

**Proceedings of the
8th European Conference on
IS Management and
Evaluation
University of Ghent,
Belgium
11-12 September 2014**



Edited by

Jan Devos and Steven De Haes

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**The Proceedings of The
8th European Conference on
IS Management and Evaluation
ECIME 2014**

**University of Ghent
Belgium**

11-12 September 2014

**Edited by
Jan Devos
Ghent University
and
Steven De Haes
University of Antwerp
and Antwerp Management School
Belgium**

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Preface

The 8th European Conference on Information Management and Evaluation (ECIME) is hosted this year University of Ghent, Belgium. The Conference Chair is Geert Poels from Ghent University and the Programme Co-Chairs are Jan Devos from Ghent University and Steven De Haes from The University of Antwerp & Antwerp Management School, Belgium.

ECIME provides an opportunity for individuals researching and working in the broad field of information management, including information technology evaluation to come together to exchange ideas and discuss current research in the field. We hope that this year's conference will provide you with plenty of opportunities to share your expertise with colleagues from around the world.

The opening keynote address will be delivered by Prof Hans Van Der Heijden from The University of Sussex, UK. The second day keynote will be given by Prof. Dr. ir. Dirk Deschoolmeester from the University of Ghent, Ghent, Belgium.

ECIME 2014 received an initial submission of 86 abstracts. After the double-blind peer review process 31 academic Research papers, 9 PhD Research papers, 1 Masters Research paper and 4 Work in Progress papers have been accepted for these Conference Proceedings. These papers represent research from around the world, including Australia, Belgium, Bosnia and Herzegovina, Brazil, Finland, France, Greece, Lebanon, Lithuania, Netherlands, Norway, Portugal, Romania, Russia, South Africa, South Korea, Spain, Sweden, The Netherlands, Turkey and the UK.

We wish you a most interesting conference.

Jan Devos and Steven de Haes
Co-Programme Chairs
Ghent University, Belgium

September 2014

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Jan Devos, Ghent University, Belgium

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Steven De Haes, University of Antwerp & Antwerp Management School, Belgium

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Committee Members

The conference programme committee consists of key people in the information systems community. The following people have confirmed their participation:

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Biographies

Conference Chair



Geert Poels is a full professor of Management Information Systems in the Department of Management Information Science and Operations Management of the Faculty of Economics and Business Administration of Ghent University. He is director of the Information and Knowledge Management research group where he supervises about ten doctoral students. The main research lines of this group are: business process management; enterprise modeling, architecture, and engineering; service science; data mining and business intelligence. Geert Poels holds a doctoral degree in applied economic sciences from the Katholieke Universiteit Leuven. He was a post-doctoral fellow of the Fund for Scientific Research, a lecturer at the former Vlekho Business School in Brussels, and since 2002 he has held professor positions at Ghent University. He has published widely in international academic journals on topics like definition and validation of software metrics, functional size measurement of software, quality in conceptual modeling, and ontology-based conceptual modeling patterns. His current research interests are conceptual modeling of service systems and service-oriented business architecture modeling. In 2012 he was chairman of the sixth International IFIP Conference on Research and Practical Issues of Enterprise Information Systems (CONFENIS).

Programme Co-Chairs

Jan Devos, PhD, is currently professor in Information Systems, IT Security and IT Trends at the Ghent University. He holds a master degree in Engineering, Computer Science and Applied Mathematics (Katholieke Universiteit Leuven) and an MBA (Vlerick Leuven Gent Management School). His current research interests are IT Governance in SME's, IT/IS failures, IT Trends and IT Security. He has published several peer-reviewed articles on IT and SMEs and is often a speaker at international academic and business conferences. He was co-author of the Cobit QuickStart methodology and editor of a recent contributed volume on IT and SMEs. Jan Devos is a member of ACM, AIS, and is co-chair and country representative (Belgium) for IFIP TC8.



Steven De Haes, PhD, is Associate Professor Information Systems Management at the University of Antwerp & Antwerp Management School. He is actively engaged in teaching and applied research in the domains of IT Governance & Management, IT Strategy & Alignment, IT Value & Performance Management, IT Assurance & Audit and Information Risk & Security. He teaches at bachelor, master and executive level and acts as Academic Director for the Executive Master of IT Governance & Assurance, the Executive Master of Enterprise IT Architecture and the Master in Management. His research has been published in international peer-reviewed journals he co-authored and/or edited several books. He is co-editor-in-chief of the International Journal on IT/Business Alignment and Governance and acts as Academic Director of the IT Alignment and Governance (ITAG) Research Institute.

Keynote Speaker

Hans Van Der Heijden is a Professor of Accounting at the University of Sussex. He holds a Ph.D. in Business Management from Erasmus University Rotterdam, and have previously worked in the Netherlands, Denmark, Ireland and the UK. Before his academic career he worked as a consultant for a Big 4 accountancy firm, specialising in accounting and information systems. He is SAP certified (TERP10). Hans's research interests are at the intersection of accounting and information systems. In particular he studies the design and presentation of complex enterprise data for better decision making. He develops tailor-made software prototypes for this purpose, which collect and enhance the data stored in large complex enterprise systems such as SAP and Sage. He has been a member of, and an advisor to, several professorial selection committees in the UK, Ireland, and Finland and is currently an external examiner at Manchester Business School.



Mini Track Chairs



Elena Serova is an Associate Professor and works at the International School of Economics and Politics, High Economics School, Marketing Dept. St. Petersburg State University of Economics. Her role combines teaching and research and her current research interests are related to Information Systems, Information Management, Information and Communication Technologies, Marketing and Business Models. She has co-authored a book and contributed chapters to several books and collections of essays, she is a regular key presenter at national and international conferences and workshops. As a research active academic with a number of PhD Students under her supervision, Elena is focusing on Complex Information Systems Modelling, Marketing Information Systems, and Business Models in a

Global Environment.

Danilo Piaggese is Managing Director of the *Fondazione for the Renaissance of the Americas (FRAmericas)* a non-for profit organization. FRAmericas focuses on Knowledge Society, Knowledge Economy, E-governance, ICT for development, and innovation for development. He founded and directs FRA's International Knowledge Economy Program (IKEP), working with multilateral and bilateral cooperation to support development projects where ICT, innovation and the principles of the Knowledge Economy can be instrumental for achieving socio-economic growth. He is also the founder of the "ICT for Development International School" or ICT4DEVIS a higher education summer program focusing on training on ICT for development, hosted by prestigious international Institutions and Universities. At FRAmericas, Mr. Piaggese brings into bearing his experience in the private sector (Telecom Italia) and with multi-lateral development organizations (Inter-American Development Bank as Chief of its ICT4DEV Division), and previously, the United Nations' Food & Agriculture Organization).



Gilbert Silvius is a professor at LOI University of Applied Sciences in the Netherlands and principal consultant at Van Aetsveld, project and change management. He holds masters' degrees from Erasmus University Rotterdam and the Catholic University Leuven in Belgium and a PhD in information sciences from Utrecht University. Gilbert worked for over 15 years as a consultant and project manager in the field of business and IT, before joining the academic community in December 2002. His work focuses on the fields of information management and project management. Gilbert is a member of the AIS, IIMA, IPMA and PMI. He has published over 70 peer reviewed papers at conferences and in journals.

Biographies of Presenting Authors

Luay Anaya is a PhD Research Fellow in Information Systems at University of Agder in Norway. He received his masters degree from the British University in Dubai. Anaya is conducting research about enterprise systems. Before that, Anaya worked as an IT practitioner for many years in United Arab Emirates, Palestine, and Jordan.

Evangelia Angelopoulou is a university graduate in Informatics with an MSc in Information Systems. She has combined technical background with business while working for 7 years in Financial Institutions. Having participated in projects as a developer, analyst, IT consultant and project manager and in academic research on SOA business values has a mixed technical and business profile.

Farshid Anvari BE, GradDipSc, GradDipIT, MACS has 17 years of experience in software engineering and 12 years of experience in Power Engineering, specialising in hydro system modelling and reliability studies. His research interests include reflective practices, cognitive load, user-centered design, persona ontology and architecting systems that are economical, robust and reliable.

Marie-Therese Christiansson is a PhD, Assistant Professor in Information Systems at Karlstad University, Sweden. Her research interests are in the area of Business Process Management and e-Service innovations. Based on research in public as well as private organisations from a change management perspective, she develops a lightweight process methodology to facilitate process-orientation in practice.

François Deltour is Assistant Professor in Business Administration and Information Systems Management at Mines de Nantes Engineering School (France). He is a member of the LEMNA Research Centre. His research interests are on IS implementation and assessment issues and on knowledge management practices. He has also published several papers focused on societal challenges of IS.

Brian Dempsey spent 30 years as a practitioner in the ICT industry in Ireland. Returned to academia in 2010 and is currently in final year of study for a PhD at the Business School, Trinity College Dublin. Brian holds a BSc. and MA from Trinity College Dublin and an MBA from the Open University.

Yavuz Ercil graduated from Turkish Military Academy in 1991. He got his PhD from Gazi University, Turkey in Strategic Management. He has been lecturing in different universities in Strategic management, System Dynamics, Communication Techniques. He has been teaching in Baskent University, Faculty of Communication since 2012.

Mike Hart is Emeritus Professor of Information Systems and Senior Scholar at the University of Cape Town, South Africa. The main focus of his research and teaching is business intelligence and analytics. He is rated as an established researcher by the National Research Foundation of South Africa.

Dr Ciara Heavin is a college lecturer in Business Information Systems. Research interests include the development of ICT industries, primarily focusing on Ireland's software industry specifically investigating knowledge management (KM) in software SMEs. Reviewer for a number of top IS journals and conferences, Managing Editor of the Journal of Decision Systems since November 2011.

Miles Herrera is IT Governance Consultant working in the Financial Industry in the Netherlands where he is currently involved in COBIT implementations and Lean Six Sigma Improvement programs. He also follows a part-time executive PhD program at the University of Twente. Miles holds a university degree in Business Administration from the university in Rotterdam in the Netherlands.

Annika Holmbom is a PhD student in Information Systems at the Department of Information Technologies at Åbo Akademi University and Turku Centre for Computer Science (TUCS). Her main research interest is in customer profiling. She is finalizing her doctoral thesis "Customer Profiling using Data Mining Methods – From vast amounts of data to actual knowledge".

Carlos Juiz is IEEE Senior Member, ACM Senior Member, ISACA Academic Advocate and Associate Professor at University of the Balearic Islands, Palma de Mallorca, Spain. He was visiting researcher at University of Vienna and visiting Associate Professor in Stanford University. He is team leader of Governance of IT at AENOR, the Spanish body in ISO/IEC.

Jwan Khisro has a master degree in informatics and is part of the IT management research group, Department of Applied IT, Gothenburg University, Gothenburg, Sweden. Her research interest is in the field of informatics; the management of coordinated development of business, information system and knowledge in healthcare sector.

Sungtae Kim is an Associate Research Fellow in Korea Institute for Defense Analyses(KIDA). He is also a Ph.D. student. He received M.S. and B.S. degree in Computer Science & Engineering from Seoul National University and Inha University respectively. His research interests include information system evaluation, informatization evaluation, ICT policy, supervision of ICT project and bigdata.

Adnan Kraljić is PhD candidate at Ghent University, Belgium. He is also a Senior SAP Consultant with 6 years' experience and 11 full-cycled SAP ERP implementation projects. Adnan's research concerns MIS and ERP Implementation methodologies and frameworks. In particular, interests are: ERP implementation, ERP implementation frameworks and methodologies and Software metrics.

Tarik Kraljić is PhD candidate at Ghent University, Belgium. He is also a Senior SAP Consultant with 6 years' experience and 7 full-cycled SAP ERP implementation projects. Tarik's research concerns MIS and ERP Implementation methodologies, business process modelling frameworks and business process management in general.

Dmitry Kudryavtsev is an Associate professor of Intelligent Computer Technologies department at St.Petersburg State Polytechnical University since 2006. Associate professor (part-time) at Graduate School of Management St. Petersburg University since 2014. Senior consultant and methodologist at Business Engineering Group SPb since 2003. PhD, SPbSPU, 2009. Topic: "Models and methods of ontology-based knowledge processing in the field of enterprise engineering"

Michaël Le Duc, Ph.D. from Stockholm University School of Business, is assistant professor in business and information systems at Mälardalen University, Västerås and Eskilstuna, Sweden. He is member of the EMEA advisory council for the Microsoft Dynamics Academic Alliance. His research interests include implementation of ERP as well as local and regional development.

Thomas Lind is currently a PhD student in Computer Science with a specialization towards Human-Computer Interaction at the Department of Information Technology, Uppsala University. In his research he is studying the complexities involved in changing sociotechnical systems, focusing on the applicability of a sociotechnical perspective for facilitating user adoption of IT in large governmental organizations.

Kim Maes, is a PhD candidate at University of Antwerp (IWT Fellow). He is affiliated with Antwerp Management School and the ITAG Research Institute as IT management researcher. His work focuses on business case use, IT value management, IT governance and alignment, and appeared in international peer-reviewed journals and conferences.

Prof Nico Martins holds a PhD in Industrial Psychology and is with the Department of Industrial and Organisational Psychology at The University of South Africa and specializes in the field of Organisational Psychology. He has published several articles and presented papers at several national and international conferences in organisational culture/climate, organisational trust, organisational diagnoses and research .

Alvaro Martins is BA PhD student from EAESP - Fundação Getulio Vargas, Brazil. He got a master's degree in 2010 and graduated in BA in 1987. He has over 27 years of experience in Business, with an emphasis on IT channels and business development through Latin America. He is currently MBA Professor at FGV Brazil.

Porya Mohajer Soltani is a research student at the University of Gothenburg and Chalmers University of Technology in the field of Informatics. His field of research is digital innovation and its application. He also holds a BSc Business Management from the University of Essex.

Dr. Gunilla Myreteg is assistant professor at Uppsala University, Sweden. Her research interests include how information technologies are designed and used in organizations for a variety of information purposes. Current research activities involve issues regarding e-health services, work environment and IT, and work roles, professions and IT.

Nazareth Nicolian has over 25 years of managerial and consulting IT experience from PWC, Walt Disney, and Universal Studios. He also has 11 years of experience in chairing and lecturing IS programs. He is President and founder of the CIO Lebanon Association, with an MS degree in IS from Pittsburgh, and a PhD in Business Systems from Portsmouth.

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Towards a Culture of Engagement Leveraging the Enterprise Social Network

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Abstract: Employee engagement is defined as “the harnessing of organisation member’s selves to their work roles; in engagement people employ and express themselves physically, cognitively, and emotionally during role performances.” This research regards employee engagement as a three part concept composed of a trait (personality/cognitive) aspect, a state (emotional) aspect, and a behavioural aspect. Gatenby *et al.* (2009) propose that employee engagement is fostered by creating the desire and opportunity for employees to connect with colleagues, managers and the wider organisation. This standpoint is supported by Kular *et al.* (2008) who state that the “key drivers of employee engagement identified include communication, opportunities for employees to feed their views upward and thinking that their managers are committed to the organisation.” Further indicators of employee engagement include strong leadership (particularly in the form of servant leadership), accountability, a positive and open organisational culture, autonomy, and opportunities for development. In order to produce a theory of enterprise social networking sustaining and growing a culture of employee engagement a rigorous grounded theory methodology coupled with a case study methodology was applied. The case study methodology was used to identify a suitable research site and interesting participants within the site while the grounded theory process was used to produce both qualitative (through interviews) and quantitative (through a survey) data sets in a suitability rigorous fashion. The corroborative data was then used to discover and define the emergent theory. Based on the analysis of the quantitative and qualitative data, it is proposed that an enterprise social network sustains and grows a culture of employee engagement by positively impacting the organisational society and positively impacting the way that organisational members work and develop.

Keywords: employee engagement, social networking

1. Introduction

Employee engagement is defined by Kahn (1990: 694) as “the harnessing of organisation member’s selves to their work roles; in engagement people employ and express themselves physically, cognitively, and emotionally during role performances.” Blessing and White (2011:6) describe five levels of engagement. The highest consisting of fully engaged employees whose personal interests align with the interests of the organisation and contribute fully to organisational success. A level down are the almost engaged where employees are high performers and are reasonably satisfied with their work. Below this are the honeymooners and hamsters, the honeymooners being employees happy to be in the organisation but who haven’t had the opportunity to make a contribution and the Hamsters described as employees who choose to work on non-essential low value tasks. The next level down is the crash and burners, a group defined by high organisational contribution but who suffer from low satisfaction. The crash and burners feel disillusioned and exhausted , being high contributors , but are not meeting many of their own goals. Finally the disengaged are those employees with low to medium satisfaction and low to medium contribution. This group is the most disconnected from organizational priorities, often feel neglected and do not meet their own definitions of success (blessing White, 2011:6). Figure 1, illustrates the BlessingWhite (2011: 5) description of full engagement:

2. The business proposition

An actively engaged individual takes calculated risks and is always learning, feels stretched by their work, takes personal satisfaction from the quality of their work, and finds work to be stressful but rewarding and fun (Rogal and Warner, 2010: 22). An actively disengaged employee is bored and frustrated by their work, is publicly negative about the company, is always looking for someone to blame, and is likely to be searching for alternative employment (Rogal and Warner, 2010: 22). Research has shown that engaged employees have an unequivocal positive impact on business outcomes (MacLeod and Clarke, 2009: 3; Kular *et al.*, 2008: 1; Forbringer, 2002: 1). These impacts include increased profitability, business performance, employee retention, competitiveness, productivity and earnings per share in publicly traded companies (MacLeod and Clarke, 2009: 3; Kular *et al.*, 2008: 1; Forbringer, 2002: 1). Not only are positive increases shown, but decreases in

absenteeism, inventory shrinkage, safety incidents and quality defects can also be observed (Forbringer, 2002: 1).

Five levels of employee engagement



Figure 1: The five levels of employee engagement (BlessingWhite, 2011: 6) [Copyright © BlessingWhite, Inc. All Rights Reserved.]

3. Engagement drivers

Employee engagement is fostered by creating the desire and opportunity for employees to connect with colleagues, managers and the wider organisation (MacLeod and Clarke, 2009: 8). This standpoint is supported by Kular *et al.* (2008:1) who state that the “key drivers of employee engagement identified include communication, opportunities for employees to feed their views upward and thinking that their managers are committed to the organisation.” Further indicators of employee engagement include strong leadership (particularly in the form of servant leadership), accountability, a positive and open organisational culture, autonomy, and opportunities for personal development (Kular *et al.*, 2008: 11). Robinson *et al.* (2004: xii) argue in favour of good line management, two-way communication, effective internal co-operation, a development focus, commitment to employee wellbeing, and clear HR policies and practices, as the key drivers of engagement. Having identified psychological, physical or organisational conditions necessary for engagement to exist, explaining why individuals respond to these conditions with varying degrees of engagement may be explained through Social Exchange Theory (SET) (Saks, 2006: 603).

SET involves a series of interactions that generate obligations (Cropanzano and Mitchell, 2005: 874). These interactions are interdependent (outcomes are based on a combination of parties’ efforts) and rely on the actions of another person (Cropanzano and Mitchell, 2005: 874). These interdependent interactions have the potential to create high-quality relationships, but only under particular circumstances (Cropanzano and Mitchell, 2005: 874). One of the pillars of SET is that relationships evolve over time into trusting, loyal and mutual commitments (Cropanzano and Mitchell, 2005: 875). From an EE standpoint, trust is important for an engaged employee (BlessingWhite, 2011: 15). The most significant trust relationship for creating engagement in an organisation is between the employee and the executive rather than the employee and their immediate manager (BlessingWhite, 2011: 15). A high-quality relationship can only be built if the active parties conform to certain rules of exchange (Cropanzano and Mitchell, 2005: 875). The most important and beneficial rule is that of reciprocity (Cropanzano and Mitchell, 2005: 875). Within the workplace there are two types of reciprocal relationships: exchange and communal relationships (Cropanzano and Mitchell, 2005: 882). Exchange relationships demand repayment within a particular time frame, involve the exchange of economic or quasi-economic goods, and are motivated by self-interest (Cropanzano and Mitchell, 2005: 882). An example of a workplace exchange relationship would be the economic relationship between an employee and the company for which they work. An employee works for a company in exchange for money, reciprocally, the company

demands time and expertise from the employee in exchange for the money. Communal relationships are more open-ended and less time specific, involve the exchange of socio-emotional benefits, and emphasise the needs of the other party (Cropanzano and Mitchell, 2005: 883). A workplace example would be a manager taking the time to recognize, without an economic exchange, the contributions of the employees under their charge. This recognition could be as simple as a pat on the back or the giving of an employee of the month award.

Failure to meet the obligations of the exchange relationship will erode the quality of the relationship between the reciprocal parties (Dabos and Rousseau, 2004: 52). Frequent communication, sharing of information and a common frame of reference generally creates a high level of perceived and objective agreement on the obligations between the reciprocal parties (Dabos and Rousseau, 2004: 55).

Reciprocity, or payment in kind, is a bidirectional transaction, where both parties' actions are dependent on the behaviour and actions of the other (Rousseau, 1989: 128; Cropanzano and Mitchell, 2005: 876). Since the 1960's, reciprocity has been used to explain positive employee behaviour and the formation of positive employee attitudes (Settoon *et al.*, 1996: 219). In the 1980's, reciprocity was also used to explain organizational loyalty as well as positive employee behaviours that were neither formally rewarded, nor contractually enforceable (Settoon *et al.*, 1996: 219). Research suggests that positive, beneficial actions directed at employees by the organization or its representatives, will create obligations, that the employee will satisfy with positive, beneficial behaviours directed at the organization (Settoon *et al.*, 1996: 219).

As already stated, one of the key drivers of employee engagement is 'connection' (MacLeod and Clarke, 2009: 8). According to Deloitte (2009: 8), the three most important connections for optimal role performance are: connecting people in ways that promote development; connecting people to a sense of purpose; and connecting people to the resources that they need to perform their roles. Deloitte (2009: 14) further define the mechanisms through which these connections can be made. For the purposes of this paper, the following areas are addressed: collaborative tools, stimulating high-quality relationships, and cultivating communities (Deloitte, 2009: 14). Deloitte propose that the tool through which these mechanisms are best delivered is enterprise social networking (Deloitte, 2009: 21).

4. Social networking

The internet, and more recently Online Social Networking (OSN), has been shown to supplement and sometimes replace face-to-face interaction in creating social capital (Wellman *et al.*, 2001: 444; Ellison *et al.*, 2007: 1146). OSN's have been associated with the formation of 'weak ties' which allow for the creation of larger networks of loose relationships and provide access to resources (Ellison *et al.*, 2007: 1146). This creation of large, loose networks of relationships is directly supportive of the 'connections' which form the basis for employee engagement as proposed by MacLeod and Clarke (2009:8).

