes is believed to be possible only if it is accepted and originated by the management layers of the government. Overcoming the barriers in this way and moving the existing administration to this point is a grave challenge to which *training* is the solution. A carefully designed plan for educating government agencies management layers has been recognized as a fundamental action to prepare them for accepting changes and encouraging them to initiate change programmes. The training programme is designed in several layers and three levels, and incorporates workshops and practical work for managers to assist them approaching reengineering of their systems while getting introduced to concepts and issues. It is expected that organisational initiatives are triggered during the training courses inside the agencies for study, change and implementation of systems leading to the realisation of GEA objectives.

Security standards, codes and guidelines: The infrastructure of GEA is physically separated from the internet. However, in order to secure the applications and data, special considerations are sought. Providing the required training for employees, making the software and databases secure, and encryption activities are a few examples of such concerns. Besides moving toward open source operating systems in long term is under consideration. Also an organization for managing this issue is introduced within the agencies, and a security officer job is defined to undertake maintenance of the network's security.

Laws, rules, regulations and procedures: Development of GEA and its components must abide by general laws, rules and regulations of the country, and also comply with international laws and regulation (accepted by Iran). The complexities associated with the plan of GEA will lead to the introduction of new business methods and relationships throughout the country for which legal support should be sought. New proposals in this regard are developed and set forward for official approval.

GEA organization and management: Reaching the above mentioned goals requires insertion of extreme measures in planning, organizing and coordinating the efforts and responsible offices and organisations in the government. However, applying these measures to a system like GEA is a critical task that is caused by several issues such as:

1. Lack of consensus among officials on the definition, mission, goals and objectives of the e-government and GEA. This has resulted in the emergence of different aims and hence directions throughout the time. This problem again roots in the fact that the e-government in Iran has emerged out of three factors

which are needs, problems, and possibilities. These issues could become highly variable and incongruent especially in Iran where the basis of decisions and policies are priorities rather than planning. At such circumstances priorities change very often which consequently affect the decisions on resource allocation,
2. Lack of sufficient scientific capabilities and expertise in managing and administrating large IT projects,
3. Inherent complexity of systems at this level and rapid changes in technology,
4. Lack of cooperation and coordination among responsible agencies.

Therefore in order to avoid formation of a new organisation, which is a part of the government strategy, a task force, in a project organization form, is formed and supported by the First Vice President to enforce the plan and make the required coordination.

6 GEA implementation and challenges

Moving toward development of GEA, having three main characteristics of complexity, broad scope, and diversity, encompasses various considerations each is inherently complicated on its own while having extensive interactions with others. Theses issues, to which we can refer as obstacles in the way of GEA, spread over a wide spectrum and many of them are already pointed to in previous sections of the paper. Some key issues are highlighted in the following with a short discussion on some of them:

- Vast diversity of users with different levels of capabilities and preparedness. This makes the information need analysis difficult, hinders the move to attend more serious aspects of GEA, and in practice reduces the level of systems to ordinary applications such as Mailer.
- Difficulty of reaching a unique mindset among authorities and politicians for managing and utilising GEA.
- Broad geographical and political boundary of the government, and immense size of the administrative organisation. This factor will be a major challenge for integrating the agencies and their systems.
- Incongruent and unsupportive laws and regulations pertinent to the issue of GEA and the very slow rate of change in them.
- An unfavourable mix of politics with technology. This means that the factors that influence decisions on adoption of new technology are political oriented and hence unstable in nature. Relying on such frames would be too risky.
- Short life of the managerial posts, and frequent new appointments. This matter would add insecurity and turbulence to the administrations' environment making decisions and plans very instable and unreliable.

- Significant costs associated with the maintenance of GEA. This element will cause trouble in budgeting the government and its agencies resources, putting the health and continuity of the networks in risk.
- Existence of a traditional attitude among agencies and their managers which is the willingness to only act upon receiving orders from higher authorities and not initiate movements.
- Extensive need for educating and training managers and employees of the government. The sizeable number of agencies and hence managers, professionals and skilled employees who relate to this project from one side, and the level of IT knowledge and literacy among them from the other side necessitates a massive training programme which is very time and resource consuming and difficult to implement.
- Low level of motivation of the government managers and employees in general due to economic and organisational problems, and in particular for the change programmes towards the new frame of GEA. This matter can have fatal effects on the plans and the efforts for implementing GEA.
- Low level of available expertise in the area of ICT in the country compared to the needs, both in terms of number of professionals, consultants and ICT companies, and also in terms of level of technology and knowledge they can provide. Development of GEA in its full potential in the country requires an army of experienced experts and professionals in the field of ICT to join forces of the government agencies and transfer the resources to required systems and software.
- Difficulty in bonding the academic and research sectors of the country with the project, and utilising their abilities in developing GEA. This matter, which is a general issue for the country in most development areas, restricts the scope of potential energy available for a major movement in transforming the administration system.