One of the mechanisms through which Enterprise Social Networks creates engagement is proposed to be social capital. Social capital is defined by Nahapiet and Ghoshal (1998: 243) as "the sum of the actual and potential resources embedded within, available through, and derived from the network of relationships possessed by an individual or social unit. Social capital thus comprises both the network and the assets that may be mobilized through that network." Social capital has been shown to increase organizational commitment, provide the ability to 'mobilize collective actions', and promote psychological well-being (Ellison *et al.*, 2007: 1145-46). Any lack of social capital can be associated with social disorder, reduced organizational participation and distrust between community members (Ellison *et al.*, 2007: 1145). The resources which accrue through social capital to members of the community include: access to shared and private information, relationships, and the capacity for group action (Ellison *et al.*, 2007: 1146). Based on the resources that social capital provides, improvements in personal and organizational innovation, learning, decision-making and problem-solving may be experienced (Deloitte, 2009: 10).

5. Research aim and goals

The company in which this study was conducted is a private IT consulting organisation. The organisation began implementing enterprise social networking in 2010 by means of the customizable Yammer software tool, described as a "Facebook for business".

Three main research goals were identified:

- Propose a survey tool that will be a measure of engagement.
- Determine the current employee engagement levels in a selected South African private sector company currently making use of social networking using the employee engagement survey created in goal 1.
- Generate a theory of how enterprise social networking generates and/or sustains a culture of employee engagement.

6. Methods, procedures and techniques

It is a universal understanding that the research approach must suit the research problem. In the case of this research work the research problem was defined as being to "...provide a theory of enterprise social networking that generates and sustains a culture of employee engagement within a chosen South African private sector company." Given that information systems (IS) research is described as a "...nexus for many diverse research fields and disciplines" (Mingers, 2001) and the focus of this research is on a *culture* of engagement, the authors believe that interpretivism with its clear emphasis on social inquiry best served this research work. To facilitate the research effort a combination of a case study methodology and grounded theory was used. The structure of the amalgamation was based upon the work of Andrade (2009) who proposes that such an amalgamation will provide an academically rigorous platform for the generation of theory. Andrade (2009) describes his grounded theory process as follows:

- **The Theory Building Exercise:** Researchers can take their prior knowledge into account, either from the existing literature (*a priori*) or from their previous experience (*a posteriori*) (Andrade, 2009: 46). The literature review acts as a sensitizing device that will allow for the guided and grounded generation of original categories (Andrade, 2009: 46).
- **The Unit of Analysis and Theoretical Sampling:** The case study methodology helps the researcher to define the temporal and spatial boundaries of the research; the so called research context (Andrade, 2009: 51). The first step of the research process is to define the case design and the unit of analysis (Andrade, 2009: 51). Theoretical sampling refers to "...being flexible to determine... individuals to be included in the research, those which provide appropriate comparable data [and might prove valuable] for generating categories" (Dey, 1999: 5).
- **Corroboration and Chain of Evidence:** Summarising and distilling Andrade's (2009: 52) narrative of this section reveals that he corroborated his work by making use of both primary and secondary sources of data.
- **Coding, Saturation and Generalisation:** While gathering the case study data, the first phase of analysis is theoretical coding (Andrade, 2009: 52). The coding process begins with initial coding, described by Andrade (2009: 52) as breaking the data analytically and running the data open while seeing actions in each segment of the data. This process is synonymous with the open coding technique described by Goulding (2005: 296) as a line-by-line analysis for words or sentences with theoretical meaning which help the researcher to identify initial explanatory concepts. Focused coding, follows initial coding and emerges from the most significant and/or frequent initial codes in order to sort and organise large amounts of data (Charmaz, 2006). (Andrade, 2009: 53). Andrade (2009: 53) then compared the emergent focused codes to one another in order to determine conceptually similar and dis-similar focused codes to discover the emergent categories. The iterative process of initial coding, focused coding and category discovery would end when theoretical saturation is achieved (Andrade, 2009: 53); a point where no additional data that can be found whereby the sociologist can develop the properties of the categories (Glaser and Strauss, 1967: 61). Once the categories are theoretically saturated, the core themes of the data can then be determined which are used to explain the research problem and produce the theoretical generalisations (Andrade, 2009: 53-54).

6.1 Developing a survey tool

In order to corroborate results, multiple data collection methods were employed. In the first phase of data collection a quantitative survey tool was rolled out to all of the case's members; some 153 potential respondents. The survey tool originated from Macey and Schneider's (2008), proposed framework for defining engagement which includes trait engagement, state engagement and behavioural engagement. Macey and Schneider (2008) proposed that trait engagement predisposes one toward a state of engagement which engenders behavioural engagement. See figure 2. below.

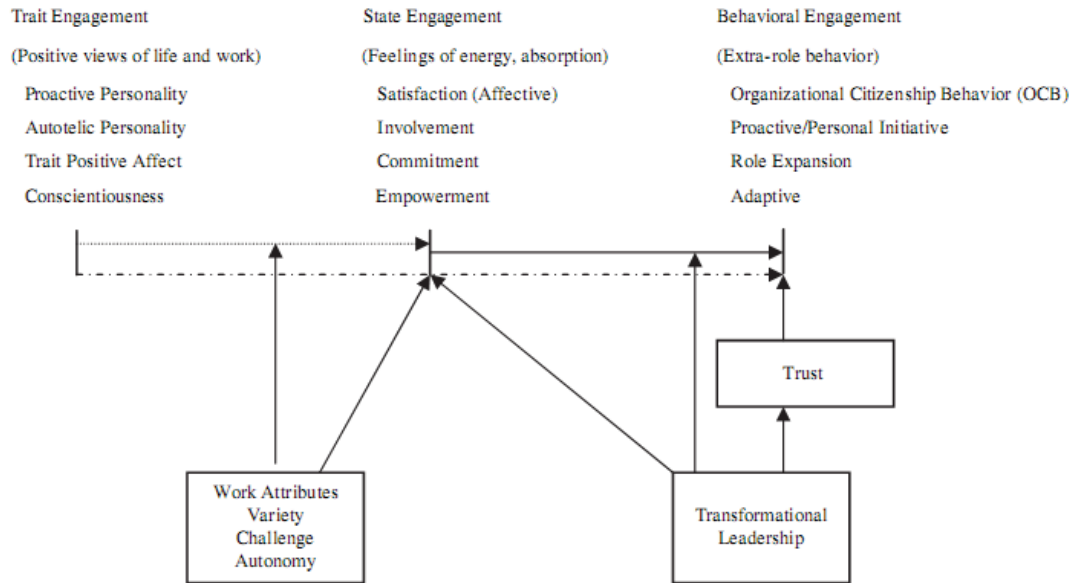


Figure 2: Framework for defining employee engagement (Macey and Schneider, 2008)

The Gallup Q¹², the IES Employee Engagement Survey, the Utrecht Work Engagement Scale (UWES) and the Positive and Negative Affect Schedule (PANAS) were considered as potential instruments for measuring employee engagement based on Macey and Schneider’s framework. A detailed analysis of the respective instruments suitability for measuring employee engagement is a paper in itself and for reasons of brevity cannot be detailed here. However, Gallup’s Q¹² was found wanting in terms of Macey and Schneider’s (2008) engagement framework and instead was considered as a measure of the antecedents of EE, or measuring an environment conducive to a culture of EE. The Institute of Employment Studies (IES) 12 statement employee engagement survey was found to be a superior measure over the Gallup Q¹² instrument as it provided a clear emphasis on how employees work within the organisation, indicating how behaviourally engaged they are. The IES instrument fell short, however, on trait engagement, establishing how employees feel about life at work. This was problematic as employee’s beliefs, if found to be generally positive or generally negative, would give an indication of their trait engagement and hence their propensity toward a state of engagement. For this reason, IES questions relating to BEHAVIOURAL engagement, eight of the twelve questions, are deemed suitable for this research. The third instrument considered for measuring employee engagement within the chosen case organisation is the Utrecht Work Engagement Scale (UWES). The UWES is based on their definition of employee engagement described as a positive and fulfilling work-related psychological state that is characterized by vigour, dedication, and absorption (Schaufeli and Bakker, 2003: 4-5). Macey and Schneider (2008: 6) suggested that state engagement is best defined as a combination of states of attachment, absorption and enthusiasm, reasonably proposed as synonyms for the Schaufeli and Bakker (2003) definition terms. The Macey and Schneider (2008) and the Schaufeli and Bakker (2003) definitions of state/emotional engagement are congruent and for that reason may be regarded as a perfect fit as a measure of STATE engagement for the purposes of this research. The final two instruments evaluated for the purposes of measuring employee engagement is the Positive and Negative Affect Schedule (PANAS) developed by Watson et al. (1988) and a variation of this instrument, the Internationally Reliable Short-Form of the Positive and Negative Affect Schedule (I – PANAS – SF) as developed by Thomson (2007). The PANAS offers a strong relationship with the concept of engagement, in particular that of trait engagement. Macey and Schneider (2008: 19) proposed trait positive affect (PA) as a ‘precise’ definition of an engaged individual; in this way, trait PA is the tendency to regularly experience PA as a state (Macey and Schneider, 2008: 19). Trait PA serves as a frame through which work experiences are perceived and dictates how an individual will behave in response to these experiences (Macey and Schneider, 2008: 20). What Macey and Schneider (2008) propose is that generalised positivity (trait PA) will likely generate a state of engagement and the state of engagement will then produce positive organisational behaviours (i.e. behavioural engagement). While the original PANAS criticized for the redundancy of items in the measure as well as the ambiguity or incoherency of certain items in different cultural contexts, the Internationally Reliable Short-Form of the Positive and Negative Affect Schedule (I – PANAS – SF) as created by Thompson (2007) addressed these concerns and was ultimately deemed as the appropriate instrument for measuring TRAIT engagement in this research work.

6.1.1 Survey results

The survey was made available for a period of three weeks during August 2012 after which time 118 responses were received; 77% of the case's total population. The quantitative results of the survey showed a positive correlation ($r = 0.573829476$) between behavioural engagement and state engagement after removing three outliers. A t-test performed on the data showed the correlation coefficient to be statically significant at $\alpha=0.01$.

Macey and Schneider's (2008) proposed model of employee engagement put forward that state engagement engenders behavioural engagement. The intention of the quantitative phase of the research was to determine whether or not a culture of engagement exists within the chosen case. To determine whether the culture exists, it was shown that state and behavioural engagement, as determined by the survey instrument, were positively correlated within the case context.

The mapping result is depicted over page and is an engagement map that provides a pictorial view of the case's culture with regard to employee engagement. Individuals can be categorised into one of five engagement levels: the engaged, the almost engaged, honeymooners and hamsters, crash and burners or the disengaged. This categorisation was subjectively formulated by the researcher and is based on a combination of the individual's results from the state engagement section and the behavioural engagement section of the survey.

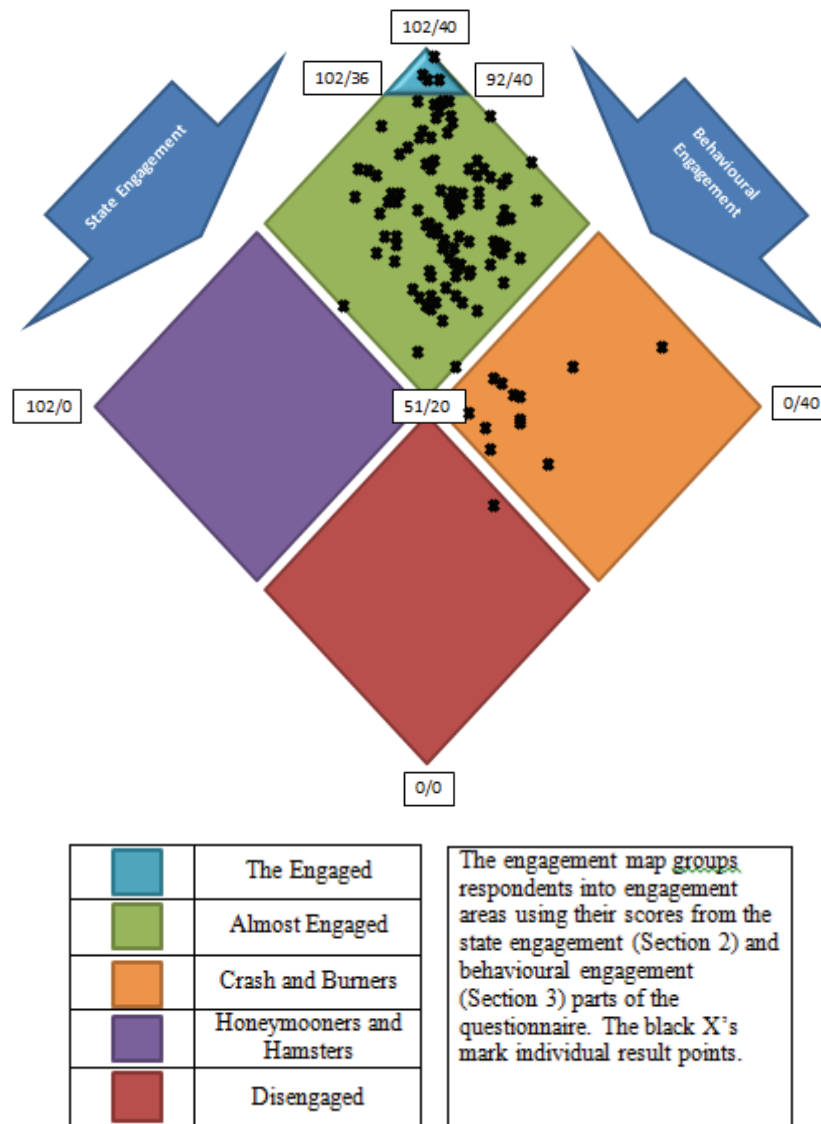


Figure 3: Engagement map

6.2 Defining initial and focus codes

Once the engagement map had been created it was possible to identify theoretically interesting cases within the case's population. In order for the researcher to observe the working environment and the individual's natural settings, the interviews were conducted face-to-face. The interview process produced codes and categories that can be used to generate theory. Based upon the grounded theory methodology proposed by Andrade (2009), the coding results were as follows:

6.2.1 Initial codes

ESN provides strong sense of purpose for new members, educates new members, ESN is the 'go to' virtual person for new members, new members don't have to constantly ask questions of their immediate colleagues, ESN replaces the need for other socialization techniques, understand where you stand, ESN provides sense of community, very team oriented, people within the company are sociable, ESN gives all members a voice, members are not afraid to share their opinions, members encourage one another, members behave like all input is very valuable, members share what is important to them, develop more authentic working relationships, ESN sustains positive emotional states, access to larger pool of people, awareness of events within the community, desire to be a part of the community, ESN positively impacts behaviour, asynchronous following limits information overload, group conversations, cost of communication is low, everyone makes use of the ESN, varying degrees of use of the ESN, neural network, Relationships are more personal and better developed despite dislocation, people are not in the office so ESN is needed, aware of current events, ESN is a useful source of information, best resource within the company, members can enter a client environment knowing where they stand and what is required, members are better prepared for challenges, members have greater confidence and do not require constant validation, linking information to purpose through tags, company goals are tracked on the ESN, company goals are made visible on the ESN, better understanding of the client environment, ESN still needs to develop a culture of tagging, not everything is tagged, tags provide greater transparency in decision making, information can be found faster, lack of integration with data repositories, high standards of output, tracking performance targets, receive feedback on career progress, share feedback for other members, comments associated with recognition are valuable.

6.2.2 Focused codes

Socialization, community building, impact on dislocation, information access, performance management, organizational learning, contribution and accountability, recognition and collaboration.

Table 1: Focus codes and categories

Focused Codes	Category
Socialization Community Building Impact on Dislocation	People Impacts
Information Access Performance Management Recognition	Job Impacts
Contribution and Accountability Organizational Learning Collaboration	Culture Drivers

6.2.3 Results of interview process

The first and most critical question is: does the ESN generate and/or sustain a culture of employee engagement? The answer is yes; it does sustain and grow the case's culture, the mechanisms of which were discovered through the interview process. The reason that the ESN sustains and grows the culture of engagement rather than generating it is because some of the key drivers of engagement occur outside of the ESN. The most important of these drivers, as determined through the interviews, is that of the recruitment practices which ensure value compatibility.

In the grounded theory methodology, the categories identified are the building blocks of theory. The ultimate aim of this research is to produce a theory of enterprise social networking that generates and/or sustains a culture of employee engagement. Three categories were identified from which the research themes can be

extracted: people impacts, job impacts and culture drivers. People impacts is an umbrella term for those codes which refer to direct ESN impacts on the organisational community. The next category is job impacts which refer to specific task related processes that the ESN has a profound impact upon. The final category is that of culture drivers. This category encompasses those codes which are directly supportive of the culture of engagement; they are sub-cultures supported by the ESN that underpin the culture of employee engagement. From these categories the themes of the research can be found and used to generate the theory. The first theme identified is the ESN's positive impact on the society of the organisation. This theme incorporates the people impacts and the culture drivers categories. This theme explains how the ESN is directly supportive of and is a key feature of the society of the case company. Since its introduction in 2010, the ESN has become an important driver and sustainer of culture within the case, made apparent through the interview process. It was many times stated by interviewees that the ESN is a critical part of their daily lives allowing them to communicate regardless of location, collaborate on a grand scale and remain informed.

The second theme is composed of the job impacts category. This theme is the impact that the ESN has on the way that people work and develop. Through the interview process it was made apparent that the ESN has become a key feature not only of community life but also of work life. The ESN allows organisational members to integrate who they are as people with the work that they do within the organisation. The result is a community of contribution that resides within a culture of employee engagement. It must be noted at this point that the ESN is by no means perfect in supporting the organisational culture. It was made certain that many improvements can be made to the ESN and members' use of it. Particular areas for improvement were the recognition system which a few of the interviewees felt held little meaning for those who are not new to the organisation if the system does not have some form of economic value. Certain aspects of information access were also criticized with interviewees lamenting the lack of integration of data repositories with the ESN, limiting or crippling ease of information access. An almost universally criticized aspect of the ESN and the corporate culture was transparency of decision making with many individuals being unable to fathom the rationale behind decisions made at the top level. Tags to organisational objectives were touted by a few as the answer to this problem but they and other interviewees did point out that tagging of information on the ESN has not been consistent and needs to become a part of the organisational culture.

Despite these shortcomings all interviewees felt that the ESN was a critical part of their organisational life and plays a key part in the way that they feel (state engagement) and the way that they behave (behavioural engagement). Making use of the two identified themes the theory of enterprise social networking sustaining and growing a culture of engagement is given as follows:

An enterprise social network sustains and grows a culture of employee engagement by positively impacting the organisational society and positively impacting the way that organisational members work and develop.

7. Conclusion

In conclusion, the research found that an enterprise social network does sustain and grow a culture of employee engagement within the chosen case. A theory was then detailed which states that, "An enterprise social network sustains and grows a culture of employee engagement by positively impacting the organisational society and positively impacting the way that organisational members work and develop." The ESN sustains the culture of engagement by incorporating recognition and performance management aspects, enabling easy access to information, socializing new members, building community and negating the impact of member dislocation. Further to these processes the ESN supports three sub-cultures that have been found to positively impact employee engagement. These three sub-cultures are: collaboration, learning, and accountability and contribution.

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Assessing the Business Benefits of Service Oriented Architecture: A Case Study in The Banking Sector

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Abstract: The business value generated by IT has always been a major research topic. Since service-orientated architecture has become a very popular approach for building modular and distributed systems as well as achieving integration in heterogeneous environments, many supporters of SOA claim that it can achieve multiple business benefits. In this paper we initially present a SOA definition and a literature review on domains related to IT business value and Information Systems evaluation. We then propose a framework of SOA business benefits derived from academic and industrial publications as well as our professional experience. The framework is validated through a case study in a large corporation of the Greek banking sector. Finally, we discuss research conclusions, assumptions, limitations and possible future research steps.

Keywords: service oriented architecture, IT business value, SOA case study

1. Introduction

We have witnessed a paradigm shift from monolithic to client-server and afterwards to distributed and Service-Oriented Computing. Service-Oriented Computing is a new computing paradigm that utilizes services as the basic constructs to support the rapid and low-cost development and composition of distributed applications even in heterogeneous environments. As Kontogiannis et al. remark (Kontogiannis 2007), there is a gradual evolution even inside the Service-Oriented Paradigm itself. Regarding SOA, there is no single definition that has been unanimously agreed upon. Several definitions were published by different standardization groups (OpenGroup, W3C e.t.c.), vendors (IBM, TIBCO, SUN etc.), business analysts and academic researchers (M.Papazoglou and others), ranging from a high-level business view to implementation aspects.

In this paper, summarizing the most representative concepts, we define SOA as an architectural style for design and development of information systems and systems integration, based on the model of service provider – broker – consumer. Its set of principles, policies, practices and frameworks, describes the interaction and lifecycle of loosely coupled services in a way mapping their infrastructure to business processes and goals. Services are autonomous software entities, interoperable, location transparent, platform/language independent. They provide self-contained business logic published under an abstract, network addressable, public and dynamically discoverable interface. Their provision and consumption may be subjected to a Service Level Agreement contract and be under the control of different ownership domains. Services' functionality can be exposed from existing systems, purchased from third parties or developed from scratch. Two of the most prominent technologies that implement SOA are Web Services and Enterprise Service Buses.

The purpose of this paper is the development and validation of a framework assessing the business value of SOA. Reviewing the academic and industrial literature on SOA, IT business value and Information Systems evaluation, we present a theoretical framework of SOA business benefits. Finally, we follow a case study approach for the empirical validation of SOA business benefits and discuss research results and possible future steps. The structure of this paper is as follows: In section 2, we present the theoretical background in terms of IT business value and projects evaluation. Section 3 describes the business benefits of SOA and links them to the IT value background theory, also mentioning known drawbacks of SOAs. Section 4 refers to the research methodology followed for validating the SOA business impact, while in Section 5 we present the SOA case study. Finally, the conclusions section provides the summary of our research, including considerations for future research.

2. Theoretical background

The evaluation process of an IT investment can combine qualitative and quantitative methods. In order to be complete, it should expand in every aspect of an information system assessment such as Product Evaluation (quality, appropriateness of architecture and technical metrics), Process Evaluation (maturity of existing methodologies, best practices, implications in working patterns, reorganizations that might be needed) and Project Evaluation. Product evaluation is a similar notion with quality. Quality is defined as a degree of excellence and in case of software systems and architectures it can be broken down into a set of component quality attributes according to the McCall Model based on ISO/IEC 9126 (Jain 2007):

- Revision: maintainability, flexibility, reusability, testability
- Transition: portability, scalability, adaptability, interoperability
- Operations: security, reliability, performance, functionality, usability

Measuring IT implementations quality is common among literature especially for ERPs (Chien 2007). Project evaluation is a similar notion with business value, since it refers to costs and benefits. In this paper we focus on this part of evaluation process, where all the tangible, intangible benefits and costs are taken into consideration (Mende 1994). IT Business benefits can be widely categorized in five categories (Song 2006):

- Operational: Saving operational cost, shortening turnover, enhancing productivity, improving service quality, etc;
- Management: Optimizing resource and time management, budget and other relevant decision making etc.
- Strategic: Supporting expansion of business in new markets, products or services, external partnerships, adapt to changing business needs and provide strategic advantages.
- Fundamental interest of IT: Improving the infrastructure flexibility, ease of use, saving IT costs, enhancing capacity of IT, etc.
- Organizational: supporting the re-formation of the organizational structure, promoting training and improving skills of staff, promoting organizational culture etc.