Considering the mentioned restrictions and barriers associated with the development of GEA which add to its complexities, the requirements for successful accomplishment of GEA programme in Iran are identified as follows:

Content management: GEA content requires many complex and interrelated systems which needs to be coordinated by numerous organisations and individuals. This means a vast and complicated network of activities and extensive measures in planning and management. Issues such as the architecture of the content, standards, integration, setting the priorities, motivating the managers and operational groups, system analysis and development, information and application security, updating existent applications, financial resources for new applications, and assuring full utilisation of the information are among the most important challenges.

Culture and human resources: Success in utilising GEA demands close consideration of cultural and social background of the society. Understanding existing barriers as a determinant of the society readiness for accepting system changes is among these considerations. Furthermore, this transformation will be in severe need for educated human resources, and the current capacity of the country in this relation is insufficient and needs swift and rigorous attention and actions by authorities.

Organizational: A well-coordinated organisational model is needed for management of GEA. This model should be accredited for leading the issue in the whole country, and should aid successful completion of various projects in many different areas. This approach should also be able to remove the organizational barriers for the operational agencies given the fact that any structural changes should be approved by Management and Budgeting Office. Designing such organization is a part of GEA technology.

Technology: Choosing the right level of technology is very important. For instance, the selected software should be highly reliable and with the possibility of further development and extension.

Financial resources: Providing financial resources for timely implementation of this plan is a vital issue in the ways of its success. Obtaining resources from a bureaucratic system, cost-benefit analysis and justification, feasibility study of different projects, initiatives, negotiation for financial support, changing priorities, and lack of enough resources are some of the challenges in this group.

Time factor: GEA is being developed in response to a number of essential requirements of the country. These needs if are not fulfilled in an acceptable time period may harm the justification and validity of the project, and affect its success. Managing the project and its implementation efforts, which is not a normal practice in administrative systems, will, therefore, be a critical challenge in achieving the objectives of GEA and G-to-G

7 Conclusions

Moving towards e-government is a great opportunity for Iran not only to reduce its technology/digital gap with the developed world but also to improve the performance of its administration system and achieve the targeted democratic society. In order to minimise the complexities associated with the development of e-government, a particular definition is presented for e-government in Iran considering the structural and political specifications of executive systems of the country. Based on this definition, development of Government Electronic Administration (GEA) receives the top priority from among different elements of the e-government. Moving toward this objective, which entails complicated dimensions, must be planned and implemented carefully so that the country's capabilities are utilised fully, and the least possible disturbances are caused hopefully bringing about the maximum advantage for the country. Myriad Obstacles exist in the way to achieve success in this move, removing of which needs extensive and careful actions. In particular transforming this movement into a national culture is a crucial aspect which needs focus on cultural elevation programmes and major training programmes. Participation of universities and research centres in this national movement can significantly support and even guarantee its success.

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Some critical factors in Local e-Government: the case of Lombardy

Walter Castelnovo, Massimo Simonetta , Antonio Lasi
Walter Castelnovo:
Università dell'Insubria, via Valleggio, 11, Como, 22100, Italy
walter.castelnovo@uninsubria.it
Massimo Simonetta:
Ancitel Lombardia, via Meucci, 1, Cologno Monzese, 20093, Italy
simonetta@ancitel.lombardia.it
Antonio Lasi:
Lombardia Informatica, via don Minzoni, 24, Milano, 20158, Italy
antonio.lasi@lispa.it