The impact of IT investments on organizational structures, business processes efficiency and management is extensively pointed out by Tzeng et. al in their research work regarding RFID business value (Tzeng 2008). Business value can either derive from cost reduction or revenue increase. In these two categories we can also classify risks and new opportunities respectively, since an opportunity generates potential revenue while a risk generates potential cost. According to Soh et al., IT can promote business value in the aforementioned areas through a number of ways (Soh 1995):

- IT can reinforce development of new products and services, leading to increased customer satisfaction, new markets entrance, increased market share etc.
- IT can promote Business and IT processes redesign to become more efficient, leading to increased productivity, employee satisfaction, decreased operational costs etc.
- IT may enable organizational decision makers to improve their understanding of markets leading to enhanced decision making process (better sourcing of inputs, better products design, etc.)
- IT may enable flexible organizational structures both intra-organizational as well as with customers and business partners, potentially leading to decreased time in product or service development/delivery, leveraging economies of scale and value chains, etc.

Building IT business value measurement frameworks is popular in industry (Carty 2009). On the other hand, in order to completely determine the way through which IT creates business value, researchers have adopted diverse conceptual, theoretical, analytic approaches and empirical methodologies. The literature includes contributions from several academic disciplines in addition to information systems, including economics, strategy, accounting, and operations research. Melville et al. have produced a holistic integrated theory of IT business value creation, including numerous theories and perspectives in a research effort to present a common framework (Melville 2004). In this paper we focus on the Local Firm (I.) part of business value creation process. National environment seems not to be so relevant in the case of SOA business value. Competitive Environment part (II.) of Melville's model refers to environmental factors that may indirectly impact on IT business value, and since we do not include factors in this research work, we consider it out of scope for this paper.

3. SOA Business benefits: The research question

Liegl argues that the influence of Service Orientation may expand in multiple areas

such as infrastructure, applications, innovation and standards, investment and human resources (Liegl 2007). Öhrström defines business value of SOA as the combination between the given benefits of SOA and the costs of service oriented implementation (Öhrström 2007) (Lagerström 2007). Thus, regarding SOA business value, a lot of different perspectives could be examined. Our proposed framework focuses on business value potentially created by SOA as an architectural approach, due to its inherent characteristics (Table 1) and general theory of how IT creates business value (Section 2).

SOA, based on its definition and literature review, has some specific characteristics (well described by Erl (Erl 2007)), all of which did not co-exist in any architectural style in the past. These are listed in Table 1.

Table 1: SOA characteristics

A ₁ : Interoperability, Platform, Language and Protocol Independence
A ₂ : Location Transparency of Services (indifference whether the services are accessed locally or through a network or Internet)
A ₃ : Loosely Coupling (components interdependence to the least extent)
A ₄ : Dynamic Discovery and Binding of services through Network addressable Interfaces
A ₅ : Self-Containment, Modularity and Abstraction of Business Logic
A ₆ : Business Process Orientation and Composability of services
A ₇ : Contracts/SLAs and QoS requirements assurance

The above attributes result in a set of hypothetical/ claimed business benefits of SOA found in academic literature (Öhrström 2007),(Baskerville 2010), (Kryvinska 2010), (Nasr 2010), industrial publications (IBM 2009),(Gartner 2007),(Classon 2004), (Schmelzer 2005), (WebMethods 2005) and case studies (ESRI 2007), ((Rabhi 2007), (IBM 2005), (Fujitsu 2007) by vendors, consulting companies and other SOA practitioners, as well as SOA books (Krafzig 2004), (McGovern 2006), (Hurwitz 2009), (Bieberstein 2005), (Erl 2005). These benefits, representing our hypotheses, are listed below:

B₁: Support for multiple Channels. Through SOA, companies may use multiple client types to access the same services (e.g. e-banking, m-banking and branch front-end application for a common bank business and infrastructure services) (Ganesh 2004).

B₂: Potential external Service Provision or use of Services provided by Third Parties. Potential outsourcing or use of external services or chargeable provision of internal services to third parties is a known benefit of SOA. A diversity of options for services realization exists including “in house” implementation, purchasing from external providers or outsourcing the implementation. In the opposite scenario, since services are autonomous, self-contained, interoperable and location transparent, an organization may expose its services for external use (defining the pricing, functional and QoS requirements) (McGovern 2006).

B₃: Short Time to Market. New products and services may be quickly launched thanks to the composability of existing services and the limited modifications needed to IT infrastructure.

B₄: Improved Customer Service. A SOA can link disparate business processes and data sources in ways that were impossible due to technological barriers. The sharing of data and composition of workflows can result in a streamlined enriched customer experience.

B₅: Reusability / Reduced Code Redundancy. SOA expands reusability to enterprise scale versus Object Orientation which limited reusability inside a specific technology (e.g. java classes). Users can create new business processes and composite applications from existing services (Orriens 2004). The economics of composite application development improve over time, as companies build and reuse services, creating a service repository which continuously expand (Schmelzer 2005).

B₆: Utilization of Existing IT Assets. Another important aspect of service reuse is leveraging existing / legacy assets. SOA allows legacy code to be wrapped behind interoperable shells and offer its functionality to external consumers (Sneed 2006),(Smith 2007).

B₇: Reduced Maintenance/Modification Costs. Maintaining or modifying a single service is more cost-efficient than modifying the business logic code that is incorporated into multiple applications.

B₈: Access to Diverse Data and Improved Decision Making. Data silos prevent IT from delivering good information quality to the business. Timely access to accurate and consistent information can improve business operations and decision making, produce differentiation from competition, better customer service, increased revenues and market share (Schaffner 2006).

B₉: Regulatory Compliance and Audit Support. Implementing SOA for the purpose of controlling business processes, establishing corporate-wide security, privacy and providing auditable information trails, are examples of ways through which SOA can reduce compliance risks (Schaffner 2006). In SOA, a compliance service could be reused reducing costs while ensuring that standard auditing practices are met (Friedrich 2005). As stated in Redmonk Analyst firm report "Rather than implementing monolithic applications designed to tackle a single regulatory challenge, enterprises should implement a flexible architecture that consumes compliance services " (O'Grady 2004

B₁₀: Lower Costs for Internal Integration and Integration with Business Partners. New application development in a company frequently results in a new isolated piece of IT infrastructure exacerbating the integration problem. Companies can realize significant and immediate ROI from simply moving from tightly-coupled forms of integration (point-to-point interfaces) to loosely-coupled ones (Schmelzer 2005). For companies with a settled SOA infrastructure integrating with a new business partner demands the simple exposure of existing services. Similarly, during mergers or acquisitions a SOA infrastructure will result in quick integration of information systems and promote quick start of operations and competitive advantage (Henningsson 2007). SOA can also help organizations to avoid vendor-lock in having assured interoperability with the existing systems.

B₁₁: Effective Business Process Management and Business – IT Alignment. Business-IT alignment refers to applying Information Technology in an appropriate and timely way, in harmony with business strategies, goals and needs (Luftman 2000). Many approaches to alignment have been spawned in distinct research areas (alignment via architecture, governance or communications) and integrated by Chen in his proposed BITAM-SOA Framework (Chen 2008). Through SOA, IT depicts business processes clearly, emphasizing on alignment and business processes optimization. Moreover, technologies built on SOA (such as Business Activity Monitoring) provide the means of monitoring real-time execution of business processes, providing feedback regarding functionality or QoS.

All the benefits listed and described in this section are correlated in Table 2 with IT business value theory of Section 2.

Table 2: SOA benefits correlation with business value theoretical background

		B ₁	B ₂	B ₃	B ₄	B ₅	B ₆	B ₇	B ₈	B ₉	B ₁₀	B ₁₁
IT to Business Value	New Products/Services	X		X	X							X
	More Efficient Processes			X		X	X	X	X		X	X
	Improved Decision Making								X			
	Flexible Org. Structures		X				X			X	X	X
Benefit Type	Reducing Costs		X	X		X	X	X	X	X	X	X
	Increasing Revenues	X	X	X	X				X			X
Business Area of impact	Operations							X	X		X	X
	Strategy	X	X	X	X							X
	Organization		X			X				X		
	Management								X			
	IT	X	X	X		X	X	X		X	X	X

The correlation points out how these benefits produce business value. For example B₄ “Improved Customer Service” is a possible increasing revenue factor, has strategic impact on the organization and is assigned to the

“New Products/Services” category of business value. The aforementioned benefits are going to be validated through the case study in Section 5. On the other hand, we also list the most known drawbacks of SOAs, mentioned in the literature in order to validate them in Section 5.(Kontogiannis 2007),(Papazoglou 2008), (O’Brien 2007)

- D₁:Security Complexity
- D₂:Performance Issues
- D₃:Transaction Management
- D₄: Testing Complexity
- D₅: Versioning

4. Research methodology

Case studies facilitate a multi-perspective analysis of all factors and their interaction leading to a holistic understanding (Tellis 1997), thus being a popular methodology for validating models in IS research (Tzeng 2008), (Anderson 2005). Considering the nature of the research question, we selected a case study approach to validate the hypothetical SOA business benefits. We chose to study the implementation case in a large corporation in Greek banking sector, examining which of the hypothetical business benefits of SOA were achieved and in what extent. The hypothetical benefits as research questions were formulated through a thorough literature review. We also validated known issues of SOA implementations. The second target of our case study was to inspire to us new insights of SOAs not found in the literature (exploratory point of view). The specific case study included multiple points of views and data collection was based on interviews (structured and open questions) with multiple job roles (i.e. technical specialists and the Head of the Enterprise Application Integration department), questionnaires and study of official organizational documents as collection methods proposed in case study research (Yin, 2003). Quantitative metrics of the hypothetical benefits (B_n) was a target for us, but the maturity of the implementation did not allow quantitative results. Thus, qualitative data such as intuitive declarations and experience of SOA stakeholders will be presented. IS case study research though, has known issues regarding generalizability (external validity) and repeatability of outcomes (reliability validity) (Lee 1989). These issues could be addressed in the future by a multiple-cases design or a mixed method approach (Gable, 1994) (e.g. multiple case studies or a supplementary web-based survey in a significant sample of companies).

5. SOA: A banking case study

Company Overview: The Bank belongs to a Group of almost twenty Companies in the Financial Sector, present in the ten countries. With more than 25000 of employees and 82 billion € of assets, the organization is a leader in the Greek Market where it has its headquarters. The Group net income fluctuates around €400m. The company is known for its aggressive strategy and for being a pioneer both in the business and IT area. The IT department consists of about 1000 employees not including the outsourcers. The company’s IT assets include more than 100 software applications of diverse technologies (developed in-house, outsourced or packaged applications), creating a complex heterogeneous environment. The prevalent IT strategy is not to invest into software packages, but to outsource the initial development of IT systems, while keeping the programming know-how to continue with maintenance without external companies’ involvement. In general, the company invests huge budget on flexible IT infrastructures aligned with its strategy. **Project Objectives:** The SOA project was initially triggered by an IT need to replace the obsolete portal of the bank, which addressed serious performance and maintenance issues. The name of the project “Multi-Channel” depicted the vision of a unified back-end infrastructure supporting the different channels of the bank.

The initial goals for the project were to:

- create an organization-wide service repository exposed to all systems/applications, providing information from a single point of access
- provide an abstract, easily monitored and maintainable solution to the integration problem of the bank instead of point-to-point interfaces by encapsulating all heterogeneity of bank’s systems behind a middle-layer

Project Description: The business side was convinced for the need of a new architecture and approved this IT-initiated cost. IBM was selected through an RFP process as the external contractor for the project, resulting in

a project kick-off on September 2006. IBM and IT had the whole responsibility for the initial analysis and design phase which lasted more than 6 months, while business participation was necessary only by the time services started being developed. The project lifecycle process followed the methodology already established by the bank (high level requirements -> application design -> detailed design -> implementation -> testing -> UAT -> roll-out). There was no specific SOA-oriented methodology. The project is still running 7 years later while new services are added to the repository, modifications are performed and new applications are integrated onto the SOA platform. All new systems are connected with the multi-channel infrastructure, while some new applications' business logic is completely incorporated into multi-channel's services and only the presentation layer is maintained separately. The responsibility for the SOA is under a very specific department called "SOA and Enterprise Application Integration Sector", which consists of five developers and their Head and operates without the need of outsourcers. Implementation Approach: SOA was implemented as a multi-layered middleware initially supported by IBM WebSphere ESB:

The Consumer Applications Layer: Client applications, called channels, are numerous and completely heterogeneous. For example, the front-end of the core banking system of the bank is implemented in C++ and progressively transferred to java web-based UI, while the Portal, Loans work-flow, E-banking and m-Banking applications are developed in Java/JSP technologies and numerous other applications are developed in .NET. Network and application protocols are hidden behind adapters that provide the potential to choose a specific protocol (e.g. HTTP, TCP, SOAP) for each request.

The Invocation Layer: The invocation layer consists of sub-layers. There is an initial service called dispatcher, which receives all requests and routes to the appropriate underlying service. The dispatcher communicates with clients using Data Transfer Objects. All requests initially pass through the validation and security layers. Validation layer is responsible to identify the requesting application and manage data filtering policies as well as pre-execution and post-execution steps such as logging activities. Finally, the security layer performs all role-based access rights policies.

The Services Layer: Services are mainly implemented using EJB3 technology. Web services approach, though the most popular SOA implementation choice was rejected by the bank considering the following arguments:

- Complexity of implementation of security mechanisms for Web Services
- Low performance estimation due to the use of XML/SOAP messages
- Versioning problem when updating a WSDL interface

Consequently, IT decided to implement services as Enterprise Java Beans and use adaptors to achieve interoperability, than using standards approach offered by web-services. Application servers used are IBM Websphere and JBOSS, though more and more services are transferred to open source JBOSS in order to eliminate the licensing costs. For services orchestration into business processes no BPEL is used, but building business rules is achieved through ILOG platform. The granularity of services is fine-grained, since each service performs a very specific self-described business activity (e.g. GetAccountBalance_Service).

The Mediation Layer: This layer consists of adaptors, wrappers for COBOL transactions and database related code in order to connect the services layer with the back end systems and data repositories. Databases are decoupled from development due to the use of Hibernate framework.

For each new service need, there is an assessment whether it must be developed from scratch or an existing cobol transaction can be wrapped. If an existing COBOL transaction meets the business need with minor modifications, the second approach is adopted.

The Back-End and Data Layer: This layer consists of legacy code and data repositories. The core database of the bank (DB2 platform) is hosted on AS 400 platform. The multi-channel database (also DB2) is currently hosted on a UNIX server.

Challenges: The effort of migration of SOA infrastructure to open source technologies was not decided at the beginning of the project and thus caused 30% overhead to the project budget, since the code needed serious refactoring. Performance overhead due to multi-channel middleware was measured at 60ms on top of 120ms which is the average response time of a mainframe transaction. This 50% overhead, though considerable, was

considered acceptable, taking into consideration the other benefits. Versioning is another serious issue addressed now through backward compatibility. Every time a service is modified to accommodate new functionality, new input variables are optional in order to avoid errors occurrence to the existing consumers of the service. Transactionality of services flow was perhaps the greatest challenge that should be addressed. When an action is performed using a sequential flow of services that interact with the database, only logging of services activities reveals where a process has been interrupted and indicates necessary actions to maintain data integrity. Database records could not be locked in advance for the whole duration of the transaction “services-flow” to assure transactionality, since this approach could cause serious problems to other applications.

Results: SOA does not intend to replace but to leverage bank’s legacy systems, integrating them with newer technologically advanced assets of the bank. The legacy core system in COBOL code is the most valuable IT asset, since it has been developed and tested by tens of developers for almost 20 years. Regarding SOA implementation costs; we identified tangible costs related to the training of staff, upfront effort to adopt service orientation, licenses of software, administration and governance costs. The most significant costs estimated by the stakeholders are the administration/governance costs and the initial preparation budget, that both seem elevated compared to other projects. We also validated with the stakeholders the known drawbacks of SOAs listed in section 3. The qualitative ratings in terms of significance and of validation (to which degree each drawback has been identified) provided to us are depicted in Table 3. Again the 5-point scale is used (Lowest Value: 1 – Highest Value: 5), outlying that Versioning (D₅) has been the greatest challenge during SOA implementation, while performance and transaction management (D₂, D₃) problems, were not assessed as a remarkable barrier in their whole initiative.

Table 3: Validation of SOA drawbacks

	D ₁	D ₂	D ₃	D ₄	D ₅
Validation Rating	3	2	2	4	5
Significance Rating	4	4	5	4	5

On the area of business benefits the following were considered very important by the stakeholders:

- Reusability of code has become bank-wide and code-redundancy is eliminated.
- SOA leverages legacy IT assets, since legacy code is wrapped and re-used for new projects.
- Integration is more efficient (reconciliation is not needed since all data are retrieved from the same source), real-time (multi-channel is an on-line system), and cost-effective (unmaintainable point-to-point interfaces are abandoned).
- Technical/Integration difficulties are hidden not only from the end-users but even from the developers, who focus their best effort on meeting the business needs.
- Client applications have been completely decoupled from back-end systems. Modifications in back end systems do not cause problems to client applications, so maintenance costs have decreased.
- A virtual repository has been created and is provided even to external consumers. Services are used by other companies of the Group or by external partners (e.g. an asset management company) through SSL over SOAP/HTTP and behind DMZ enterprise firewall.
- Access to multiple data-sources which provide unified results in the presentation layer, results in better reporting and decision making
- Better customer service

Project benefits have not been quantified. We were only provided with a qualitative rating (5-point scale - Lowest Value: 1 – Highest Value: 5) indicating in which extent the benefits were identified (validation rating) and in which extent the specific benefit was considered important (significance rating). For example the provision of services to external entities was identified as a potential of SOA but not considered significant because it was business-wise applicable only among the companies of the Group and not to external entities. Using the ratings in Table 3, we can calculate the weighted average rating of SOA business benefits in the specific business case in the Banking Sector as:

$$\text{Weighted Av. (5-point scale)} = \sum_n (\text{Significance_Rating}_n * \text{Validation_Rating}_n) / n = \mathbf{3,75} \quad (1)$$

Table 4: Validation of SOA business benefit

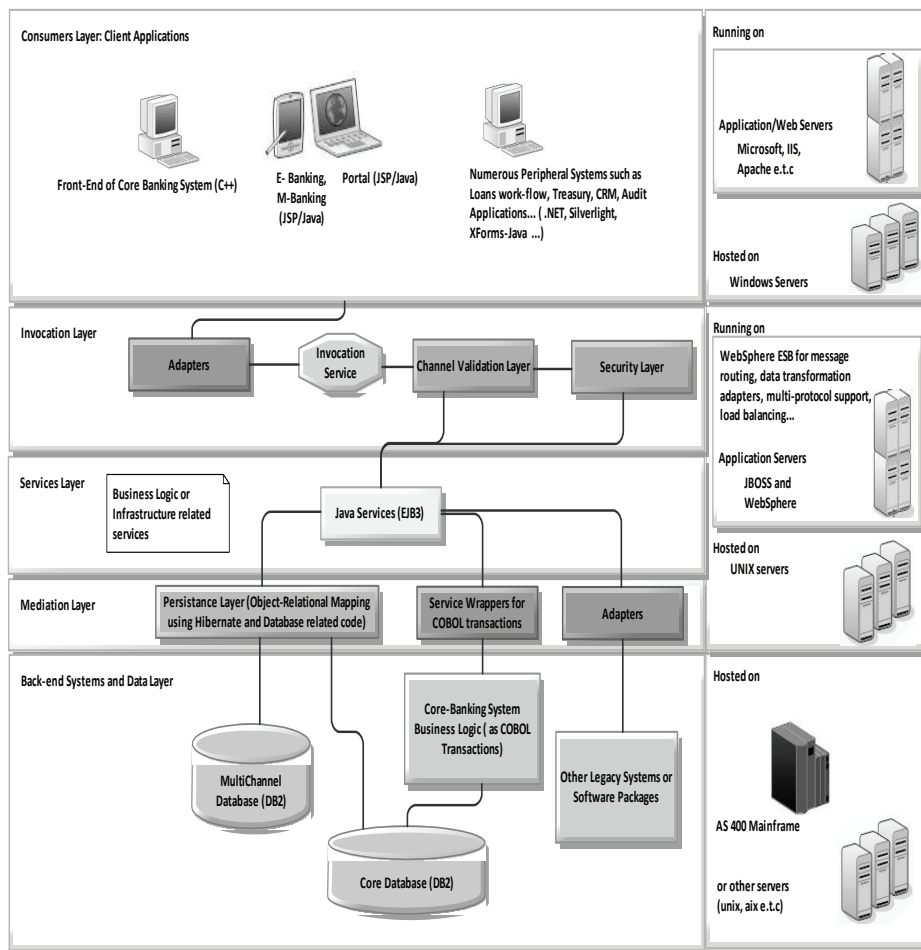
	B ₁	B ₂	B ₃	B ₄	B ₅	B ₆	B ₇	B ₈	B ₉	B ₁₀	B ₁₁
Validation Rating	5	4	4	4	4	5	3	4	4	4	5
Significance Rating	5	2	5	5	5	5	4	5	5	4	4

6. Conclusions

While service-orientation is a wide-spread idea in both academia and industry, there are still a lot of research gaps especially in the business domain of SOAs. The aim of this paper is to present an assessment of SOA business benefits based on academic and industrial publications as well as a case study approach. The case study was performed in a large financial organization. Having described the company, the project objectives, challenges and implementation approach, we presented the business benefits derived from the project. Qualitative assessment of SOA business benefits and drawbacks in 5-point scale is presented. The weighted average of ratings validates that SOA produced significant business benefits in the case of large financial organization. As future steps, we could expand our research to performing a survey in a wide sample of organizations as well as to assess factors that may affect a SOA investment business value, such as SOA level of maturity, scope of the implementation and specific organizational characteristics. In similar context there is related work by Anderson et al. (Anderson 2005) regarding web services projects success factors. Next research steps could also include quantitative metrics of benefits. Measurements as well as Critical Success Factors are significant parts of an Information System evaluation according to Mende et al. (Mende 1994).

Appendix 1

Below we depict the SOA implementation of the business case we described.



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Holistic Personas and Reflective Concepts for Software Engineers

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Abstract: In a small to medium sized organisations, managements' understanding of the complexity of the Information Technology (IT), software applications' usability and lead time needed to build a new application is limited. Often these organisations do not have comprehensive understanding of the new market due to inadequate market research. To design and develop a new software application, software engineers elicit requirements, ideally from end users, but the end users and stakeholders are often unavailable. User-Centred Design (UCD) is a methodology used to develop applications that consider the goals of the users as a primary requirement. Personas, archetypical users, and scenarios, the interaction of personas with the application to achieve goals, are tools used within UCD methodology. Software engineers can deduce the application requirements from personas and scenarios. Hence the closer the persona represents the end user, the more usable the resultant software application will become. *Holistic Persona*, a persona with five dimensions: factual, personality, intelligence, knowledge and cognitive process, seeks to more closely resemble the end user. Reflection-in-action, reflection on the spontaneous thinking that is happening during a task, Reflection-on-action, reflection after the task is over, Reflection-for-action, reflection done to gain knowledge for a similar future task, enhances the skills of software engineers while designing a new software application. Reflective capacity is regarded by many as an essential characteristic for professional competence. In this paper we explore the research question: how can software engineers apply UCD methodologies and reflective concepts in designing and developing new software applications? Through two case studies, we provide insights into the applications of UCD methodologies and reflective concepts in software engineering for development of a new application. We present our experiences during design and development of the applications and lessons learnt from the projects. We speculate how *Holistic Personas* and scenarios would have resulted in speedier development and improvements in the quality of the end products. Case one is about engineering an idea into an e-health software application at a research-intensive Australian university. Case two is about engineering a system and an application to provide automated program guide, news, sport highlights, short feature films and weather published on an Australian national broadcasting services' website for the multi-channel digital television system. Both applications were green-field developments with no past histories of a similar application to model for their design and development.

Keywords: reflective practices, user-centred design, *Holistic Persona*, scenarios, empathic design

1. Introduction

In recent times computing equipment has become ubiquitous and has changed the way users learn, shop, manage health records, bank, entertain; the users can come from all walks of life and from all over the world (Petter et al. 2012). To meet the goals of the users, UCD methodology was proposed by Norman and Draper (1986). Personas, archetypical users, are fictional characters that represent the needs of typical users of the application (Cooper 2004). Scenarios are the actions carried out by the personas interacting with the application to achieve goals (Goodwin 2009 p.11). Personas and scenarios are tools to design applications and complement other quantitative and qualitative methods (Pruitt and Grudin 2003). Software engineers refine personas and scenarios to actors and use cases (Constantine and Lockwood 2001, Elkina and Pursian 2012). Reflective capacity is regarded by many as an essential characteristic for professional competence (Redmiles and Nakakoji 2004, Schön 1983).

In this paper we explore the research question: how can software engineers apply UCD methodologies and reflective concepts in designing and developing new software applications?

This introduction is followed by a literature review on UCD, persona, empathic design and reflective practices. We present two case studies and reflect on our experiences.

2. Literature review

Requirements specification is an important aspect of software development (Van Lamsweerde 2000). Software engineers interact with personnel from various disciplines and actively collect requirements of an application from users, customers and other stakeholders (Aoyama 2005, Zowghi 2009). UCD methodology considers the goals of the users as a primary requirement for developing software applications (Norman 1986). It is often expensive and time consuming to involve end users during the design and development (Vredenburg et al.

2002). In some cases, such as e-health, the end users are not available to software engineers due to the sensitive nature of data about the patients' condition (Jay et al. 2012) and in case of digital consumer products end users are unknown (Aoyama 2005). In a small to medium sized organisations, management's understanding of the complexity of the IT, software applications' usability and lead time needed to build a new application is limited (Stolterman 2008). Often these organisations do not have comprehensive understanding of the new market due to inadequate market research (Thong 2001, Verhees and Meulenberg 2004).

Researchers studying design process have divided creativity into separate, synonymously named, phases or segments (Howard et al. 2008, Kryssanov et al. 2001). Researchers agree that the most important and influential phase of the design is the conceptual design phase in which the behaviour of the design is formed (Gero and Kannengiesser 2004, Norman 1986, p. 57). The use of personas in UCD is well established in the software industry (Miaskiewicz and Kozar 2011). Personas are fictional characters that represent the needs of typical users of the application and the way they interact with it (Goodwin 2009, pp.11;13). Personas support the design of applications by focusing on target users and facilitating communication with stakeholders (Goodwin 2009, pp. 231-234, Wikberg Nilsson et al. 2010). Chang et al. (2008) found that personas may take various forms: personas, mash-up personas, incomplete personas and unspoken personas, personas that exist but is not documented. Empathic designers through observation, information gathering, reflection and analysis, brainstorming, and prototyping have designed innovative products (Leonard and Rayport 1997). In an experiment Chen et al. (2011) used empathic design and personas as replacement for end users participation in the design and found that the designers were more focused on the users' emotions.

Boud et al. (2013, p.19) defined reflection as *'a generic term for those intellectual and affective activities in which individuals engage to explore their experiences in order to lead to a new understanding and appreciation'*. A reflective practitioner frames a problem, hypothesises it and understands it (Schön 1983). *'As [inquirers] frame the problem of the situation, they determine the features to which they will attend, the order they will attempt to impose on the situation, the directions in which they will try to change it. In this process, they identify both the ends to be sought and the means to be employed'* (Schön 1983, p.165). Schön (1983) introduced the terms 'reflection-in-action' and 'reflection-on-action'; he describes reflection-in-action as *'thinking on our feet'*, the thinking and reflecting that happens in the midst of activity and, reflection-on-action as the thinking and reflecting that occurs after an event. The practitioners who practice reflection-in-action, operate on two levels, they attend to the task as well as assess and modify their action through observation (Westberg and Jason 2001). For future success in a similar task, Killion and Todnem (1991) extended Schön (1983)'s concepts to include reflection-for-action, practitioners review what has been accomplished and identify constructive guidelines for future action. Metzrow (1990) suggested that reflecting practitioner should critically question contents, processes and premises; he defined content reflection as analysis of problem situation, the 'what' questions, process reflection as analysis of the problem-solving strategies, the 'how' questions, and premises as analysis of the practitioners own assumptions the 'why' questions. Nguyen and Swatman (2003) found that 'reflection-in-action' and 'reflection-on-action' assisted in managing requirement engineering processes. Bach and Twidale (2010) observed that reflective users contribute positively to the design of an application. Sengers et al. (2005) used reflective design for creating unique application, living art in the museum, which would not have been achievable using normal design practices. Reflective practitioners use reflective journals to reveal tacit knowledge (Cowan 2014). Tran and Anvari (2013) presented the Five-dimensional Reflective Cycle Framework (5DRCF) to guide reflective thinking; the 5DRCF consists of five dimensions: *Describe, Analyse, Transform, Act and Evaluate*.

3. Case studies

We present two case studies spanning over a decade in which the authors used personas or users in various stages of design, development, communication and testing. In explaining design activities we have adopted a linear model in line with most researchers' publications even though design processes are not linear activities and they cannot be divided into clear phases or segments (Howard et al. 2008). In both cases we applied reflective concepts and action research. The lead author, a software engineer, while solving real-world problems, was studying the experiences of solving the problems (Easterbrook et al. 2008). He framed a problem, reflected-in-action, reflected-on-action (Schön 1983), examined the issues from multiple perspectives and was open to new insights (Cowan 2014).

3.1 Case study one: Design an e-health application

The software engineer architected the solution and led a team to build an e-health application, *Healthy.me*, an online research platform to support consumer health decision making at an Australian University. Following is his reflections while designing the application.

3.1.1 Describe the requirements

There are multiple elements to the e-health application: authoritative explanations of health topics; personal space for personal information; collections such as pillbox, schedules, reports; sharing information with team members and social space to interact with others (Anvari 2009). A feature of the application is a health journey, the authoritative explanations of health topics, where a medical condition is divided into stages and members can obtain information on their medications, tests and procedures during each stage; by selecting a health journey, the application auto-populates the member's pillbox and personal records (Coiera et al. 2010). The software engineer kept a reflective diary to record his reflections on activities such as meetings with stakeholders, summaries of relevant scientific papers and project notes. From these notes he prepared a conceptual description of the application. In this project, no focus group meeting was held and end users were not available for the software engineer to interview.

3.1.2 Analyse the requirements

The software engineer considered prospective users' knowledge, state of mind, need for information from an e-health application and gain in knowledge to address health issues. He considered the technical knowledge of health professionals who would interact with the application and their requirements to make contributions into the application. As it was a research platform, the needs of the researchers were also considered. Through reflective processes, the software engineer conceived unspoken personas which were based on his experiences and close observation of his family members who had incidentally undergone health journeys of the kind anticipated by the application (Anvari and Tran 2013). The conceptual descriptions of the application were modified many times while the software engineer reviewed his notes and analysed the issues. He made a list of requirements and prepared a chart for problem framing and evaluation of a conceived design for the application (figure 1). Through reflection, the software engineer added features to the list that were not asked for but would be found useful, such as ability to customise a journey according to a user's profile. Different researchers have synonymously listed this activity as problem framing (Schön 1983) and establishing a need (Howard et al. 2008, Kryssanov et al. 2001).

3.1.3 Transform meaning of the analysis

The software engineer conceived a number of solutions, evaluated and selected a few of them for further investigation. Moon (1999, p.155) referred to this activity as cognitively demanding and procedurally the least definable activity as 'meaning is applied to relatively complicated or unstructured ideas'. Howard et al. (2008) and Kryssanov et al. (2001) referred to it as analysis of task and conceptual design phase. These activities would affect the future of the application in terms of robustness, economy of development and operation, and planned expansions.

3.1.4 Act on the decisions

The solution selected was a modular design, figure 2 (Anvari 2009). In this design, individual modules with their own data, business requirements and user interface can be designed, developed, tested and added into the application when UCD tools such as personas are available. The software engineer considered possible alternative methods of building each module and prepared a table, figure 3. To meet the initial expected user numbers, load on the application and limited programming resources available, he architected a scaled-down solution with an in-built flexibility for the application to evolve and become fully compliant with the National E-Health Transition Authority (NEHTA) requirements.

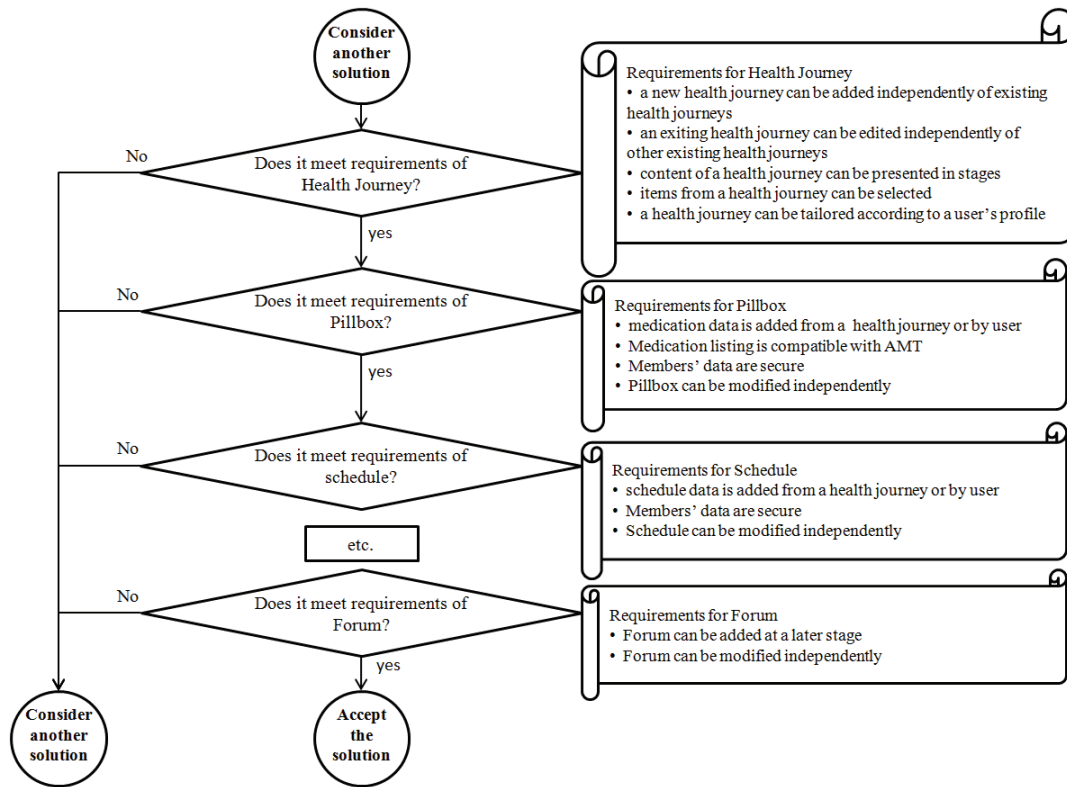


Figure 1: Problem framing and solution evaluation (edited)

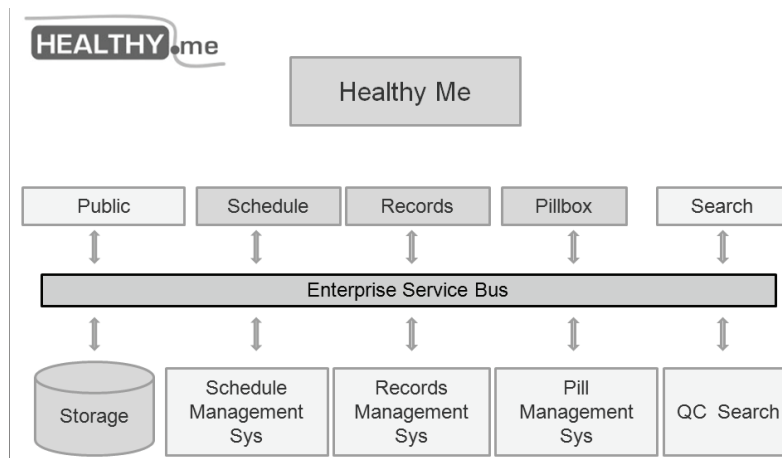


Figure 2: Modular design of the application (edited)

Through reflection, the software engineer was aware that the design of the data modules affects usability and future development of the application. He employed empathic design techniques (Leonard and Rayport 1997) to design data modules for journey, pillbox, scheduling, etc. and build prototypes for testing purposes. For each module, he prepared detailed design by converting the unspoken personas and scenarios to actors and use cases (Constantine and Lockwood 2001, Elkina and Pursian 2012).

3.1.5 Evaluate

Evaluation of the design and build of an application provides the software engineer with insights for future design. As part of the evaluation, not only consideration should be given to how usable the application is or how it has enhanced the experiences of users who interact with the application, but also to what extent the application has been embraced by the community. Surveys were conducted to evaluate the effectiveness of the application's design features and tools (Coiera et al. 2010). The application has been online since 2009. The application was operated on a small-scale platform successfully. It attracted the university's 2011 Major Research Equipment and Infrastructure Initiative Scheme (UNSW 2011) funding for its expansion. Researchers

have used it to conduct experiments on health issues such as in vitro fertilization, influenza vaccination, mental health, cancer etc. (Coiera 2013).

Module	Freeware software	In-house application development	Partnership with commercial organisations	Can installation be delayed to later stages?
Journey	Wiki style (needs editing)	Time consuming	Not available	Authoring of individual journeys can be delayed
Pillbox	NEHTA provides Australian Medicines Terminology (AMT)	Yes (use AMT)	Available options are not suitable	No
Schedule	Available (requires editing – evaluation proved editing is time consuming)	Yes This option is found to be more suitable		No
Forum	Available (requires editing – evaluation proved editing is time consuming)	Yes This option is found to be more suitable		Yes
Messaging	Available (requires editing – evaluation proved editing is time consuming)	Yes This option is found to be more suitable		Yes

Figure 3: Alternative methods of building each module (edited)

3.2 Case study two: Digital TV extras application

The lead author, a software engineer, designed and developed the system and the application called Digital TV Extras (DEXTRAS) at the Special Broadcasting Services (SBS) Australia. DEXTRAS provided automated program guide, news, sport highlights, short feature films and weather published on an Australian national broadcasting services' website for three digital channels.

3.2.1 Describe the application

This case was an example of designing a technically challenging application with expected usability changes. Features were incorporated into the application which later were found to be important. This project demonstrates application of reflective concepts when the environment is changing. Initially the automated system provided web published materials such as program guide, news and weather for one digital channel called Essential. Later DEXTRAS was extended to include other media formats such as highlights of live events and short feature films; DEXTRAS provided different contents for three digital channels (figure 4). The software engineer gathered technical requirements from stakeholders, managers, journalists, TV engineers and system operators. Unstructured qualitative technique was used to interview the managers and the journalists and, semi-structured qualitative technique was used to interview the operators.

3.2.2 Analyse the requirements

Through interviews the software engineer was able to understand the personalities (Goldberg 1990) intelligences (Gardner 1993) knowledge and cognitive processes (Anderson et al. 2001) of the users of the application (Anvari and Tran 2013); these were the unspoken personas (Chang et al. 2008) that influenced the conceptual design and were converted to actors during the detailed design of the application. For example a group of the primary users of the application were the urban (demographics), seeking factual information (knowledge), have good understanding of events (cognitive processes), some of them spoke a number of languages (linguistic intelligence); the operators of the application were mature (demographics), followed procedures (knowledge) un-agreeable (personality) and applied their knowledge to the tasks (cognitive process). During these interviews, it became clear that the contents and formats of the media and the users of the application could change frequently.

3.2.3 Transform the issues

There were technical challenges to interconnect the information and television broadcasting systems. Prototypes were built to test the feasibilities of a number of conceptual designs. It was important to include the needs of the users for solutions under investigation. However these needs would change. Hence through foresight and reflection, future users' needs were incorporated into the design of the application. Expected

users, unspoken personas, were analysed and their needs were converted to requirements to include in the conceptual design.



Figure 4: Samples of DEXTRAS outputs on SBS digital TV channels (from top clockwise, News on Essential Channel, News on World News Channel, Weather map on the Digital Main Channel and Sports Highlight on Essential Channel)

3.2.4 Act on the decisions

All interactions with the application were arranged through an interface layer. The interface layer was separated from the editing and DEXTRAS engine, the technical infrastructure to convert media into suitable formats for output to digital TV. DEXTRAS engine would remain unchanged (figure 5). This decoupling allowed the changes to be implemented without affecting the technical infrastructure. The accepted conceptual design was used to prepare detailed design, developed, tested and installed.

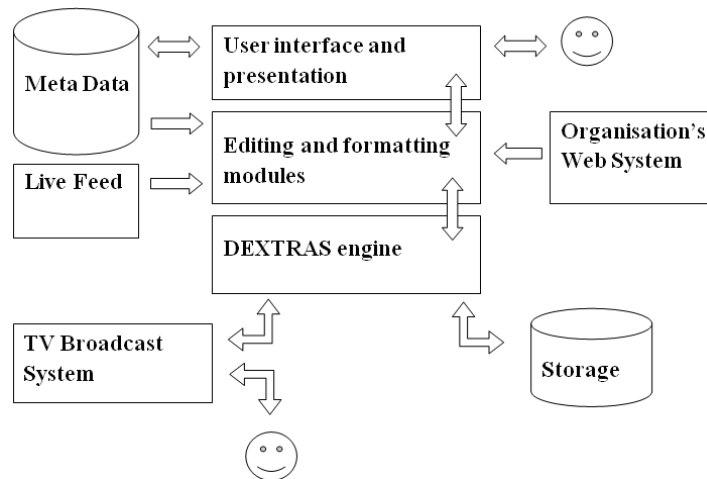


Figure 5: DEXTRAS conceptual diagram

3.2.5 Evaluate the decisions

The software engineer designed the application to be flexible and expandable. Inbuilt capacities were architected into the solution to consume contents in various media formats and provide output for multi-digital channels. This capacity was utilised later when the application was used for broadcast of sports highlights and feature films. It was also used to broadcast news headlines and weather information in the

other channels when contents were not available for broadcast. The system operated continuously from 2002 to 2007. 'Farshid Anvari, who designed the automated digital channel system for SBS Essential, was highly commended in the Commonwealth Broadcasting Association awards for cost-effective engineering' (SBS 2005, p. 87).

4. Speculation on the use of *Holistic Persona* and reflective concepts for design

Both applications offered unique challenges; they were green-field developments. They required problem framing, hypothesising and understanding (Schön 1983). Both applications required examination of the issues from multiple perspectives and openness to new insights (Cowan 2014). The software engineer practiced reflection and critically examined his premises, assumptions, values, biases and convictions including the knowledge of programming languages, packages, frameworks, databases, operating systems and understanding of the users. For example in the case of the e-health application, initially a free text was provided for users to enter their medications into the pillbox; after testing, discourse and examination from multiple perspectives by the authors, the software engineer was prompted to search for and adopt AMT. In the case of the Digital Extras, the second author monitored the live system output on TV and suggested changes to the sequence of the operation which prompted the software engineer, in consultation with stakeholders, make changes to the application.

The ideas that emerged from these cases are: (1) the software engineer with experiences or understanding of the prospective users of the application, has an inherent tacit knowledge to act as an end user (Bach and Twidale 2010, Leonard and Rayport 1997); (2) empathic design is suitable when the software engineer practices reflection; (3) the 5DRCF assists in reflective thinking; (4) tacit knowledge can be discovered by reflective journaling (Cowan 2014); this knowledge assists in predicting users' interaction with the application; tacit knowledge aided by reflective practice allow the software engineer to implement unasked features that are beneficial to users; (5) in a changing environment, separating the user interfaces from technical components, modifications can be implemented economically; (6) in a modular design, each module can be built when necessary UCD tools such as end users, focus group or personas are available; (7) in an organisation with limited funds, a scaled-down version of the application with in-built flexibility for its expansion meets current and future needs economically; for example in the case of the e-health application, an independent consultant from *Intersect Australia Limited*, reviewed the system architecture for scalability, and concluded that '*The design of the application is such that it should scale successfully to 500,000 users*' (Dec, 2010); in 2002 DEXTRAS operated on a single computer provided web published materials to one digital channel, in 2006 it operated on 12 high speed computers and provided materials to three digital channels. (8) data modules that are designed reflectively is a major contributor to the robustness of the applications; (9) personas and scenarios are useful tools during conceptual phase of the design; for detailed design scenarios and personas can be distilled into use cases and actors; personas and scenarios augment traditional software engineering methods (Constantine and Lockwood 2001, Elkina and Pursian 2012, Pruitt and Grudin 2003).

On reflection, in both applications the end users were not available for the software engineer to elicit requirements. By analysing the requirements engineering of five case studies in various Australian industries, Anvari and Tran (2013) proposed *Holistic Persona*, a persona with five dimensions: factual (demographics), personalities (Goldberg 1990) intelligences (Gardner 1993) knowledge and cognitive processes (Anderson et al. 2001). *Holistic Persona* is envisioned to more closely resemble the end users. We speculate *Holistic Personas* and reflective concepts can influence changes in the design of the application. For example if *Holistic Personas* were officially accepted by stakeholders and would have been introduced into projects, they would assist in forming the conceptual design sooner and the applications would have been more usable. *Holistic Personas* would minimise any possibility of misunderstanding by stakeholders and allow for better communication with team members. In an e-health application, the *Holistic Persona* would allow the software engineer to conceive solutions that cater for the needs of a wider groups of users with varying personalities (Goldberg 1990), intelligences (Gardner 1993), knowledge and cognitive processes (Anderson et al. 2001). For example Behrenbruch et al. (2012) used persona with personality to develop a mobile social networks application. Goldberg et al. (2011) used personas to resolve challenges in health care requirements elicitation and provided a framework to design e-health information system. In an e-health application that required authorship from health experts, *Holistic Personas* representing health experts would allow for a quick understanding of the requirements and preparation of the conceptual design of the authoring part of the application. In a broadcasting organisation, *Holistic Personas* that represent marginalised groups such as artists or indigenous

people would allow stakeholders, on reflection, test assumptions about viewers' facts, personalities, intelligences, knowledge and cognitive processes. This would reveal viewers' unfulfilled needs, for example their artistic intelligences would influence the design of applications such as DEXTRAS.