Abstract. The implementation of E-Government systems is a complex activity, due especially to the variety of the aspects involved (technological, organizational, normative). The difficulties are even major on the local level, where the task to implement E-Government systems is often entrusted to Small Local Government Organizations (SLGO): for them the management of the innovation can be a problem because of the lack of resources. In this paper, making a reference to a case study in Lombardy Region (Italy), we point out some critical aspects that can arise in the implementation of E-Government systems by SLGOs. The discussion of these elements is based on the data collected through a survey carried out at the end of 2005 on a sample of the 1546 Lombardy municipalities. The survey is based on the use of smart cards for the access to online services of the Local Public Administration. Thanks to some projects carried out in the last few years, in Lombardy already exist all the infrastructural and technological conditions necessary to guarantee a secure access to online services. From this point of view, the critical aspects which arose in the survey and which are discussed in this paper highlight the fact that for SLGOs the problems in the implementation of E-Government systems are not so much technological as actually organizational.

1 Introduction

Lombardy Region, such as other Italian regions, has defined an E-Government Action Plan of its own [1]. Among the priority projects of this action plan it is especially important the project "Progetto Carta Regionale dei Servizi - Sistema

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Informativo Socio Sanitario" (CRS-SISS: Regional Citizen Card - Healthcare Information System) that has been active since 1999.

Initially, the project was focused on the implementation of healthcare services whose secure access can now be granted to both healthcare professionals and Lombardy citizens by means of the Regional Citizen Card (Carta Regionale dei Servizi, CRS hereafter). However, the final goal of the project is to connect electronically the entire Public Administration and allow citizens to access the complete set of online services.

The CRS card is a smart card that conforms to the international standards, and particularly to the norms that concern the Identification cards. The card can provide identification and authentication functions, as well as electronic signature and payment. [2]

As for December 2005, in the framework of the CRS-SISS project in Lombardy, as many as 8.7 million cards were issued, out of a total of 9.4 million resident citizens. Given its wide diffusion, the CRS card is a tool that could also be applied for accessing the online services of the local Public Administration, fostering the e-Government development. Actually, for people in Lombardy, the CRS card also acts as National Citizen Card (Carta Nazionale dei Servizi - CNS), i.e. the card providing a secure and authenticated access to the general Public Administration online services. In this respect, analyzing the use of the CRS card by the local municipalities in Lombardy can provide useful information about the general problems to be faced in implementing e-Government solutions.

To this end, in December 2005 a research on a sample of the 1546 Lombardy municipalities was carried out with the aim of acquiring information concerning the level of knowledge of the CRS functions within the Local Government organizations of Lombardy and the main difficulties that could prevent online services from being implemented and used.

In this paper, we present the survey results which point out some critical aspects SLGOs can encounter in the implementation of E-Government systems. On the basis of the discussion of these results, we design an operative model fit to support the implementation of local E-Government systems; in this model are integrated multiple techniques such as information campaigns, training courses, assistance support, promotion incentives, and control policies.

In section 2 we present some data which allows to understand the diffusion of local E-Government systems in Lombardy. In particular, the data concerns the diffusion of E-Government projects financed by Lombardy Region and of projects financed within the E-Government Action Plan of the Italian Government. In section 3 we present the goals and the methodology of the survey. The results and the critical aspects of the survey are discussed in section 4. Finally, section 5 presents the general lines of an intervention model able to support the projects for the implementation of local E-Government systems.

2 Local systems of E-Government in Lombardy

The CRS-SISS project has been initially developed for uses in healthcare applications, whereas the development of E-Government systems in Local Public Administration in Lombardy has been supported especially by two financing forms:

- regional financing for the realization of Sistemi Informativi Sovracomunali di Comunicazione TELematica (SISCoTEL - Inter-organizational Information Systems for Local Government)
- national financing within the national E-Government Action Plan.

2.1 The regional projects for the activation of SISCoTELs

The SISCoTEL projects, financed starting from 2001, aim at the implementation of a technological and organizational infrastructure shared within an aggregation of Local Government Organizations for the implementation of associated managements of services.

From the legal and organizational point of view, an associated management of services can take different forms, ranging from the simple delegation to one of the members of the aggregation, to the definition of inter-organizational workflows requiring the cooperation of several organizations for the production and delivery of services to citizens and enterprises. In order to enable the associated management of services within a SISCoTEL, the regional announcements define some technological and organizational conditions which must be fulfilled [3]. Such conditions require:

- to join the virtual private network *Lombardia Integrata*, which links on equal terms all the member organizations and which allows a safe exchange of information and services between Local Government Organizations of Lombardy; [4]
- to adhere to interoperability and communication standards;
- to structure the application portfolio on the basis of a standard articulation in functional areas and services defined by the Regional Government;
- to realize training projects related to ICT and organizational innovation in all the Local Government Organizations following the programme;
- to activate a Service System Centre which provides to the member municipalities ICT services concerning infrastructures, application, training, contracts and management.