5. Conclusion

Our case studies have highlighted that software engineers need to practice reflection, critical thinking and consider issues that are beyond technical knowledge. Our cases support previous research that reflection turns experience into knowledge (Schön 1983). We have provided evidence that software engineers can apply empathic design and UCD methodologies to design and develop new software applications in situation where end users or focus groups are not available during the project description and conceptual design stages. Through modular development of the application, it is possible to build sophisticated usable applications in stages. Empathic design is effective when the software engineer practices reflection and has tacit knowledge to perform the role of the reflective end user. We speculate that formal *Holistic Personas* and scenarios would result in speedier development of applications. *Holistic Personas* would prompt reflection and facilitate design of applications which normally would not be conceived and applications developed would exceed in meeting users' requirements. In our future research we plan to investigate the effectiveness of the *Holistic Persona* for conceptual design of applications.

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Investigating the Application of the IT-CMF in Maturing Strategic Business-IT Alignment

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Abstract: Since the 1970s, the concept of strategic business-IT alignment (BITA) has been recognised as one of the top IT-management issues. When alignment exists, organizations experience improved efficiencies, reduced costs and improved stakeholder relationships. Further, the IT function is enabled to deliver IT services and systems that support the organizations strategic goals and day-to-day operational needs, and can anticipate and plan for future business requirements. However, achieving alignment is not simple and remains a perennial concern. Failure to align business and IT strategies contributes to several adverse business conditions, including increased financial and opportunity costs. A rapid BITA silver bullet does not exist; rather achieving alignment is an evolutionary and dynamic process. Many approaches have been proposed to address the issue. One approach of growing importance in IS research is that of the maturity model approach. Maturity models serve to help organizations to understand their “as is” situation and enable them to transition to desired “to be” maturity, through prescribing and implementing specific practices or improvement roadmaps. The Strategic Alignment Maturity Model (SAMM) developed by Luftman (2003) was one of the first attempts to apply maturity model concepts to the issue of strategic BITA. This widely tested model suggests that the degree of strategic alignment can be measured by examining six components: communications, value, governance, partnership, scope and architecture, and skills. Improving strategic BITA maturity has been found to positively correlate with enhanced organization performance. This paper examines the extent to which a new systematic IT management framework, with growing levels of global adoption, can be used to assist in an organization’s strategic BITA. The IT-Capability Maturity Framework (IT-CMF), developed using Design Science principles, serves as an assessment tool which enables organizations to understand and improve 35 IT-related capabilities over five maturity levels, in order to deliver improved business value from IT. In order to effectively support optimum business value delivery, the authors contend that strategic BITA must be dynamically evolved and improved. In this paper, the authors map the various IT-CMF capabilities against the six components of SAMM in order to identify which IT-CMF capabilities contribute to understanding strategic BITA and where gaps, if any, exist within the framework. This exercise serves as a solid foundation for the future development of a prescriptive IT-CMF strategic BITA maturity assessment, with associated improvement practices, outcomes and metrics.

Keywords: strategic business-IT alignment; maturity models, SAMM, IT-CMF

1. Introduction - the concept of business-IT alignment

Business-IT alignment (BITA) is perennially regarded as one of the top IT management issues. According to a survey conducted in 2013 by the Innovation Value Institute across its global membership community, one of the key priorities identified by organisations during the subsequent 12 months was aligning IT and the business. This issue has been a topic of wide debate since the 1970s drawing interest from numerous academic researchers and industry practitioners (for example, Chan and Reich, 2011; Henderson and Venkatraman, 1996; Huang and Hu, 2007; Luftman, 2000; Luftman and Kempaiah, 2007; Parker and Benson, 1988; Silvius et al, 2012).

Several approaches/models have been and continue to be developed to support achievement of BITA (for example, Bartolini et al, 2011; Wagner, 2014; Schlosser et al, 2012; Bergeron et al, 2004; Gutierrez and Serrano, 2008; Hussin et al, 2002; Kearns and Lederer, 2003). The volume of publications surrounding this topic is reflective of its importance and potential contribution to organizational performance. Achieving BITA can, for example, contribute to improved efficiencies, reduced costs, improved customer and supplier relationships, and the creation of new business solutions and market barriers to entry (Weiss and Anderson, 2004). With BITA, IT understands and can provide IT systems and services that support the company’s strategies and operational needs, as well as anticipate future requirements. Further, there is enhanced visibility of the role IT plays in supporting the business, leading to greater organisation-wide acceptance and recognition of IT (Huang and Hu, 2007). On the other hand, failing to achieve alignment can lead to significant financial and opportunity costs, with poor IT-related investment decisions, limited credibility of IT within business units, and little measurement or communication of IT’s contribution to the business (Weiss and Anderson, 2004).

Despite its importance, achieving a state of BITA is complex, being regarded as “elusive” and “a perennial concern”. For example, in a study by Shpilberg et al (2007), approximately three quarters of 504 survey respondents suggested that IT capability was not highly aligned with the business. One of the key factors for failing to align business and IT lies in the regular focus on IT’s alignment with business units, as opposed to how IT and the business units align and are in harmony with each other (Luftman and Kempaiah, 2007). According to Huang and Hu (2007), “*to make IT deliver business values beyond supporting daily operations, management needs to plan and execute, not from the technology end, but based on the business strategies*”. Despite this recognition and the fact that ICT’s pervasive nature is widely regarded as a key to enabling organizations, IT may still be regarded as “*a necessary evil*”, because “*the technical nature of this resource frequently isolates it from the rest of the business*” (Huang and Hu, 2007). In many cases, a culture gap between IT and the business acts as an impediment with non-technical business managers focusing on financial/ budgetary aspects of IT as opposed to understanding how IT can enable the business, and technical IT personnel failing to communicate IT’s contribution to the business in a lexicon that business managers understand. Further, without long-term commitment to BITA and a cultural mindset shift that recognises the evolving and dynamic nature of market conditions, BITA is not sustainable in the long-term (Moody, 2003).

Achieving alignment is evolutionary, dynamic, gradual and continuous, requiring senior management support and leadership, integrated planning, partnership-type relationship management, effective communication, trust, an institutionalised culture of alignment, and an understanding of both the IT and business environments (Huang and Hu, 2007; Luftman, 2000). Maturity models are now widely recognised in the IS literature as being useful in the evolutionary and gradual improvement of organization states towards desired targets. Hence, it follows that maturity models reflect a useful approach to achieving BITA in an incremental fashion. In fact, the Strategic Alignment Maturity Model (SAMM) (Luftman, 2000, 2003; Luftman and Kempaiah, 2007) reflects a significant contribution in this respect, with this maturity model being widely tested and adopted for over a decade.

This paper reflects a further contribution to achieving BITA incrementally by determining the feasibility of using the IT-Capability Maturity Framework (IT-CMF) (Curley, 2004; 2007) to assess strategic alignment; this is facilitated through mapping the IT-CMF to the Strategic Alignment Maturity Model (SAMM) (Luftman, 2000). The structure of the paper is as follows: Section two examines the value of adopting a maturity model approach and introduces the use of the maturity model concept in the area of BITA. Section three presents the Strategic Alignment Maturity Model (SAMM), as one of the principally cited and tested BITA maturity models. Section four provides a high-level overview of the IT-CMF, as a basis for investigating the feasibility of using the IT-CMF to assess BITA, which is the focus of section five based on a mapping of the IT-CMF against SAMM. Section six provides some discussion, draws conclusions and identifies avenues for further research.

2. Value of the maturity model approach in business/IS research – adopting a maturity model perspective to BITA

Maturity models are “conceptual models that outline anticipated, typical, logical and desired evolution paths towards maturity” (Becker et al, 2010), where maturity is “a measure to evaluate the capabilities of an organization in regards to a certain discipline” (Rosemann and de Bruin, 2005). Maturity models outline characteristics associated with various levels of maturity, thereby serving as the basis for an organization’s capability maturity assessment. In essence, they serve to help organizations to understand their “as is” situation and enable them to transition to the desired “to be” maturity, through deriving and implementing specific practices or improvement roadmaps. These improvement maps support a stepped progression with respect to organizations’ capabilities, enabling them to fulfil the characteristics required to meet specific maturity levels.

While the Software Engineering Institute’s (SEI) Capability Maturity Model (CMM) for software development and the successor Capability Maturity Model Integration (CMMI) are most prevalent in studies of maturity (Becker et al, 2010), nonetheless, several new maturity models have been developed in recent years. These focus on improving maturity in, for example, BITA (Luftman, 2003; Khaiata and Zualkernan, 2009); business process management (Rosemann and de Bruin, 2005); business intelligence (Hewlett Packard, 2007); project management (Crawford, 2006); information lifecycle management (Sun, 2005); digital government (Gottschalk, 2009); inter-organizational systems adoption (Ali et al, 2011) and enterprise resource planning systems use (Holland and Light, 2001).

Despite the growing interest in this area, according to Becker et al (2010), IS research has “rarely endeavoured into reflecting and developing theoretically sound maturity models” and as such there is a lack of evidence of scientifically rigorous methods in their development processes, with some models based on poor theoretical foundations (Mettler, 2009). Methods, such as Design Science (DS) (Hevner et al, 2004) are proposed as a useful means to develop new maturity models in a rigorous manner, using both prior studies and empirical evidence as the basis for the model’s content development and stages of maturity.

The Strategic Alignment Maturity Model (SAMM) (Luftman, 2000, 2003; Luftman and Kempaiah, 2007) is one of the primary attempts to apply the concept of maturity measurement to BITA. This model also addresses many of the concerns outlined in the research regarding developing theoretically sound maturity models. SAMM is modelled on Carnegie Mellon’s Capability Maturity Model and has been tested/adopted across approximately 200 Global 1,000 organizations in the United States, Latin America, Europe, and India. Adopting a maturity model perspective to BITA supports companies in understanding their current state and developing a prescriptive roadmap on how to improve the business-IT relationship. The value of this perspective has been noted in previous research which found that positive correlations exist between maturing BITA and the IT department’s structure, the CIO’s reporting structure, and company performance. Of particular interest is the finding that higher BITA maturity correlates with higher company performance (Luftman and Kempaiah, 2007).

3. Strategic alignment maturity model (SAMM) – an overview

The basis for developing the Strategic Alignment Maturity Model (SAMM) lies in the identification of strategic alignment enablers and inhibitors (Table 1) (Luftman et al., 1999). This built on the previous work of Henderson and Venkatraman (1993) and their development of the well-cited Strategic Alignment Model (SAM). This model consists of four specific domains – business strategy, IT strategy, organisational infrastructure and processes, and IS infrastructure and processes. The model is conceptualised in terms of strategic fit (i.e. the interrelationships between internal and external domains) and functional integration (i.e. the integration between business and technology domains). Building on SAM, Luftman reflected the additional BITA maturity perspective, basing his maturity levels approach on Carnegie Mellon’s Capability Maturity Model (Paulk et al, 1995).

Table 1: Enablers and inhibitors of strategic alignment

	ENABLERS	INHIBITORS
1	Senior executive support for IT	IT/business lack close relationships
2	IT involved in strategy development	IT does not prioritize well
3	IT understands the business	IT fails to meet commitments
4	Business – IT partnership	IT does not understand business
5	Well-prioritized IT projects	Senior executives do not support IT
6	IT demonstrates leadership	IT management lacks leadership

SAMM defines six main criteria which reflect the behaviour of BITA enablers and inhibitors in the organizational environment (Luftman and Kempaiah, 2007):

- **Communications.** Measures the effectiveness of information exchange, including ideas and knowledge, between IT and the business in order to understand each other’s priorities, risks, strategies, and plans.
- **Competence/Value Measurement.** Involves balanced measurements to evaluate the contribution of IT to the business presented in a clear and transparent way that both IT and the business understand and accept.
- **Governance.** Emphasises the identification of authorized personal for making IT decisions and defining regulations for the core processes for IT and the business to use on various levels, from strategic to operational, in order to properly set priorities and allocate required/available IT resources.
- **Partnership.** Strengthens the position of IT on a strategic level through evaluation of the relationship, perceptiveness, and trust between IT and the business.
- **Scope and Architecture.** Focuses on the evaluation of IT infrastructure on the subject of its readiness for the seamless adoption of new emerging technologies and services, its ability to adjust to possible business process changes, and deliver customized solutions for both internal and external users.
- **Skills.** Measures human resource practices to guarantee organizational readiness for change, learning, training, and openness to new ideas.

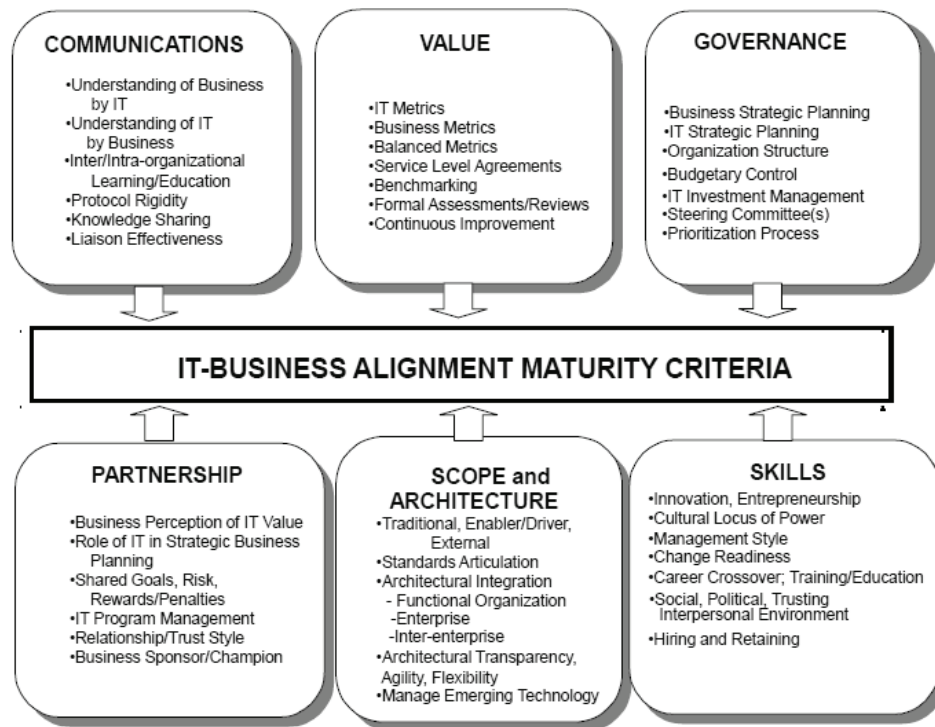


Figure 1: SAMM’s BITA maturity criteria (Luftman and Kempaiah, 2007)

As outlined in Figure 1, each BITA criterion has a series of attributes against which maturity is determined, on a scale ranging from Initial/Ad-hoc to Optimized. Through organisations scoring themselves against each of the criteria attributes across a range of questions and an aggregation of these maturity scores, a picture is established of the organisations current position in relation to BITA. This enables organisations to establish a plan of key actions to take in order to minimize the gap between their ‘as is’ position and desired ‘to be’ BITA maturity.

4. IT capability maturity framework (IT-CMF) – an overview

The IT-CMF is a capability maturity model developed by the Innovation Value Institute (IVI), National University of Ireland Maynooth, using the Design Science (DS) research paradigm (Hevner et al, 2004). It represents a systematic framework to enable organisations to understand and improve maturity in order to derive business value from IT investments (Curley, 2004; 2007). The framework represents an emerging blueprint of IT capabilities and serves as a tool which enables organisations to access and monitor relative importance of IT capability across five levels of maturity to enhance overall business performance. At a macro level, the IT-CMF consists of four integrated IT management strategies (macro capabilities); these comprise 35 critical capabilities (CCs) (Table 2) which represent key activities of the IT organization. One of the macro capabilities – Managing the IT Capability – is focused on the organisation’s IT capabilities, while the remainder – Managing IT like a Business, Managing the IT Budget, and Managing IT for Business Value – create a connection between the IT department and the rest of the organisation. Maturing these macro capabilities moves the focus from IT as a cost centre towards a value driver and corporate core competence that can enable business value realisation.

The generic architecture of the IT-CMF includes three main levels: macro-capabilities, critical capabilities (CCs) and capability building blocks (CBBs). In the current research, we focus on the second level of granularity, that of the CC. According to the architecture of a CC, the capability building blocks provide a comprehensive understanding of the CC’s structure, performance and goals. Each CBB was created on the basis of industry best practices and academic research. A detailed capability maturity assessment exists for each CC - through involvement of both IT and business stakeholders in scoring their organisation’s maturity against a series of CBB related questions, organisations can determine both their “as is” current maturity, and desired “to be” target maturity. Moreover, a series of detailed practices, outcomes and metrics (POMs) provide organisations with an explicit development or improvement pathway to transition to their target state and provide a clear

vision of what measures should be addressed for each capability investigated. Thus, this provides a balanced measuring system across the entire organisation.

Table 2: IT-CMF “managing IT like a business” critical capabilities

CC Acronym	Capability Title	Definition
Managing IT like a Business		
AA	Accounting and Allocation	The capability to calculate and distribute the costs of IT.
BP	Business Planning	The capability to produce an approved document that describes tactical objectives, operational services to be provided, and the financial and non-financial resources and constraints that apply to IT for the coming planning period.
BPM	Business Process Management	The capability to identify, design, monitor, optimize, and assist in the execution of an organization’s processes.
CFP	Capacity Forecasting and Planning	The capability to model and forecast the capacity needed by an organization to meet demand for IT services, infrastructure, facilities and people, and produce a capacity plan.
DSM	Demand and Supply Management	The capability to manage an interface between business and IT, endeavoring to maintain the balance of demand and supply of IT services.
EIM	Enterprise Information Management	The capability to develop, establish, and manage systems and processes to effectively gather, manage, disseminate, exploit, and dispose of media based data and information.
IM	Innovation Management	The capability to identify, create, fund, and measure innovations that are based on IT in order to generate business value.
ITG	IT Leadership and Governance	The capability to provide the overarching framework for the development and implementation of capabilities to lead the IT organization on different hierarchy levels, and IT decision-making processes.
ODP	Organization Design and Planning	The capability to establish the interface to the IT business, suppliers and partners; the IT organization's internal structure; the planning process of the IT organization; and communication of organizational changes, roles and KPIs.
RM	Risk Management	The capability to assess, monitor and manage the exposure to and the potential impact of IT-related risks.
SAI	Service Analytics and Intelligence	The capability to enhance the detail and scope of IT insight, support improved decision-making, and improve alignment between IT and the business by defining and quantifying the relationship between IT infrastructure, IT services, IT-enabled business processes, and the enterprise itself.
SRC	Sourcing	The capability to evaluate, select, and integrate providers of IT services according to a defined strategy and model, with the aim of optimizing the delivery of business value.
SP	Strategic Planning	The capability to formulate a long-term vision and translate it into an actionable strategic plan for IT.
SICT	Sustainable Information and Communication Technology	The capability to adopt an integrated approach to the management and application of IT resources across and beyond the organization, with the purpose of achieving positive environmental impact.

Table 3: IT-CMF “managing the it budget” critical capabilities

CC Acronym	Capability Title	Definition
Managing the IT Budget		
BGM	Budget Management	The capability to review and adjust the IT spending plan to ensure that allocated budgets are being spent effectively, remain within budget parameters, and are in line with the governance model.
BOP	Budget Oversight and Performance Analysis	The capability to periodically review IT spending versus the IT plan, in order to provide stimulus for re-profiling or reprioritization of budgets.
FF	Funding and Financing	The capability to understand how, why and from where IT is funded.
PPP	Portfolio Planning and Prioritization	The capability to select (approve), cancel, and prioritize programmes/projects that are seeking resources within an organization.

Table 4: IT-CMF “managing the it capability” critical capabilities

CC Acronym	Capability Title	Definition
Managing the IT Capability		
CAM	Capability Assessment Management	The capability to evaluate an organization’s ability to conduct current state assessments across its IT capabilities.
EAM	Enterprise Architecture Management	The capability to provide the necessary models and practices for defining, planning and managing the business and IT capabilities.
ISM	Information Security Management	The capability to direct, oversee and control the actions and processes required to protect information and information systems from unauthorized access, use, disclosure, disruption, modification, or destruction in order to provide integrity, confidentiality, accessibility, availability and usability of data and to support nonrepudiation.
KAM	Knowledge Asset Management	The capability to identify, analyze and represent the knowledge assets that the organization owns or requires to fulfill its business objectives, optimize the maintenance and protection of a knowledge asset repository, distribute knowledge assets for sharing within the organization, and improve the added value of knowledge assets through use and reuse within the organization.
PAM	People Asset Management	The capability to manage human resources in order to meet a company’s demand for employees with respect to its quantitative requirements and qualitative requirements, and enable the IT workforce.
PPM	Programme and Project Management	The capability to plan, organize, manage and optimize resources for programmes and projects to achieve desired results, to manage associated risks and issues, and ensure all associated changes are properly handled.
RAM	Relationship Asset Management	The capability to analyse, plan and enhance the relationship between the IT organization and the business.
RDE	Research, Development and Engineering	The capability to formally manage the investigation, acquisition, development, and testing of emerging technologies, solutions and usage models that may offer value to an organization.
SRP	Service Provisioning	The capability to execute IT services to satisfy business requirements.
SD	Solutions Delivery	The capability to specify, design, implement, validate and deploy solutions that effectively address the organization’s IT requirements and opportunities.
SUM	Supplier Management	The capability to execute the IT supplier strategy and manage suppliers on an operational basis.
TIM	Technical Infrastructure Management	The capability to manage the technical IT infrastructure during all lifecycle phases.
UED	User Experience Design	The capability to manage the design and evaluation of technology solutions in a way that supports the needs of the organization and the end-user.
UTM	User Training Management	The capability to improve the proficiency of those who use business applications and other IT supported systems – through the provision of appropriate courses and content.

Table 5: IT-CMF “managing it for business value” critical capabilities

CC Acronym	Capability Title	Definition
Managing IT for Business Value		
BAR	Benefits Assessment and Realization	The capability to ensure the potential value of business-changes enabled by IT investments is understood and that fulfillment is governed, including the cultural and behavioral change needed to create and to sustain business value throughout the full lifecycle.
PM	Portfolio Management	The capability to ensure there is an appropriate level of monitoring of the programmes and projects in the portfolio that have an IT component.
TCO	Total Cost of Ownership	The capability to track, compare, and control direct and indirect costs associated with IT assets (infrastructure and systems) in order to maximize value.

5. Determining the feasibility of using the IT-CMF to assess BITA

The algorithm outlined below for mapping the IT-CMF to SAMM is based on critical capability identification and allocation against the appropriate SAMM criteria. As outlined in SAMM there are six main criteria which can be presented as a set $C_{SAMM} = [C_1, C_2, C_3, C_4, C_5, C_6]$; for the IT-CMF, the set of CCs is represented as $C_{IT-CMF} = [CC_1, CC_2, \dots, CC_Y]$, currently $Y=35$. The basic rule for the IT-CMF-SAMM mapping is based on examination of the main CC definition compared against the SAMM criteria description (primary connection). However, if a CC could not be mapped using this approach, then a second level of granularity is considered, which involves examination of the respective CC CBBs (secondary connection). Each CC encompasses Z number of CBBs, which forms a set $[CBB_1, CBB_2, \dots, CBB_Z]$.

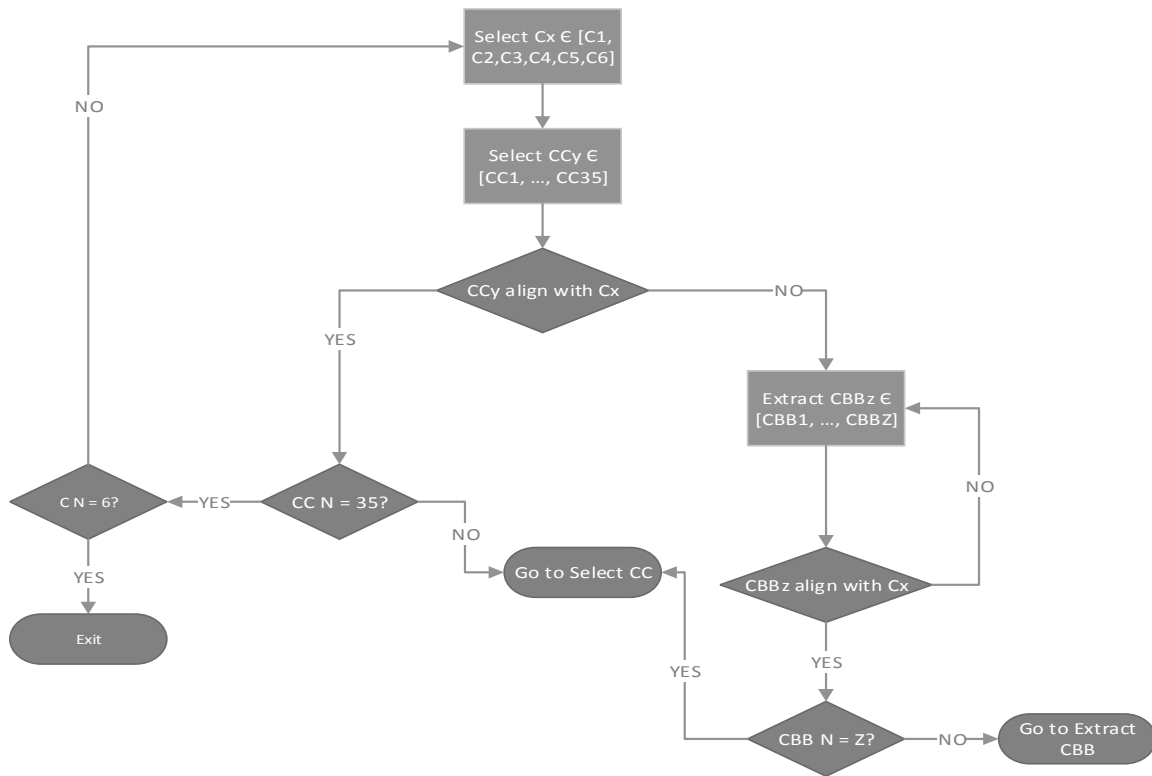


Figure 2: Generic algorithm for CC mapping

Following the algorithm presented in Figure 2, the 35 IT-CMF CCs were mapped to SAMM, and the results of this high-level mapping are presented in Table 6, while Figure 3 depicts the distribution of CCs per macro capability against the six criteria of SAMM. Note, the acronyms outlined below are explicated in Tables 2-5.

Figure 3 provides evidence of a clear match between IT-CMF functionality and SAMM attributes. Across the four macro capabilities, there is evidence of key criteria which are relevant at a strategic level, including Partnership, Governance, Competence/Value Measurement and Communications. These criteria monitor the tone within an organization and establish a solid cultural foundation to improve its maturity.

6. Discussion and conclusion

In terms of the IT-CMF-SAMM mapping, it is evident that broad coverage of all SAMM categories exists across the IT-CMF CCs and macro capabilities. This implies that the IT-CMF implicitly addresses the core BITA enabler and inhibitor concepts, and can serve as a framework to align IT to the business as a part of its IT management efforts. The mapping provides insight for companies into which CCs contribute the most to maturing the respective BITA dimensions or categories. Of particular interest is the fact that the BITA communications category is well addressed throughout the IT-CMF, which makes it a powerful tool for bridging any alignment gaps between IT and the business. Further, the coverage of all BITA criteria in the ‘Managing IT like a Business’ and ‘Managing the IT Capability’ macro capabilities confirms that the IT-CMF acts as a balanced model for supporting BITA. As outlined, the IT-CMF reflects maturity assessments based on aggregated views of both IT and business stakeholders. The findings from this process, in itself, can provide interesting insights into the perception of value delivered by IT to the business from the perspectives of both groups. Across the IT-CMF,

maturity level three is regarded as the first critical level of interaction between IT and some business units, while from maturity level four onwards, interaction between IT and all business departments is formalized. Hence working towards more aligned business and IT environments requires organizations to strive for higher maturity levels in the capabilities mapped in Table 6

Table 6: Mapping of IT-CMF CCs and SAMM criteria

Criteria	Attributes	CC
Communications	Understanding of business by IT Understanding of IT by business Inter/Intra Organizational learning Protocol rigidity Knowledge sharing Liaison effectiveness	RAM, SP, BP, BPM, ITG, PPM, CFP, DSM, SAI, EAM, ODP, UED, SD, RDE, SUM, FF, TCO, BOP, EIM, KAM, RM, ISM, IM, SICT, CAM
Competence/Value Measurements	IT metrics Business metrics Balanced metrics Service level agreements Benchmarking Formal assessments/ reviews Continuous improvement	BAR, BGM, BOP, FF, SP, BP, BPM, ITG, PM, PPM, IM, DSM, SAI, EAM, ODP, SRP, RDE, SRC, SUM, KAM, RM, ISM, SICT
Governance	Business strategic planning IT strategic planning Reporting/ Organization structure Budgetary control IT investment management Steering committee Prioritization process	ITG, SP, BP, PPP, ODP, FF, AA, BOP, TCO, BAR, BPM, IM, SRC, BGM, EAM, EIM, KAM, RM, ISM, SICT, PAM, RDE
Partnership	Business perception of IT value IT's role in strategic business planning Shared goals, risks and rewards/ penalties IT program management Relationship/trust style Business sponsors/champion	RAM, PM, PPM, CAM, IM, ITG, ODP, UED, SAI, EAM, RM, RDE, SUM, TCO
Scope & Architecture	Traditional enabler/drivers Standards articulation Architectural integration: functional organization Architectural integration: enterprise Architectural integration: inter-enterprise Architectural transparency, flexibility Managing emerging technology	EAM, TIM, SAI, BPM, DSM, ISM, RDE, SD, SRP, SUM
Skills	Innovative, entrepreneurial environment Locus of power Management style Change readiness Career crossover opportunities Education/ Cross-functional training and job rotation Social, political, trusting environment	PAM, UTM, KAM, IM, ITG, EAM, PPM, RDE, SRC, RM, ISM, CAM

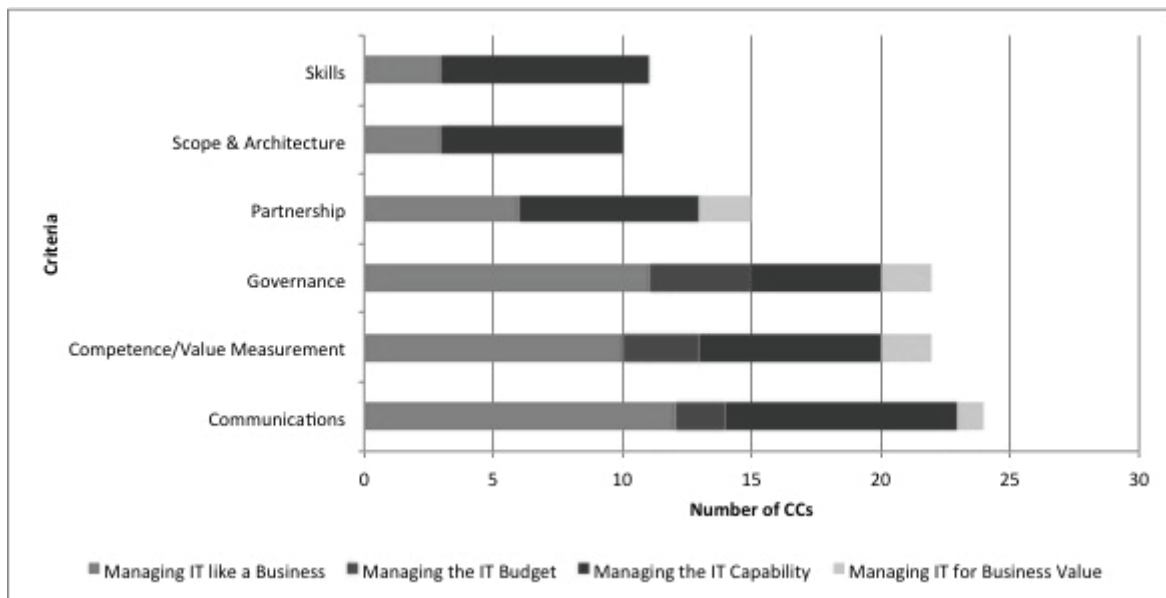


Figure 3: Macro capabilities distribution across SAMM criteria

It is important to note that the extent to which each of the mapped CCs to a specific SAMM category play a role in that aspect of BITA varies. For example, with respect to the SAMM governance category, CCs such as IT Leadership and Governance (ITG), Strategic Planning (SP), and Portfolio Planning and Prioritization (PPP) play a critical role in overall BITA; however, in relation to CCs such as Risk Management (RM) and Sourcing (SRC), the mapping of these CCs to SAMM pertains to governance related aspects specific to those capabilities only.

Similarly, taking the example of the SAMM Partnership category, the Relationship Asset Management (RAM) CC is critical in enabling overall BITA, while for other CCs such as Research, Development, and Engineering (RDE) and Supplier Management (SUM), the dimension is restricted to a partnership view localized to the specific capability.

This work is not without its limitations. Primarily the IT-CMF-SAMM mapping is based on the desktop analysis of the authors (however, this analysis was performed independently by both researchers, with any inconsistencies found in the initial mapping exercise resolved through dialogue and discussion). However, given its exploratory nature, this research paper has taken a first step to validating the suitability of the IT-CMF to assess all aspects critical to ensuring successful BITA. Thus, it is contended based on this initial exploratory mapping exercise that the IT-CMF has both conceptual and practical capabilities to support BITA and BITA maturity improvement. However, in the words of Peter Checkland (1986) “the work is not finished...”. The steps taken in this paper are the start of a research journey that involves further investigation and IT-CMF-SAMM mapping at a more granular level. This granular level involves development of a mapping algorithm that examines the IT-CMF CC CBBs against the individual SAMM category attributes. This level of granularity would further support identification of the relevant associated CBB questions from the IT-CMF that play the greatest role in supporting BITA assessment. Of critical value in any maturity model approach is the ability to transition from the current to the target maturity state – hence, an avenue of further research involves identification of relevant practices, outcomes and metrics to support a BITA improvement journey.

Findings from this academic mapping exercise are of relevance to industry-based practitioners. Given the fact that the IT-CMF-SAMM mapping highlighted strong coverage of the key BITA concepts across the IT-CMF, from a practitioner perspective, insight from this and future proposed studies will enable IT-CMF adopters who are interested in maturing BITA, to focus on the capabilities and the capability building blocks most relevant to addressing this issue. It will support practitioners in prioritizing the CCs to assess in order to understand their “as is” situation, and identify the key improvement practices to implement to bridge alignment gaps between IT and the business. Measurement of the outcomes resulting from the implementation of such improvement practices will support the tracking and measurement of progress achieved overtime.

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A Process Oriented User Test on Public e-Services – the Swedish Municipality Case

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Abstract: This paper elaborates on the potential to design and conduct process-oriented user tests on public e-Services. The idea is to use key constructs of business process orientation (BPO) to develop a basis for designing and communicating the value of user tests in a public e-Service context. Our hypothesis is that user tests can provide valuable results for all actors involved in e-Service development, not only in terms of how to conduct user tests per se, but also to provide incentives for a customer driven focus and highlighting the value derived from user tests. In the municipality case, actors and stakeholders are municipalities involved in an inter-organisational collaboration on e-Service development, i.e. different municipalities, locally and regionally, as well as the supplier. Citizens partaking in a university course conduct the user tests with eye tracking technology. In total 71 users performed in test sessions on 11 different e-Services in a standard platform provided by one supplier. In this paper, we elaborate on a BPO test design based on basic constructs of the approach compared with findings from the reconstruction of the test process design used with an implicit approach 2012 and an explicit BPO approach in 2013. Contributions include a generic test-process design for data collection, analysis and delivery to stakeholders in an overall e-Service development. Furthermore, findings from our test sessions and test process design can inspire and guide other universities to collaborate with practitioners. In addition to the strength of a real case for the students, user test sessions in collaboration can be an eye-opener not only for municipalities but also suppliers. Thus, the likelihood that test results will be applied in the further development of e-Services has increased.

Keywords: e-service evaluation, process orientation, test process design, user tests, eye tracking

1. Introduction

e-Service development has grown to become a daily practice in government; a means for realizing the digital agendas of the local level as well as national and international levels (Magnusson and Christiansson 2011). Public e-Services are progressively used as a means for governmental agencies to interact and exchange information with citizens and businesses. These services are typically web based and are meant to improve citizens' interactions with the government, to make governmental organizations more efficient and effective, and to increase the transparency of government and lead to a more democratic society (Chourabi et al, 2009). User-centred development is central in national directives (Ministry of Enterprise, 2011). However, there is little advice on how to implement this in practice. This paper elaborates on the potential to design and conduct process-oriented user tests on public e-Services. The idea is to use key constructs in business process orientation (BPO) *to develop a basis for communicating the purpose and value of user tests in the public e-Service context*. Our hypothesis is that user tests can provide a powerful basis for all actors involved in e-Service development, not only in terms of how to conduct user tests per se, but also to provide incentives for a customer driven focus and to highlight the value derived from user tests.

User needs and expectations of e-Services require municipalities to provide a solution to meet the expectations. To this end, the user test is here viewed as a business process through the lens of BPO. The application of the approach means that business is performed horizontally in and between organisations. Thus, business is viewed and defined in terms of end-to-end processes. Hence, the customer needs as trigger to value-added actions across organisational boundaries to produce a result with of significant value (Davenport 1993). A business process can be explained as a relationship where actors from different organisations are working together on complementary activities for the purpose of achieving mutual benefits and the best possible result (cf. Ford et al, 2010). From this point of view, e-Service development, including test and other issues performed in collaboration, can be referred to as an inter-organisational process. Thus, organisations with needs and willingness to collaborate with personal investments, commitments and a joint use of resources can contribute to a win-win relationship (Alter and Hage 1993). The latter may briefly be described as a practice with activities performed by the organisations with the best capability to provide the resources (persons, competence, time, technology and information) that are required. Possibilities of collaboration are important to clarify in all kinds of business performance, and the test process in no exception.

The Swedish municipality in our case, Karlstad municipality, uses an e-Service portal as one part of the overall e-Service offerings, totalling 70 e-Services. The supplier, Abou, describes the portal as a standard system that is configurable with the ability to turn the difficult handling of forms into user-friendly e-Services integrated with the E-ID and My Account. Solutions can be integrated with back-end systems, enabling faster and easier processes with functions such as transparency and duplicate signatures in the same case. Multiple channels for citizen contact with municipalities are provided by, for example, reception, telephone, email, mobile apps, social media and website forms and e-Services to initiate case handling processes. The website is the main channel in the municipality case and one challenge is to increase citizen use of e-Services. Since 2010 the municipality collaborates with all of the 16 municipalities in the county regarding e-Service development through the e-Service portal. The population ranges from around 3 700 inhabitants in the smallest municipality to 85 000 inhabitants. Common solutions, test, implementations, training and maintenance are joint issues and decisions. By using the same standard portal for e-Services on a local, regional and national basis, the overall benefits are enhanced through joint analysis, requirement and procurement phases. The collaboration aims for a better economic and functional result by means of a common technical platform. Moreover, when it comes to improvements, other municipalities in the portal community may have resolved some functions and features that another municipality has put on hold, i.e. member municipalities can benefit from development initiatives driven by other municipalities.

It is beyond the scope of this paper to elaborate on other evaluation tools, test processes and instruments for analysing e-Service initiatives. The structure of the paper is as follows: Section 2 presents the BPO constructs in a conceptual model used in this paper; Section 3 describes our research design; Section 4 reports on the user tests in the municipality e-Services conducted 2012 and discusses our findings with implications for the BPO test design in 2013; and Section 5 concludes the paper with reflections on lessons learned and suggestions for further research.

2. BPO constructs in a test design – user tests on public e-services

Business processes are crossing departmental and organisational borders as a result of e.g., digitalisation in terms of e-commerce, e-Services as well as business process outsourcing (Van Looy 2014). E-Services are usually communicated and supported by employees at the municipal contact centre. As the first line of contact with the citizens, the municipal advisors direct the user to e-Services and will guide the user through the service if necessary. Thus, providing e-Services as tasks performed across administrations implies that beside the IT-service department, the municipal advisors at the contact centre as well as employees working with the web site are stakeholders in the test process and the result. To make an impact on the design and the use of test result, stakeholders are necessary to identify. Lindgren (2013) presents a conceptual framework for identifying, characterizing and involving public e-Service stakeholders in the development and implementation. However, in a business process view this work can be narrowed down to determining where the process starts and end, i.e. defining the scope for a specific purpose. The foundation in the business process orientation is to adopt a horizontal view of the organisation and business processes through the value chain (Davenport 1993). This requires a management with a customer-focused mindset and the ability and willingness to facilitate collaboration in cross-functional process teams (Hammer and Stanton 1999) across administrations, instead of individual efforts. Since business processes should contribute to a result with a significant value for the external customer (Österle 1995), value added business performance needs to serve the customer needs and goals (Neubauer 2009). Further on, in order to align business processes with the organisation strategy, the vision, strategy and goals must be translated into the purpose of business processes and goals (metrics) to fit with management directives together with metrics on business performance, i.e. the activities (Davenport 1993; Kohlbacher 2010). Thus, strategic alignment is achieved when the employees in an organisation act in direct relations to fit the intentions of the management. In order to succeed in this direction, business processes need to be identified, visible, measured and monitored, i.e. the business process management (BPM) work practice (Rohloff 2009). Thus, BPM requires an integrated approach and holistic perspective. In addition to IT, core factors in terms of strategic alignment, governance, methods, people, and culture are highlighted (Rosemann and vom Brocke 2010). Van Looy (2014) uses the funnel structure to define BPO as the broader concept, which implies business process management (BPM) with distinguished focus on the culture (top management support and rewards) and structure (horizontal or matrix chart) capability including management of modelling, optimisation and deployment (implemented and working). However, the basis of this paper is the view of BPO as the effects (BPM paper) following the means in the process oriented approach. Additionally, the view on business processes as well as BPM and BPO differs in organisations as well as in

research. Thus, it is necessary to define and clarify the scope. Figure 1 illustrates our scope in terms of the test process design with a purpose and goal, together with a need for test and the performance required. Different stakeholders affect the test or are affected by the test result.

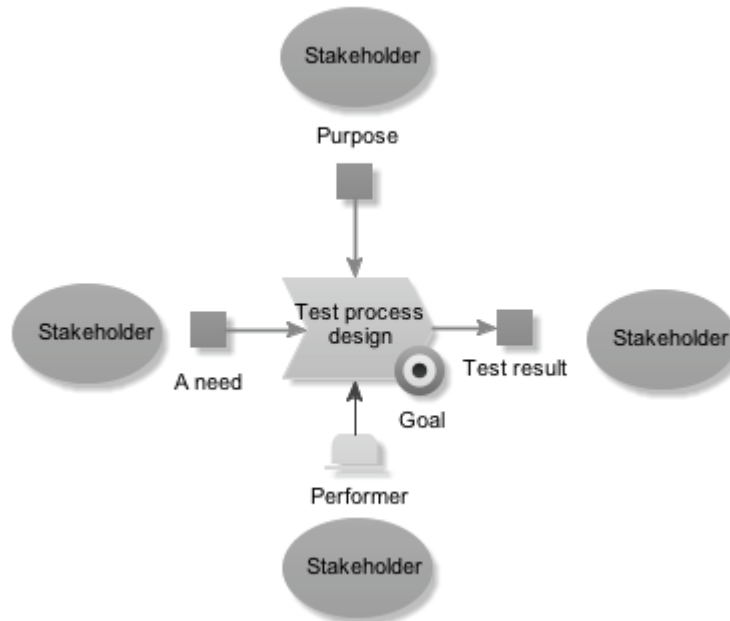


Figure 1: The business process scope – in relation to test process design

The business should be identified, defined and described as business processes in a modelling to illustrate the test process design based on the presented constructs below. We have given some examples from the reconstruction in the municipality case, described in section 3 and 4. In order to use a BPO approach, intended effects should be explicitly based on core ideas in BPO theory as well as practice. The main point is to make the basis of performance explicit in order to set indicators and measurements according to the purpose and goals of different stakeholders interest. Performance indicators and metrics (e.g., time, cost, accessibility, flexibility) based on the business process constructs are operationalized in business. Hence, a BPO approach can be used in order to plan and evaluate quality and performance in a systematic and holistic way with the possibility to work on horizontal end-to-end processes, across organisations, with continuous improvements. The focus of usability tests is on whether if the system meets specific usability criteria (Rubin and Chisnell 2008) or on identifying problems which arise in use (Benyon 2014). The focus and purpose of our test were the possibilities for the user to find, understand and use the e-Service based on provided information.