The fulfilment of these conditions determines a technological and organizational integration for the organizations activating a SISCoTEL. From this point of view, an aggregation of municipalities activating a SISCoTEL forms an Integrated System of Local Government [5]. The overall data concerning the financing of the SISCoTELs is shown in Table 1.

Table 1. SISCoTELs financed in the period 2001-2005 [6]

Year of the financing announcement	Number of aggregations financed by each announcement	Total number of municipalities financed by each announcement
2001	19	191

2002	33	396
2003	17	157
2004	21	191
2005	17	166

In the first financing announcements the stress was particularly on the innovation at the back-office level, whereas starting from 2003 the SISCoTEL announcements include explicitly the obligation of implementing online services to citizens and enterprises. In particular, the announcements provide that the financed aggregations must implement at least 3 services to be supplied through the CRS within 3 years from the beginning of the project.

2.2 E-Government national projects

The Ministry for Innovation and Technology defined two phases of intervention for the realization of E-Government in Italy. These two phases, through the Ministry's co-financing, have supported innovation projects on a territorial level. The second phase is still being started, while the first phase is coming to its conclusion.

The first phase started in 2002 with an announcement for the co-financing of E-Government projects. This first announcement was followed by the presentation of 377 projects, whose overall value was 1200 million euros. Out of these 377 projects, 138 have been co-financed with 120 million euros (for an overall value of about 500 million euros).[7]

Out of all the projects which have been financed, 18 involved public administrations of Lombardy. Out of these, 4 were carried out directly by the Lombardy Region, whereas 14 concerned Local Public Administration. Table 2 contains a list of the 14 projects, showing their coordinating administration, the financed amount, and the population covered by the services which were the object of the different projects. Since the projects financed aggregations of local public administrations without any territorial link, table 2 shows also projects covering part of the population of other regions in Italy, even though the coordinating administration is a public administration of Lombardy.

Table 2. E-Government projects involving public administrations of Lombardy [8]

Coordinator	Object	Financing	Covered population
Province of Brescia	Library system of the province of Brescia	170.000	2.232.540
Municipality of Milan	Wireless and mobile access to administrative processes related to economic activities	180.000	1.285.000
Province of Bergamo	Access to the computerized cartographic data of the province of Bergamo	40.000	974.000
Municipality	Delivery of services to citizens and	1.430.000	203.596

of Como	enterprises through the Web		
Municipality of Milan	System for the online management and payment of taxes and rents	980.000	1.686.495
Municipality of Milano	Use of ICTs in order to simplify and foster the relations both among enterprises and local Public Administration, and among different PAL	260.000	1.200.000
Province of Lecco	Delivery of services to citizens and enterprises through the National Citizen Card	400.000	310.000
Municipality of Tavazzano	Realization of a modular and scalable solution for front-office and e-government services for citizens and enterprises	680.000	357.109
Municipality of Bergamo	Implementation of services for citizens and enterprises mostly on UE level 4 of interaction	3.270.000	3.408.944
Province of Milano	Realization of an information system for employment services (involving 16 provinces and 2 regions)	3.210.000	13.000.000
Province of Pavia	Secure mailing among citizens, enterprises and public offices and interoperability among the registering systems	610.000	497.000
Municipaliy of Milano	Management of the relations among schools, enterprises and Public Administrations	600.000	1.380.201
Province of Milano	E-Procurement system involving also other regions	100.000	5.800.000
Municipality of Desio	Realization of a computerized front office for the online delivery of services to citizens and enterprises	200.000	3.965.121

3 Characteristics of the survey

The survey on the CRS functions awareness in the municipalities of Lombardy has been jointly run by Lombardia Informatica and by Ancitel Lombardia. Lombardia Informatica is a company that, in behalf of the Lombardy Region, contributes in bringing to fruition electronic systems that enable citizens and companies to access local government and healthcare services. Ancitel Lombardia is the service company of ANCI Lombardia (the association of the municipalities of Lombardy).