Core elements in a business process are identified (cf. e.g., Davenport 1993; Goldkuhl 2005; Österle 1995) and used as constructs in this paper by following the means presented above and in previous work (Christiansson and Wik 2014; Christiansson 2013), see Table 1:

Table 1: The conceptual model of constructs in a business process – in relation to our case

Construct	Case 2012	Case 2013	Evaluation object	Effects
Purpose	To evaluate usability	To evaluate communicability	Why is the design appropriate?	Business with a result to achieve
Goal	User tests to gain experiences and apply theory in practice	User tests with test results to improve e-Services	What is the expected outcome?	A target value in relation to organisational strategies
Stakeholder	The municipality The university	Municipalities The e-Service portal supplier The university	Who affects the test of e-Services? Who are affected by the test result?	Perspectives on business performance
Organisation	Karlstad municipality Karlstad university	Municipalities in Värmland	Who has the resources/skills and is	Where business performance

Construct	Case 2012	Case 2013	Evaluation object	Effects
		About Karlstad university	accountable for results?	takes place or who provides resources
Actor/Role	Course manager Researchers Test moderator Test administrator Observer User/Student	Course manager Researchers Test moderator Test administrator Observer User/Citizens	Who will be involved in the performance? A person in a professional role, an organisation, or a system/machine?	Someone who initiate and perform business process activities
Customer	Students Karlstad municipality	Municipalities e-Service portal supplier Students	Who is the external reason for performing business and who benefits from results in their internal use?	Someone who has needs, expectations and goals
Trigger	A test assignment	Requests for test	Who or what initiates the business?	Customer needs, regulations, directives
Activity	To identify, prepare, conduct, analyse and report user tests with students	To identify, prepare, conduct, analyse and report user tests with citizens in the municipality	What action is value added?	A desired way of working to reach a specific result
Flow	Way of performing actions and take decisions	Way of performing actions and take decisions	What business logic will be performed?	A structure of activities and information required for performance
Resource	The municipality home page/e-Service portal/ test environment Eye tracker, Web cam, Recorder	The municipality home page/e-Service portal/test environment Eye tracker, Web cam, Recorder Survey & Report tool, Wireframes	What is necessary to support the activity in order to be able to perform?	Instruments, information, knowledge, time, machines etc. needed to support the performance
Input	Preconditions Test instructions Template/protocol Gaze replay	Lessons learned Preconditions Test instructions Template/log notes Scenario Role description Gaze replay	What is necessary to be able to perform the activity?	A basis for/a prerequisite for conducting a process activity
Output	Gaze replay Heat map Gaze plot Analysis protocol	Gaze replay Heat map Gaze plot	What is the result of performed activity, what is necessary as input in the next one?	Partial result from a performed process activity
Result	Test result report	Test result report based on wireframes	What is delivered to the customer?	The purpose of the process, something that is produced and offered with a significant value

3. Research design in the municipality case

The Municipality Case is described and analysed based on the conceptual model of the BPO construct presented above. A reconstruction of our test design of 2012 and 2013 in the university undergraduate course will serve as the empirical basis of this paper. One course assignment is to conduct a user test in a laboratory

specifically designed for conducting user and usability tests. For the students, the user test assignment is a possibility to conduct a real case and to apply theory to practice. The lab consists of three rooms: the reception room where users are greeted and on occasions are interviewed at a pre- or post-stage of the test; the test room where the eye tracker is situated and the users perform their task and the control room where various stakeholders can observe the test sessions through a mirror wall and listen to the audio output. At the time of the 2013 testing, students in different test roles and two users (citizens) each conducted a test for 30 minutes. The following sections present our methodological routine for the user test data collection and analysis to give a background to our test process design.

3.1 Data collection

In the municipality case, we used the Tobii technology 1750 eye tracker (Tobii 2014) as a data collection tool to capture and record eye movements as well as the real time dialogue between the user, test monitor, administrator and observers. Gaze data were collected at a 50 Hz sampling frequency. The recording and analysis software used was Tobii Studio 2.8, running on Windows XP. Additionally, audio and video of the test participants were recorded with a Logitech webcam.

Elements in the communicability concept (Christiansson 2013) were used when developing a test protocol for observations and a template for the students' test report, to improve the transfer of findings from the test process result to the municipality. A complementary technique of data collections used by the researchers was a pre-interview with the users to collect user expectations of an e-Service per se, handling time and expected results (when and how such result should be delivered). In test sessions, we asked and encouraged the users to "think aloud" meaning that verbalized their thoughts, actions, confusions and frustrations (Rubin and Chisnell 2008). The think-aloud technique is associated with some disadvantages as the user can find it as unnatural and obtrusive to constantly think out loud (Rubin and Chisnell 2008) and it may affect the interaction and scan paths of the user (Pernice and Nielsen 2009). Nonetheless, by combining gaze replay with the think-out-loud technique we were able to see exactly what the user saw, acted upon and says which help in understanding why users have problems finding e-Services, performing and completing their task(s). In analysis, the eye tracking data can be visualised in heat maps (still images that show user attention, i.e. where eyes are focused in terms of length and time); gaze plots (still images that shows where users fix their eyes in terms of order); and gaze replay, which is a recording of the screen and the user's eye movements visualise each fixation and action over time. See Figure 2.



Figure 2: A heat map and a gaze plot - shows one user searching for the e-service - apply for direct debit

Reasons for not using gaze plots and heat maps in our analysis were that, gaze plots constructed from lengthy eye-movements recordings (such as ours) are easily overplotted, and heat maps do not show the order of the user's fixations (see e.g., Cöltekin et al, 2010; Andrienko et al, 2012). Furthermore, these static visualizations do not take dynamic elements, which are common on the e-Service platform, into account (Pernice and Nielsen 2009). This means that if the user opened a popup window, the static visualization will be displayed as if the user has studied the web site behind the popup dialogue. Such circumstances can be detected by studying the gaze replay, allowing affected recordings and/or heat maps and gaze plots to be excluded, but would be a tedious task. Another option of analysis is to manually draw areas of interest (AOI) on the gaze recordings. However, this is also a time-consuming task and as we are not conducting a quantitative analysis, AOIs would not elicit the information we are interested in. Instead, we defined AOIs separately by using wireframes. Wireframes are a commonly used method when outlining the structure of the content on a

website, without focusing on details of the design (Benyon 2014). We used the approach to extract data to a web survey used in parallel with the gaze replay.

3.2 Gaze replay analysis

Using the eye-tracking technique result in large amount of data to handle. Extracting results and interpreting the eye tracking data are labor-intensive as well as difficult (Jacob and Karn 2003). To our best knowledge most eye-tracking studies focus on quantitative measures and analysis, such as number of fixation per AOI (Poole and Ball 2006) or analysis of static stimuli (Kurzahls and Weiskopf 2013), instead of analysis based on viewing the eye-movement recordings. In studies reporting on gaze replays, eye-movements recordings have been used in combination with “retrospective think aloud” (Mazman and Altun 2012; Kostonos et al, 2009). In both studies the test participants used retrospective think aloud while viewing the recording with eye-movement overlays, to self-assess performances. Kurzahls and Weiskopf (2013) present means of analysis of eye-tracking data on dynamic stimuli, e.g., videos. Through this method, multiple recordings of multiple users can be visualized and summarized. However, in the municipality case it is important to study one user at the time, because of our context of e-Service use. Besides, our brief search for support in analysing gaze replay data shows that this is an emerging area of research and we had to work with an inductive approach. We decided to use the gaze replay technique because it does provide valuable data, such as how efficiently a user searches for an element and indications of a user’s difficulty in extracting information from an element and the importance of the element (Jacob and Karn 2003). Eye-movement analysis is appropriate as it affords seeing what the users actually see, do, react on and act upon, instead of relying only on what the users say they have done, seen and reacted on. However, it is not possible to draw conclusions from the users' understanding of what they have seen or not seen. The recorded user comments and insights, gazes and search patterns, failed actions, action modes (status in errands) and problems occurred in finding, understanding and using the e-Service can, however, be observed and extracted from the recordings. To be able to draw correct conclusions on usability, gaze recordings from at least six users need to be included in the analysis (Pernice and Nielsen 2009).

Heat maps and gaze plots were not used to draw conclusions, only to visualize results to different stakeholders (e.g. the municipality, the e-Service platform supplier and our students). In the test process design of 2012, log notes with empirical data from the visualisations and recorded voices from the user gaze replay were captured and structured by each of us (one researcher and one master student) based on our two background references, i.e. a human-computer-interaction lens and a communicability lens. In a second run we merged our observations in an analysis protocol. The protocol was further used by the researcher in analysing and structuring our findings into the characteristics of communicability (Christiansson 2013). Altogether, this way of working was very time consuming. Therefore, the challenge in the test process design of 2013 was to accomplish a more effective handling of the extensive data results. We developed a web-based survey in the tool Survey & Report to help us collect and structure log notes and, at the same time analyse the material faster. In this work we had to reconstruct our analysis (which steps and in what order according to the gaze replay) to develop a useful template as a basis for the survey. The survey used in our gaze-replay analysis was designed in an iterative manner. To get more usable log notes, the first survey included a template on how to collect observations notes of the e-Service communicability (our purpose and test instructions) with guideline questions. However, when trying out the survey during a session of gaze-replay analysis, we found that the survey did not correspond to what we wanted to extract from the recordings, and in what order we wanted to elicit the information. Furthermore, we noticed that the focal e-Services could be accessed from different levels of the platform, and by using different elements. Extracting data from the gaze recordings therefore demanded a shared way of naming the elements and levels on the e-Service platform.

By working with wireframes in the analysis, we discovered the multiple layers in a web-based e-Service resulting in five wireframes. Wireframes for each level of the e-Service were therefore constructed, and the survey was re-designed to correspond to the wireframes. Level 1 representing the municipality home page, level 2 the e-Services start page, level 3 the focal area of e-Services, level 4 the focal e-Service and level 5 the e-Service. The areas marked in the wireframes correspond to where we wanted to capture user gaze and/or user’s actions, in other terms AOIs. However, as the result of the test process for the municipality was to increase the ability to communicate their e-Services as providers, it is important to be able to communicate our findings regarding the content, placement, user interpretations, and so on, to the communicator officers in the different administrations in a common and easy way. Thus, we used the wireframes to be able to visualize

our comments on where the usage problem occurred, where information was missing, what areas the users neglected etc. in the test result report. For two of the wireframes we used in the municipality case, see Figure 3.

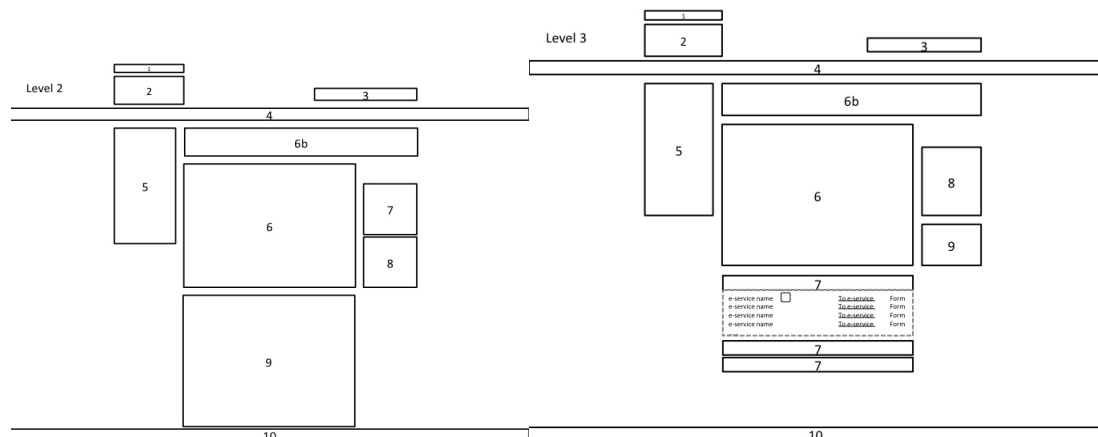


Figure 3: Wireframes of the e-services start page (level 2) and the focal area of e-services page (level 3)

The left wireframe shows the structure of the e-Services start page and the right wireframe shows the structure of the focal area e-Services page. Areas in the frame representing the municipality website link (1), the municipality logo (2), the search area (3), the global navigation bar (4), the left menu/main categories (5), the contextual content and (6). Further on, depending of e-Service level, the number corresponds to e.g., drop-down menus: e-Service categories, right menu/shortcuts, the e-Service name, information icon, link to the e-Service, link to a .pdf form, information in text right menu/shortcuts and information in text.

4. User test design – the Swedish municipality case

Based on the motives and arguments according to the methodological considerations presented in section 3, this section compares the two different test designs from 2012 and 2013 with a focus on a test process design with an implicit as well as explicit BPO approach as well as identifying improvements still to be made to achieve value and performance in an efficient manner.

The purpose of the test process design in 2012 was to conduct a usability test as a case in the university course. Thus the student was the customer with an experience of testing and applied theory as a result. By using the eye tracker as a tool for data collection, we deemed that the study of user experience of e-Service use would yield an idea of the concept of communicability. The test sessions were conducted with two different tasks (test 1 and test 2). The roles involved in the test were the course manager (CM), test administrator (TA), test moderator (TM) and observer (O) as well as the two researchers (R).

The established and well working co-operation with Karlstad municipality was a pre-condition for getting access to the test environment in the e-Service platform (a standard portal) provided by one supplier. To prepare the user test, 28 different e-Services in the standard portal were provided in the test environment with fake E-ID together with the course assignment. Selected e-Services used in the test were: Apply for Direct Debit; Parking permission for “green cars”; Composting food waste; Drawing archive; Sign up for food supply business; Food poisoning and Booking civil marriage. The idea of this selection was that our users could relate to the service provided.

In test 1 the user was asked to *find* one (without using the search function) of the selected e-Service from *the e-Service start-page* (the test environment), *use* it and *determine case status and expected turnaround time* (case handling time). In test 2 the task was to *navigate* from *the municipality home page* to *find* the requested e-Service and to *describe its purpose* and *expected turnaround time*. Overall 31 test sessions were conducted and analysed to understand the concept of communicability in e-Service use for research and practical purposes. The practical implications for the municipality however, was limited to a demo of gaze replay from some test sessions, the heat maps and gaze plots for illustrating and communicating our findings in the municipality. For a more comprehensive report on lessons learned, confer Christiansson (2013) and Christiansson and Wik (2014).

By using the BPO approach in the 2013 test process design we shifted attention to value added actions in relation to different stakeholders and the customer. Three different external customers are identified as the municipalities, the e-Service portal supplier and our students in the university course. Thus, “two tracks” in the test process are interesting to design in terms of performance and result with a significant value. In our case, the municipality requested some more hands-on recommendations on how to communicate their e-Services. Thus, the purpose was changed from testing usability to testing communicability (including metrics from e.g. usability) and a focus on test result report with guidelines to where information actions should be taken (based on wireframes). Moreover, new test data collection could be the basis of further development, a possibility that increased with the supplier observing the user test. During test sessions in 2013, see Figure 4, the user was directed to a scenario, to interpret the task and to find an e-Service to handle the errand from the e-Service start-page (the test environment) and use it. As the users are part of the “Google generation” and some municipalities expressed their interest in using a more powerful search engine in their e-Service delivery, we let the user describe intended keywords to use in order to deliver more value in the test report.

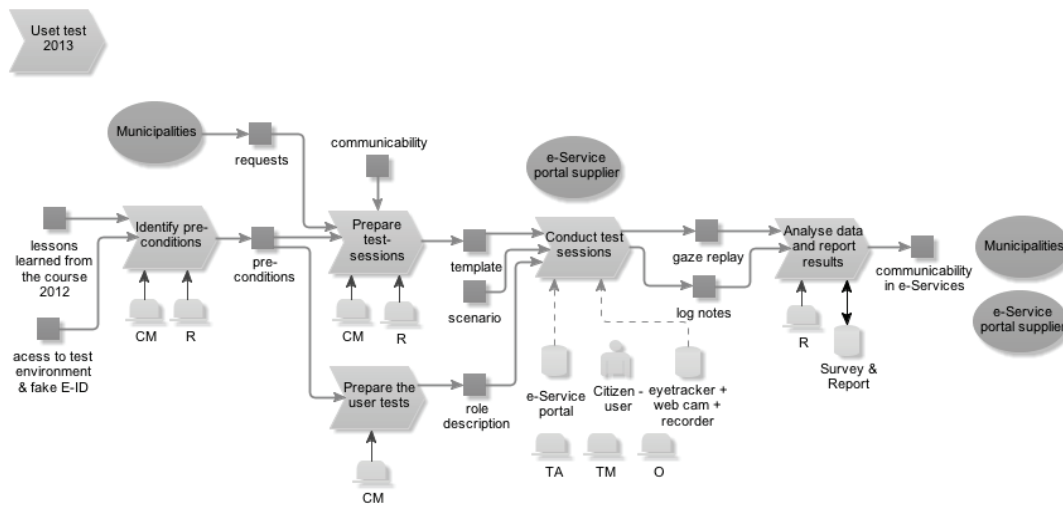


Figure 4: The test process design in the municipality case 2013

5. Conclusions: Lessons learned

The purpose of this paper is to develop a model for communicating the purpose and value of user tests in the public e-Service context. Besides contributing a user test case employing the eye tracking technology and the applied BPO in a test process design, our findings have several implications for organisations and test managers. In general, principles of a generic test process design are presented in terms of BPO key constructs presented in Table 1 and the generic test process in Figure 5, as guidelines in practice as well as to be used in further research for repeated studies and test process improvements.

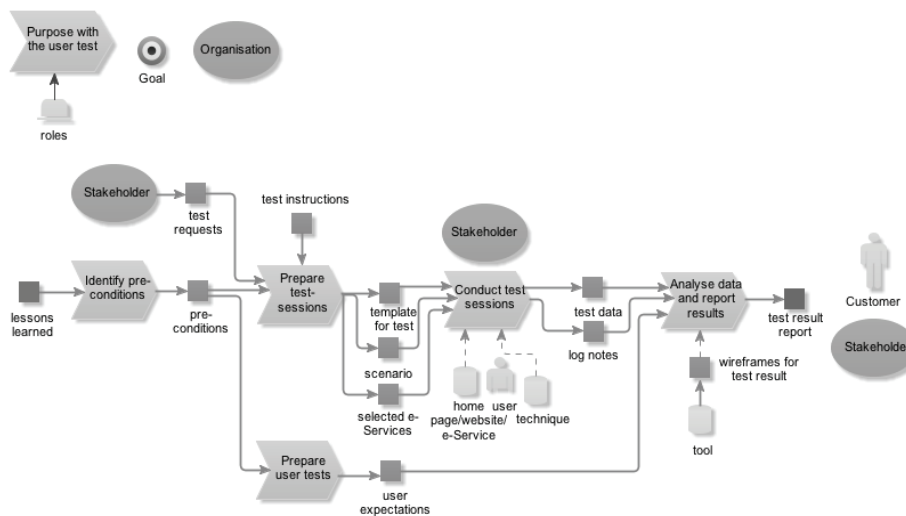


Figure 5: A generic test process design based on key constructs in BPO

This paper elaborates on the potential to design and conduct process-oriented user tests on public e-Services. The idea is to use key constructs in business process orientation (BPO) to develop a basis for communicating the purpose and value of user tests in the public e-Service context. A process oriented user test on public e-Services can provide a powerful basis for all actors involved, not only in terms of conducting user tests per se, but also to provide incentives for a customer driven focus and to highlight the value gained from user tests results. By using stakeholders as co-producers in the test process (e.g. the supplier to act as observer), the learning and customer insights will significantly increase. With a business process perspective, the end-to-end process will be viewed across organisations and make use of win-win situations.

The lessons learned from a process-oriented test design is that it provides value added potential because the customer/stakeholder can view test results in the context of their goals in organisations. Further on, by collecting user expectations, values in the e-Service per se can be defined as well as acting as basis for comparing test results. In addition, the customer process can be mapped and discussed in terms of the e-Service value in use, in order to gather a more comprehensive view.

We believe in visualisations for communicating ‘what’ to do and ‘why’ when using the generic test process design as a basic pattern to describe, explain, discuss and adjust. The test process description can provide a powerful basis for all actors involved in e-Service development, not only in terms of how to conduct user tests per se, but also to provide incentives for a customer driven focus and to highlight the value for different stakeholders gained from user tests. In addition, all stakeholders and actors involved in the inter-organisational evaluation are visualised with important “hand-shakes” to make sure that the test assignment is prioritized and that test results are implemented by “whom it may concern” from the e-Service user perspective. With a BPO approach it is easier to design an appropriate test process by visualising the performance based on the customer perspective and from the different stakeholder views to identify opportunities to reach win-win situations. Each action in the inter-organisational process should add value, which means that no time is spent on activities or documentations that are not relevant to the internal customer or the external customer. Hence, the stakeholder analysis is crucial in defining the actors who are affected or should participate.

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Information Security Culture: A Comparative Analysis of Four Assessments

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Abstract: An Information Security Culture Assessment (ISCA) aids in identifying what components an organisation needs to enhance or impede to improve the protection of the organisation's information. The objective of the ISCA, developed in previous research by the authors, is to assess the current information security culture level in organisations using a survey approach. This paper discusses a case study of one of the international financial institutions where the ISCA was conducted four times over a period of eight years, across twelve countries. The research indicated that the information security culture improved from one assessment to the next, with the most positive results obtained in 2013. The Group Information Security Officer concentrated on training as the main improvement action in each country, in line with the recommendations of each assessment. It was found that the results of employees who received prior information security training were significantly more positive than those of employees who did not. The overall information security culture, from a dimensional and biographical perspective, also improved from one assessment to the next. The output of the ISCA can aid management in directing and prioritising information security awareness and training in terms of topics and biographical groups in the organisation. It provides insight into an approach that organisations can consider to address the risk to the protection of information, from an employee perspective. The trends identified in the case study also aid in understanding how an adequate information security culture can be inculcated in an organisation.

Keywords: information security culture, assessment, behaviour, benchmark, training, awareness

1. Introduction

Implementing information security controls has an impact on the organisational processes, technology and the manner in which employees process information. To implement information security practices effectively, organisations must ensure that the culture is conducive to the protection of information. Instilling a culture in which information is governed and protected by all employees at all times in accordance with organisational policy and regulatory requirements is by no means an easy task. It is crucial to understand the perceptions, attitudes and behaviour of the organisation's employees in order to shape the information security culture into one in which the nature, confidentiality and sensitivity of information are understood and handled accordingly. The objective is to provide an approach aimed at cultivating a strong information security culture in an organisation and to assess whether this culture is at an acceptable level. The results obtained from such an assessment can be used to direct human interaction with information assets and thereby minimise the threats that user behaviour pose to the protection of information.

The researchers developed an Information Security Culture Assessment (ISCA) in previous research (Da Veiga & Eloff 2010; Da Veiga & Eloff 2007; Da Veiga, Martins & Eloff 2007; Martins & Eloff 2002). The ISCA instrument aids in identifying what components an organisation needs to enhance or impede to improve the protection of the organisation's information by identifying potential risks to the protection of information from a human perspective. The objective is ultimately to foster a strong information security culture utilising the results of the ISCA.

2. The aim of this paper

This paper discusses a case study of an international financial institution where the ISCA was conducted four times (i.e. four assessments) over a period of eight years, across twelve countries. The objectives of the project were to establish what level of information security culture is present in the organisation, to recommend improvements, to benchmark the data from one assessment to the next to monitor changes, to identify trends, and to continuously improve the information security culture to minimise risk from an employee perspective.

This paper portrays the key findings, trends and recommendations provided by the ISCA by considering the results of the benchmarking data and the following research questions:

- Does the implementation of the recommendations of each assessment result in an improved information security culture?
- Does information security training positively influence the level of the information security culture?

3. What is an information security culture?

Schein (1985) defines culture as “a pattern of basic assumptions – invented, discovered, or developed by a given group as it learns to cope with its problems of external adaptation and internal integration – that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems”. According to Schein (1985) the core substances of corporate culture are the basic assumptions, attitudes and beliefs of employees, which relate to the nature of people, their behaviour and beliefs. Assumptions are values that become embedded and as such are almost taken for granted. These basic assumptions are non-debatable and non-confrontable (Schein 1985).

Organisational or corporate culture is expressed in the collective values, norms and knowledge of organisations. Values relate to the sense that people have of what ought to be. Many values are adopted consciously and guide the actions of employees (Schein 1985). Such norms and values affect the behaviour of employees and are expressed in the form of artefacts and creations. Artefacts are the visible output of a culture, for example the written or spoken language, or the way status is demonstrated (Schein 1985).

An information security culture concerns the manner in which employees perceive and interact (behave) with the controls that are implemented to protect information. An information security culture therefore consists of:

- basic assumptions regarding information security and how to protect and interact with information in all formats;
- the attitudes and beliefs of employees in respect of information security, controls, compliance and how to protect and interact with information; and
- knowledge of the organisation’s information security policy and compliance requirements, what information security incidents are, how to minimise risk to information when processing it, and what constitutes confidential or sensitive information from an organisational as well as legislative perspective – to mention but a few aspects.