The aim of the survey was identifying the critical aspects SLGOs can encounter in the innovation projects through the analysis of the use of the CRS, in order to plan the most appropriate interventions to support them in the implementation of the local E-Government projects.

The information survey was carried out in December 2005 and involved a sample of 30 municipalities, representing the 1546 towns present in Lombardy. The sample selection criteria included: distribution in demographic classes (18 small towns with less than 5000 inhabitants, 7 towns between 5000 and 30,000 inhabitants, and 5 towns above 30,000); coverage of all the 11 counties (at least 2 municipalities per county) and geographical areas of the Lombardy region (mountain, high plain, low plain); differentiated vocation for innovation (measured in number of innovative projects run by the municipalities in the latest years).

The survey included two different approaches: sending out a questionnaire to be filled in and a subsequent interview to operators selected by the municipalities.

The acquired information mainly concerns the following subjects:

1. the organization solutions adopted to fulfil the ICT functions, as structure devoted to manage the implementation of online services and the integration of the CRS card into their provision to citizens and enterprises;
2. the technological and organizational innovation capability, as applied to three financed innovative projects; namely: the realization of SISCoTEL, the projects promoting inter-communal cooperation, and some national e-Government projects;
3. the municipality adhesion to the regional infrastructure system for e-Government, and specifically to *Lombardia Integrata*;
4. the degree of awareness and use of the CRS card in the local community. Particularly, the survey focused on the level of knowledge of the CRS functions and the application of the card in the existing or newly designed services;
5. any success or failure factors found out during the process of implementing online services.

All municipalities answered the questions in the questionnaire and willingly cooperated in the interviews. People interviewed were evenly distributed between ICT managers and political members of the municipality government. That allowed the evaluation of the opinion of both operators and decision makers of the Public Administration in Lombardy.

4 Results of the survey

The collected data shows a good vocation to the innovation in the sampled municipalities (Table 3). A partial exception concerns the adhesion to the national e-Government projects. This can however be explained by the specific constraints that those projects implied, especially for small municipalities.

Table 3. Innovation projects in the sampled municipalities

Project	Involved	Not involved	Degree of satisfaction	
SISCoTEL	67%	33%	Positive	54%
			Negative	14%
			Too early to say	14%
			No answer	18%
Project promoting intercommunal cooperation	54%	46%	Positive	64%
			Negative	12%
			Too early to say	12%

			No answer	12%
National e-Government projects	30%	70%	Positive	78%
			Negative	-
			Too early to say	11%
			No answer	11%
Adhesion to the Regional infrastructure system (Lombardia Integrata)	87%	13%	Positive	67%
			Negative	25%
			Too early to say	-
			No answer	8%

The data related to the involvement of the sampled municipalities in innovation projects makes particularly meaningful the information about their state of awareness and use of the CRS card (Table 4). In spite of the wide diffusion of the card among the citizens, the number of municipalities already capable of providing services using this authentication tool is absolutely marginal (3%). This result is not significantly modified by including data concerning projects still in progress and that can potentially lead up to the card application in online services within a reasonable period of time. In fact, 77% of the municipalities has currently no project in progress related to the implementation of online services using the CRS card.

Table 4. Awareness and use of the CRS card

Level of awareness about the CRS card and its functions	High	17%
	Medium	17%
	Low	66%
Current state of use of the CRS card	Used	7%
	Not used	90%
	No answer	3%
Project in progress for adopting the CRS card	Project(s) running	23%
	No project	77%

Furthermore, in spite of the good involvement in innovation projects, 66% of the interviewees stated they have little knowledge of the CRS functionalities and the potential benefits related to its applications. This data clearly points out how difficult it is for the municipalities, especially small ones, to launch innovation processes that include the CRS card adoption, even though the card is so widely available among the citizens. Therefore, it becomes essential to find the actions required to encourage and support the small municipalities in their innovation efforts.

To achieve this goal, the research included a qualitative survey that, based on the knowledge and perception of the interviewees, allowed identifying the troubles that could arise during the implementation of online services and the introduction of the CRS card. The interviews highlighted some potential obstacles capable of hindering the diffusion of the card. These obstacles are related to:

- insufficient knowledge of the CRS functionalities;
- contextual factors present in the Public Administration in Italy, and particularly in Lombardy;
- organizational problems

4.1 Obstacles related to insufficient knowledge of the tool

Almost all interviewees emphasised that, notwithstanding the efforts made in the latest years for promoting the diffusion of the CRS card, there is still a lack of knowledge of the tool in both providers and users of the services. The inadequate internal knowledge is perceived as a problem in understanding the potential benefits in using the CRS card and in planning services that can profit of this new tool.

One of the reasons indicated to explain the insufficient knowledge is the poor sharing of information within the organization. If the interviewee is part of the Information System management, he/she claims a medium/good understanding of the tool, whereas there seems to be no awareness about the organizational difficulties related to the implementation of online service using the CRS card. On the contrary, when the interviewee has no specific ICT background, the technical aspects are reported as unclear, while the possible organizational problems are taken into better account.

From this point of view, the collected data confirms the existence of a problem of general character: the difficulty in carrying out innovation projects without the previous creation of a minimum level of shared knowledge within the organization. As a matter of fact, the presence of subcultures within the organization, even without leading to internal conflicts, can anyway slow down the innovation projects. [10]

4.2 Obstacles related to contextual factors

Among the general obstacles identified as limiting factors in the diffusion of CRS card applications, the following causes have been reported:

- the long duration of the processes for implementing online services;
- the potential interferences between projects simultaneously dealing with CRS applications;
- the confused situation caused by multiple introductions or announcements of tools providing similar functions as the CRS card.

The implementation process duration has been found to be especially critical when the entire life cycle of an innovation project is taken into account, from design until deployment. The main difficulty reported is that, even when the service is actually implemented, it is not actually available yet, as users may not be able to access it due to insufficient information or missing tools (card, PIN, smart card reader).

It is also clear that, if the services take a long time to be introduced, a problem arises in the communication and relationship with the citizens. It often happens that new services are announced right from the projects' start, thus creating expectations among the citizens. At this point, the long period of time required to put the service into operation may cause the expectations to turn into disappointment and criticism.

Quite a few projects have been in progress for some years in Lombardy to encourage smart card applications for accessing public online services (SISCoTEL projects and national e-Government projects). The variety of projects and initiatives has been recognised as a problem since a municipality may risk to be involved in different projects whose application areas overlap. This situation generates real or potential conflicts that can delay or even stop entirely the projects.

Some interviewees pointed out also the potential risks of confusion caused by the availability of tools that, possibly due to poor information, may be considered comparable to the CRS card. Such tools include: the Electronic Identity Card, digital signature tools from various operators, some Smart Cards locally used for testing new services.

Although the problem reported is mainly originated by poor knowledge and communication, a substantial lack of clarity does exist in relation to functions and diffusion of the different tools. This lack of clarity, partially due to an insufficient integration between national and local innovation actions, is considered as a potential constraint, which may prevent CRS-adopting project from being activated.

Many potentially critical elements pointed out in the interviews refer to the necessity of defining a regulation authority capable of coordinating the innovation projects and of controlling their duration and execution. This regulating and coordinating role is particularly necessary in situations in which, due to the lack of resources, an innovation project on the regional level must be carried out through projects funded by different subjects (National, Regional and Local Government). However, the problem of coordinating the funding of E-Government is a general one, as observed in [11].

4.3 Obstacles connected to the internal organization

The list of expected problems reported in the interviews about the projects for the implementation of online services also includes:

- organizational difficulties caused by the complexity of the innovation projects management;
- lack of specific skills in the ICT domain, required by the innovation processes;
- deficiency of financial resources to invest in innovation projects.

The sample of municipalities mostly includes small towns, thus representing the actual composition of the urban territory in Lombardy. Although a widespread involvement in innovation initiatives has been measured in all municipalities, it is quite reasonable to expect organizational difficulties to arise in running innovation projects. What the interviews have emphasised is that even the largest municipalities report similar problems.

As far as the small municipalities are concerned, the plans for the CRS card use are part of projects that involve an aggregation of several nearby towns. The organizational problems reported in the interviews are in fact typical of this type of inter-communal cooperation, and similar to the ones found out in previous surveys carried out in Lombardy ([8]). Namely:

- poor scalability, which results in ignoring the differences between small and large towns;
- difficulties in handling the relationships between the different municipalities involved in the common project;

- allocation of project costs, whenever the projects require, at least partially, financing from the local administrations;
- complications related to norms and/or regulations arising from CRS card applications (e.g.: services requiring the management of personal and sensitive information).

An organizational difficulty, also reported in case of large municipalities, not necessarily involved in inter-communal cooperation, concerns the lack of specific organizational skills within the organization to manage complex project. The problem is clearly related to the CRS project characteristics - cross-sector tasks, high organizational complexity, and medium to long duration - which all require Project Management methods and techniques. These needs result clearly from the interviews, even the ones carried out in medium and large municipalities that, however, are not equipped with specialists to assign to the project management.

The analysed sample confirms a well-known phenomenon in the local Public Administration in Lombardy, as found out in previous surveys ([5]). In spite of the increasing diffusion and availability of ICT in the municipalities, specialist skills for managing the new technology are in general poor or even almost missing in the smaller organizations.

Regarding the specific subject of the analysis, the interview findings show how poor (or missing) specialist skills is a limiting factor for the projects aimed at spreading the use of the CRS card. It is important to note that this problem is not only reported in relation to the need of communicating with the infrastructure specialists of the CRS technical domain, but also for planning, implementing, and managing services that simply use the card.

Nearly all interviewees pointed out, in one way or another, the needs of financial support by the Lombardy Region in terms of:

- direct interventions for providing incentive to the municipalities to test and run services (planning, infrastructure acquisition, training);
- direct or indirect financial support for promoting the use of the CRS card by the citizens (e.g.: contributing for covering the card purchase cost, funding new assisted stations to access online services using the CRS card).

5 Conclusions

In general, the most important finding in the analysis of the survey results is the very limited use of the CRS card by the municipalities in Lombardy. This occurs even though the card is, in practise, spread over the entire population and its application would enable the municipalities to profit from the infrastructural services for authentication and security already implemented by the Region.

The CRS card has a key application domain in the healthcare system in Lombardy and the investment for the card distribution can be evaluated in relation to this application. Now, as the tool is available and the investment costs have been already covered, its adoption by local Public Administration does not require any further major investment.

Therefore, the CRS card can be a fundamental opportunity for developing e-Government services in the local Public Administration in Lombardy, one of the most populated and economically important regions in Italy. However, in order for the local Public Administration in Lombardy to adequately profit from this opportunity, the municipalities need to be supported in resolving the difficulties that this survey has highlighted.

The comments received during the survey confirm that the most serious difficulties in running e-Government projects lie in organizational issues more than in technological ones. In this respect, an intervention model only focused on the technological preconditions to enable the municipalities to implement online services would simply appear inadequate.

This aspect is particularly important, as E-Government projects are often almost exclusively considered as technological innovation projects. On the contrary, the collected data clearly points out that the modernization of Local Government needs much more investments in organizational innovation than those made up to now. Consequently, also the incentive policies, from the EU to the local level, should be reoriented from technological innovation to organizational innovation.

The main problems which arose in the survey are schematically summarized in table 5:

Table 5. Main data highlighted by the survey

General and context-based obstacles	Interferences between different projects
	Potential conflicts between CRS and similar tools
Insufficient knowledge	Difficulties in recognizing services that can use CRS
	Problems in planning new services that can profit of CRS
Technological and organizational problems	Troubles in managing innovation processes
	Lack of specific ICT skills
	Missing financial resources

The analysis of the collected data, especially the data resulting from the interviews, clearly points out that for the activation of innovation projects in Local Government it is not enough to give the municipalities the necessary technological tools. As a matter of fact, the municipalities also need to be supported in their innovation processes. The results of the survey carried out in Lombardy point out at least five specific fields which require supporting actions: communication, training, assistance, control, incentives.

In the specific case of the survey on the use of the CRS by the municipalities of Lombardy, the information actions have to encourage the use of the card by spreading the knowledge of its capabilities. On the one hand, more information is required by the Public Administration operators, who have to plan, implement, and manage the services integrating CRS. On the other hand, information campaigns for all citizens should stimulate the use of the card by creating a better understanding of the tool, which, at the moment, is only known for the healthcare applications.

The goal of the training activities is to improve the operating know-how in CRS applications, thus creating the conditions for implementing new functions and integrating the use of CRS in the municipality's services.

The assistance activities aim at providing effective answers to the possible critical cases encountered in the innovation processes related to the implementation and introduction of CRS-based services.

The control actions should ensure a harmonised and coordinated development of innovation solutions by providing an adequate legal and regulatory framework for the organizations of the system of Local Government.

Finally, the incentive actions are meant to motivate and finance the local administrations in experimenting and introducing innovative solutions that make use of the CRS card.

Without extended plans including communication, training, incentives, and organizational support, the mere distribution of an authentication tool, even though technically adequate, is not sufficient to trigger innovation processes.

The survey carried out on the use of the CRS by the municipalities of Lombardy gives general information about the problems that can arise in the implementation of E-Government on the local level. As a matter of fact, since the adoption of the CRS does not bring with it particular technological problems specifically referable to that tool, the problems pointed out can be considered as typical problems of the innovation processes within SLGOs.

From this point of view, the communication, training, assistance, control and incentive actions described above can be considered as the basis of an integrated intervention model aiming at supporting the processes for the implementation of E-Government on the local level.

Appendix

The survey was carried out in the period 1-20 December 2005. Firstly the municipalities selected as part of the sample received a questionnaire to be filled in. Subsequently, an appointment was arranged at each municipality; during these meetings the questionnaires were collected and interviews with persons indicated by the municipalities were carried out. The interviews followed the structure of the questionnaire (table 6). At the end of each interview a report was prepared to be subsequently used for the elaboration of the qualitative data of the survey.

Table 6. Structure of the questionnaire

1. GENERAL DATA
1a. INTERVIEWED PERSONS • Manager/member of the council: name, function • ICT manager (if present): name, function, salary scheme

1b. IDENTIFICATION OF THE CASE
- Municipality
- Number of inhabitants
- Number of employees
- Organization solutions adopted for the management of ICTs.

2. PREVIOUS EXPERIENCES OF ICT INNOVATION

2a. PARTICIPATION IN SISCOTEL
- Identification: Coordinating Authority for the project; Year of adhesion
- State of the project: State of progress of the project; Degree of satisfaction; Positive elements experienced during the project; Critical elements experienced during the project; Any general remarks.

2b. PARTICIPATION IN PROJECTS OF INTERCOMMUNAL COOPERATION
- Identification: Coordinating Authority for the project; Year of adhesion
- State of the project: State of progress of the project; Degree of satisfaction; Positive elements experienced during the project; Critical elements experienced during the project; Any general remarks.
- Services object of the cooperation that use the CRS.

2c. PARTICIPATION IN NATIONAL E-GOVERNMENT PROJECTS
- Identification: Coordinating Authority for the project; Year of adhesion
- State of the project: State of progress of the project; Degree of satisfaction; Positive elements experienced during the project; Critical elements experienced during the project; Any general remarks.
- Online services object of the project: level of interactivity, authentication tool used.

2d. LOMBARDIA INTEGRATA
- Adhesion to Lombardia Integrata: year of adhesion
- Use of the services implemented on the network
- Degree of satisfaction
- Any general remarks concerning Lombardia Integrata

3. REGIONAL CITIZEN CARD

3a. DEGREE OF KNOWLEDGE CONCERNING THE CRS
- Degree of knowledge about the CRS within the organization
- Main information sources concerning the CRS
- Initiatives considered as suited for spreading the knowledge of the CRS

3b. USE OF THE CRS
- Present use of the CRS to supply municipal services:

  If yes, please tell if its use is part of a financed project;

If yes, services delivered through the CRS;
If yes, difficulties encountered in the use of the CRS;
If yes, success factors in the use of the CRS.

- Ongoing projects involving the use of the CRS:
  If yes, please tell if its use is part of a financed project;
  If yes, services for which it has already been planned the use of the CRS;
  If yes, predictable difficulties in the use of the CRS (based on past experience in innovation projects)
- If there are no uses, actual or planned, of the CRS, please explain why.

3c. GENERAL EXPECTATIONS CONCERNING THE USE OF CRS

- Services considered as more suitable for the use of the CRS in general terms
- Services (not only online services) of one's own municipality for which the use of the CRS could be useful

3d. SUGGESTIONS/PROPOSALS

- Qualifying factors for the success of the CRS
- Limiting factors for the success of the CRS
- Suggestions aiming at the use of the CRS in the municipality
- General remarks

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