In addition, information security culture relates to:

- the values and norms dictating what should be done to protect information and to handle it in accordance with the sensitivity and classification of the information; and
- visible artefacts and creations of the culture such as clear desks, computers locked with security cables, lockable bins or shredders for the destruction of confidential documents, escorted visitors, encrypted confidential e-mails, annual online information security training, statistics of the number of incidents related to employee error or negligence, etcetera.

Given the above, Da Veiga and Eloff (Da Veiga & Eloff 2010) defined information security culture as the “attitudes, assumptions, beliefs, values and knowledge that employees/stakeholders use to interact with the organisation’s systems and procedures at any point in time. The interaction results in acceptable or unacceptable behaviour evident in artefacts and creations that become part of the way things are done in the organisation to protect its information assets.”

4. Assessing the information security culture

The verb “assess” means “to estimate the value or quality of” (Oxford Dictionary 1983, 2005). “Assess” in the context of ISCA refers to identifying whether the level of information security culture is adequate to protect the confidentiality, integrity and availability of information. Determining whether the information security culture is at an adequate level requires that a value for it be determined. In the current research, this value was determined by doing a quantitative assessment. Quantitative research methods have been deployed with great success in the information security discipline (Schlienger & Teufel 2005; Straub, Boudreau & Gefen 2004; Straub 1990; Siponen, Pahlila & Mahmood 2007).

Questionnaires and surveys are research tools widely used within the social sciences (Brewerton & Millward 2002) to measure behavioural content pertaining to attitude and opinions (Berry & Houston 1993). To assess the information security culture in an organisation, the attitude and opinions of employees regarding information security need to be determined (Martins 2002). Through such an assessment, management can measure employees' perception of information security and identify aspects that require attention in order to improve the information security culture to an acceptable level and so protect information assets.

The ISCA involved an information security culture questionnaire developed by the researchers (Da Veiga, Martins & Eloff, 2007; Da Veiga & Eloff 2010). For the purposes of this research, the focus was on assessing employees' perspectives and knowledge pertaining to the protection of information. The assessment of artefacts can also be incorporated for a holistic assessment of the information security culture output; however a discussion on the measurement of artefacts was excluded from this paper.

ISCA is used to identify whether there is an acceptable level of information security culture. This means that the information security culture has to provide adequate protection of information assets, thus minimising the threat to the confidentiality, integrity and availability of the information assets. The overall results may be positive, or only certain dimensions, statements, or biographical groups may display positive results. From an assessment perspective, it means that employees selected the "strongly agree" or "agree" option for the statements/questions asked in the questionnaire, utilising a 5-point Likert scale. If the overall results are positive for certain biographical areas, it means that the employees have a positive perception towards the protection of information, which could mean that there is a good level of awareness, policies are understandable, change is implemented effectively, there is management commitment, and training is effective. Having a positive or strong information security culture enables employees to interact with information in a more secure manner, creates an environment where compliance behaviour is the accepted norm, and ultimately reduces incidents.

The results of the ISCA can be used, for instance, to update information security policies, to provide input for awareness and training programmes, the information security strategy and programme and change management programmes, as well as to guide the focus of external audits. This aids in establishing a structured approach to transforming teams, individuals and the entire organisation to handle information in line with the organisation's information security policies.

5. The ISCA methodology

The ISCA methodology was deployed in the organisation chosen for the case study, in order to conduct the four assessments over the period of eight years (Da Veiga, Martins & Eloff 2007). The phases of the methodology include planning, design, survey administration, statistical analysis and reporting. A comprehensive discussion of the application of the ISCA in the relevant organisation is provided below.

5.1 Planning

The planning phase was used to identify potential stakeholders. A kick-off meeting was held with the project sponsor who, in this case, was the Global Information Security Officer (ISO). During this meeting, a high-level discussion of the information security policy and projects in the organisation took place. Information about training and awareness initiatives in the previous year was also obtained. Relevant information security policies were obtained for background purposes, to customise the ISCA questionnaire. A list of information security awareness topics and training was also obtained in order to incorporate questions about these initiatives.

The planning activities were repeated for each of the four assessments. The biographical section of the questionnaire was updated for each assessment to make provision for the organisation's structural changes. The sample sizes were calculated for each assessment to allow for changes in staff numbers. It was imperative to keep the questions the same for benchmarking purposes. In some instances a few additional questions were added based on changes in the business pertaining to that year's assessment.

5.2 Design

The objective of the design phase was to customise the ISCA questionnaire. The information security maturity level of each organisation varies. For example, one organisation might have an implemented information security policy, all employees might have received related training, and their compliance might be monitored. Another organisation might have a draft information security policy that is not implemented as yet. These aspects need to be considered when customising the ISCA questionnaire, to ensure that all questions/statements are relevant to the organisation's environment. Apart from the biographical section in the questionnaire, the knowledge section must also be adapted. A number of knowledge questions are included based on the organisation's policies, relevant information security projects and awareness initiatives.

In the case study organisation a questionnaire customisation workshop was conducted to develop the knowledge questions and biographical questions, and to adapt the culture questions to the language policy of the organisation. Once the Group ISO approved the ISCA questionnaire, the HTML version was designed and tested. As part of this phase, the communication e-mails and intranet messages that would be used to launch the survey and remind employees to complete the survey by the due date were designed.

5.3 The administration of the survey

The administration phase of the survey included the completion, monitoring and close of the survey. The Global ISO sent out the launch e-mail with the survey link, as well as the reminder e-mails. In order to motivate participation, employees could participate in an optional competition where they stood a chance to win a prize. As the completion of the questionnaire was anonymous, employees were required to provide their e-mail at the end of the questionnaire, and this was administered outside of the organisation to protect employees' confidentiality. A four- to six-week period was provided for employees to complete the survey. The responses received were tracked on a weekly basis to monitor whether enough responses were obtained in line with the required sample sizes for each biographical area, and to motivate employees accordingly to respond.

5.4 Statistical analysis

A number of statistical analyses were conducted on the data from the ISCA. The statistical analyses focused on an overall analysis of the data and a comparative analysis for the biographical areas. The data was analysed and the means, frequencies and frequency distribution were determined. The SPSS software package (IBM SPSS Statistics 21) was used for the advanced statistical analyses. Correlation and regression analyses were conducted to determine the most important focuses. Anova and t-tests were used to determine significant differences between the results of the statements for the biographical groupings. The t-test compares the results of two groups to determine whether the differences are significant. Anova tests are used to compare the results of more than two groups to determine whether the differences are significant. These tests were used to determine differences in the comparative analysis of biographical areas (Brewerton & Millward 2002). To further enhance the ISCA methodology focus groups were used to validate the survey results concentrating on both positive and developmental results and further more to obtain employees' input for recommendations and the development of action plans. The feedback from the focus groups mostly correlated with the survey results.

5.5 Reporting

During the reporting phase the statistical analyses were interpreted and areas of development identified. Once the report was compiled, a formal feedback session with the Group ISO and relevant stakeholders was conducted.

6. The ISCA questionnaire

The ISCA questionnaire was customised with the input of the case study organisation. Eighteen knowledge questions were drawn up for inclusion in the questionnaire. The objective of the knowledge questions was to derive an understanding of the awareness of employees regarding certain information security policy concepts and aspects that they are expected to know about.

Forty-four culture questions were included in the questionnaire, in line with the previous research (Da Veiga, Martins & Eloff 2007; Da Veiga & Eloff 2010). The questions were grouped in eight dimensions to gauge the perceptions of employees with regard to the protection of information. The key objective was to identify which perceptions of employees needed to change in order to create a culture in which information security is accepted as everyone’s responsibility and compliance behaviour becomes evident across the organisation.

Biographical questions were included to segment the data into: twenty-seven regions (including provinces in the breakdown for a total of twelve countries), thirteen business units, and three job levels. An additional question was added to segment the data into employees who attended information security awareness training, and those who did not. Another question was added to segment the data into employees working in IT and those working other business areas. The objective of the biographical segmentation was to identify any areas of development across the organisation on which to focus efforts and interventions in order to improve the information security culture.

The table below outlines the dimensions of the ISCA questionnaire used in the case study organisation.

Table 1: ISCA questionnaire dimensions

ISCA dimensions	Description
Information asset management	Assesses users’ perceptions of the protection of information assets
Information security management	Assesses management’s perceptions of information security management
Change management	Assesses the perceptions about change and the willingness of users to change in order to protect information
User management	Assesses user awareness and training with regard to the requirements to protect information
Information security policies	Assesses whether users understand the information security policy and whether communication thereof was successful
Information security programme	Assesses the effectiveness of investing in information security resources
Trust	Assesses the perceptions of users regarding the safekeeping of private information and their trust in the communications of the organisation
Information security leadership	Assesses users’ perceptions of information security governance (e.g. monitoring) to minimise risks to information

7. Overview of the case study

The case study organisation embarked on a journey to foster a strong information security culture across the organisation. Their objective was to instil a culture in which information security practices became part of the “way things are done” in the organisation. Under the direction of the Group ISO, four ISCA were conducted over a period of eight years – the first in 2006, followed by another in 2007.

In 2010 and 2013 the ISCA was conducted again. The organisation employed 3 927 employees in 2006, which increased to 8 220 by 2013. The organisation processes financial data on a global basis. This data is of a sensitive nature and must be kept confidential from unauthorised parties. In addition, the organisation has to comply with a number of legislative and industry requirements when processing the financial data of organisations and individuals. The organisation has established information security policies from an information technology (IT), end-user and privacy perspective. The governance of information security across the organisation is the responsibility of the Country ISOs who report to the Group ISO. Generic information security awareness training was conducted across the organisation prior to the 2006 ISCA.

7.1 Biographical data

In all four assessments an adequate number of responses were obtained for the overall data analysis. This means that the findings could be generalised across the group. The calculation of the sample size was based on a marginal error of 5% and a confidence level of 95%, to ascertain the findings across the organisation (Krejcie & Morgan 2070). In 2013 a 38.7% response rate was obtained, compared to 28% in 2010, 29% in 2007 and 40% in 2006. Non-managerial employees represented almost two thirds of the responses in 2013, with the rest being managers. Less than 3% of the respondents were made up of executives.

8. Statistical analysis

The results were analysed statistically to identify strengths and areas of development from an overall data perspective, as well as for the respective biographical areas. This paper focuses on the benchmark data obtained to identify trends and improvements.

8.1 Benchmarking

Table 2 outlines the ISCA dimensions with the corresponding means and percentage agreement for each dimension of the four assessments. The mean represents the overall mean for a specific dimension encompassing a number of statements. The arrows indicate whether the results for a dimension improved (arrow pointing upwards), remained the same (arrow being horizontal) or declined (arrow pointing downwards) from the previous year's assessment. The results of the 2013 ISCA were improved for all dimensions, when compared to the 2007 and 2006 data. A cut-off point of 4.00 for the mean was deemed acceptable for the information security assessment, given the importance of information security. This is higher than the 3.37 mean of *The Best Company to work for* survey.

Table 2: ISCA dimension means for 2013, 2010, 2007 and 2006

ISCA dimensions	Mean / % agreement 2013 N = 2159	Mean / % agreement 2010 N = 2320	Mean / % agreement 2007 N = 1571	Mean / % agreement 2006 N = 1941
Information asset management	4.30, 91.2%	4.22, 88.9%	4.17, 88.3%	4.10, 86.1%
Information security policies	4.15, 82.5%	4.08, 80.5%	4.07, 81.0%	3.93, 72.6%
Change management	4.14, 86.1%	4.09, 84.7%	4.08, 85.4%	3.97, 79.9%
User management	4.14, 85.8%	4.08, 83.4%	4.08, 84.9%	3.94, 78.8%
Information security programme	4.05, 80.55%	3.96, 76.8%	3.98, 79.9%	3.85, 71.0%
Information security leadership	4.03, 82.1%	3.88, 76.1%	3.89, 77.8%	3.79, 70.9%
Information security management	3.96, 80.1%	4.14, 90.6%	3.88, 79.4%	3.84, 76.7%
Trust	3.95, 76.8%	3.88, 74.8%	3.87, 76.3%	3.73, 68.6%

In the 2006 survey there was only one dimension that was above the mean of 4, namely information asset management. The most positive dimension in the 2013 ISCA was again information asset management, with 91.2% of the respondents having positive perceptions (86.1% in 2006).

The number of positive dimensions since 2006 improved from one to six dimensions in 2013. Trust was perceived as the most negative dimension in 2006. This dimension improved to a mean of 3.95, with 76.8% of respondents reacting favourably, compared to 68.6% in 2006.

The benchmark data over the eight years indicate that the information security culture improved from one survey to the next, with the most positive results reported in 2013. The perceptions of employees with regard to many (29 of 44) of the cultural statements improved significantly from 2010 to 2013, which is also the case for the other assessments. The overall culture mean improved from 3.89 in 2006 to 4.10 in 2013. In 2006 the overall average of the assessment was 75.7% compared to 83.6% in 2013, which indicates an improvement in the level of the information security culture.

Table 3 depicts the percentage of employees who received or did not receive information security (IS) training in the respective years. It is clear from the data that the percentage of employees that received training increased significantly from 2006 (23.75%) to 2013 (72.8%).

Table 3: Information security (IS) training received in 2013, 2010, 2007 and 2006

Received IS training	2013	2010	2007	2006
Yes	72.8%	66.5%	55.2%	23.75%
No	26.8%	22.4%	44.6%	75.43%
No response	0.4%	11.2%	0.2%	0.82%

It is critical to note that the overall information security culture of employees who attended prior information security training was more positive compared to those who did not attend prior training. This is evident in the data of all four years as depicted in Table 4.

Table 4: Information security (IS) training means for 2013, 2010, 2007 and 2006

Mean for training versus no training	2013	2010	2007	2006
Prior IS training	4.15	3.79	4.07	4.09
No IS training	3.96	3.65	3.92	3.83

9. Findings and recommendations

In summary, it was found that employees believe that they have a responsibility to protect the organisation's information and that information security is necessary in their divisions. They are aware of the information security policy and believe it is applicable to them in their daily duties.

Most respondents indicated that they are willing to accept some inconvenience to secure important information and that they are prepared to change their working practices in order to ensure the security of information assets. There was also a positive perception amongst respondents that executive and senior management demonstrates commitment to information security. Interestingly, the most preferred method to receive information security communication was face-to-face presentations, followed by web-based training and e-mail.

Some of the key concerns in the knowledge section pertained to:

- Knowledge of who the business unit's ISO is
- Having read the information security policy
- Not having received information security communication in the last six months
- Knowledge of where to obtain a copy of the information security policy
- The belief of some employees that passwords can be shared with Helpdesk, their manager, a secretary or their colleagues

The key concerns in the culture section related to:

- Third-party protection of the organisation's information
- The continuity of the organisation's daily operations if there is a disaster resulting in the loss of computer systems, people and/or premises
- Effective communication of the information security policy
- Timely communication as to how information security changes will affect employees
- Understanding the contents of the information security policy

Correlation and multiple regression analyses (Brewerton & Millward 2002) were performed to determine whether focusing on a specific dimension might improve the overall results of the information security culture. The analyses indicated that focusing on the following dimensions will influence the information security culture positively:

- Information asset management
- Information security leadership
- Information security policies
- User management

A focus on the following dimensions will have a positive impact on awareness of information security (regression analysis):

- Information security policies
- User management
- Training and awareness

To further improve the information security culture level, specific topics were identified per biographical area for management to concentrate on training and awareness sessions. The Group ISO concentrated on training as the main improvement action in each country, in line with the recommendations of each assessment.

Recommendations pertaining to the information security policy, reporting of incidents and the protection of client information when taken off-site were provided to the organisation, in accordance with data protection regulatory requirements.

10. Conclusion

The objective of ISCA is to help organisations foster an information security culture in which the nature, confidentiality and sensitivity of information are understood and information is handled accordingly by employees. The ISCA aids in identifying which components (i.e. leadership, trust, etcetera) an organisation needs to enhance or impede to improve the protection of the organisation's information. The output of an ISCA provides metrics that can be used to highlight specific focus areas for the organisation to concentrate on, thereby enabling the workforce to align themselves with the organisation's information security requirements.

The answer to the first research question, namely "Does the implementation of the recommendations of each ISCA result in an improved information security culture?", is evident from the improvement in the overall culture means from one assessment to the next, with the most positive results yielded in 2013. The results for the respective dimensions and biographical groups also improved from one assessment to the next.

The second research question, "Does information security training positively influence the level of the information security culture?" is also answered in this research study. It was found that employees who received prior information security training was significantly more positive compared to those who did not.

In summary, the research illustrates that the level of an organisations information security culture can be improved by assessing it using ISCA, and by implementing the proposed recommendations. The value is derived when addressing the developmental areas identified in the ISCA through specific action plans. Focusing on training and awareness has a positive influence on the information security culture and improves the information security culture level over a period of time.

The findings of this research are of particular importance to ISOs, Risk and Compliance Officers and Information Security Managers. ISCA can aid management in directing and prioritising information security awareness and training, because it highlights the topics and biographical groups in the organisation that require attention. It provides insight into possible approaches that organisations can adopt to reduce the risk to the protection of information from an employee perspective. The trends identified in the case study also indicate how an information security culture is inculcated in an organisation to an acceptable level.

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Are ICTs Needed for Innovative Firms to Succeed? A Survey of French SMEs

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Abstract: Firms' performance can be explained by many factors, including their innovativeness. Investment in ICTs is also seen as a source of competitiveness. Our research tests these two sources of performance and examines possible synergies with ICT supporting innovation. Based on the few existing academic studies raising the issue of synergies between ICTs and innovation, three hypotheses are formulated: the positive influences of (1) innovativeness and of (2) ICT resources on firm performance and (3) the influence of ICTs on innovation performance. The model is complemented with two control variables: market dynamism and firms' sectors. An empirical survey is conducted among 1.992 small-and-medium enterprises (SMEs) in France, complemented with an investigation of their financial performance. With a final sample of 1.088 firms, we test the direct effects of innovativeness and ICT resources (software diffusion and level of ICT skills) and the combined effect of innovativeness and dedicated ICTs. Dedicated ICTs variable captures how innovation depends on specific investments in ICTs or more intensive use of existing ICTs in the firm. This variable constitutes the major conceptual originality of our research. Our econometric results show that innovativeness has a positive effect on performance only if it is accompanied with dedicated ICTs. On the other side, econometric regression emphasizes an unexpected direct negative effect of innovativeness and of the level of ICT skills on SMEs' financial performance. We discuss these results taking place in the specific organizational context of SMEs: innovative SMEs might not always be the most financially efficient firms; the return on investment of ICTs has also to be questioned. However our results confirm that synergies between innovativeness and ICTs are a factor of SMEs' performance.

Keywords: innovativeness, information technologies (ICT), small and medium enterprises, econometrics, interaction variable, performance

1. Introduction

Companies are encouraged to innovate in order to guarantee their competitiveness and Small and Medium Companies (SME) do not escape from this rule. The capacity of an entity or an individual to innovate is generally expressed by the term innovativeness. Organisational innovativeness can be understood as "*the organisation's overall innovative capability, i.e. the propensity or likelihood that an organisation produces innovative outcomes.*" (Wang and Ahmed 2004 p.303). This capability is characterized within the organisation by support for and openness towards innovation.

The central focus of our research considers ICT as a lever for the benefits obtained from companies' innovativeness. Specifically, this role of ICT as a lever derives from their capability to accelerate the process of innovation or to encourage the capitalisation of the company's R&D knowledge (Pavlou and El Sawy 2006) or indeed their capability to better identify the emergent needs of the market (Tambe et al. 2012). Our research question is thus two-fold: do the innovativeness of SMEs and their information technology resources have an impact on their performance, and does the combination of innovation and dedicated ICT reinforce this impact? In order to answer this question, we use an original database created from a survey of a representative sample of 1.992 French SMEs, completed by a study of their financial performance. Econometric analysis is carried out on a final sample of 1.088 companies.

2. Conceptual framework

The notions of innovativeness and innovation are quite close and have sometimes been used indiscriminately (Damanpour 1991). Innovativeness can apply to an entity, that is to say an individual, an organisation or even an economy. At the organisational level, innovativeness can be understood in quite a broad sense. Thus, Wang and Ahmed (2004) define organisational innovativeness as "*an organisation's overall innovative capability of introducing new products to the market, or opening up new markets, through combining strategic orientation with innovative behaviour and process.*" (p.305). Sometimes reduced to the capability to generate product innovation, this innovativeness also concerns the capability to implement all upstream activities, particularly process innovations (Subramanian 1996).

2.1 Innovativeness and SME performance

The efforts to innovate made by an organisation can be understood as an investment leading to success. Nevertheless, all innovation implies risk-taking and innovativeness does not necessarily mean successful innovation (commercial success, gain in efficiency...); this puts into question the link with performance. In the vast body of literature on innovation management, the link between innovativeness and performance is not easily demonstrated. Among the recent studies, some research shows a positive link between innovativeness and performance (Hult et al. 2004; Das and Joshi 2012; Subramanian 1996). However, some research finds no direct relation (Dibrell et al. 2008; Jansen et al 2006). Also, for some authors, there is a non-linear link between innovativeness and performance (Huang and Liu 2005).

Conceptually, innovativeness is related to performance through resource theory or *RBV* (*resources based view*). The latter stipulates that a company is a combination of resources and capacities. These resources, as soon as they are rare or correctly combined, become the source of competitive advantage (Barney 1991). This approach, of explaining the benefits of innovativeness through resources, is applicable to SMEs (Hadjimanolis 2000), even if the latter have their own specificities. In fact, SMEs cannot be merely considered as a reduced version of large companies (particularly when they are small family companies): their ways of functioning differ in numerous ways from large companies. There can be differences between the results obtained for large companies and SMEs. Several favourable or unfavourable arguments concerning the innovation capability of SMEs can be put forward (Hausman 2005): certain specificities, such as the capacity to respond to changes in the environment, result in a high level of organisational flexibility and innovation. Proximity to, or dependence on clients and outside partners can also foster the deployment of innovations. On the other hand, the lack of in-house competences in the SME can also be a disincentive to innovation or market success. Moreover, personal and operational over-involvement of the director, his or her personality, or family considerations can be a disincentive to risk taking. Finally, we can make the following hypothesis:

Hyp.1: The innovativeness of SMEs has a positive effect on their performance over time.

2.2 ICT resources and SME performance

The impact of ICT has been a subject for debate for a long time. This phenomenon was popularised by Solow's ICT productivity paradox. Numerous studies, often econometric in nature, have obtained more pertinent results but which are not always generalisable, particularly regarding too divergent methodological approaches (Aral and Weill 2007). However, literature review based on *RBV* approach shows that IT resource generates value in organisations (Melville et al. 2004). Moreover, the majority of empirical research available indicates that the effect of ICT on productivity is positive and significant (Cardona et al. 2013).

What is the situation for SMEs? The study of the role and specificities of information systems in the functioning of small enterprises has been the object of a certain number of contributions (Premkumar 2003; Poulin and Tran 2009, Deltour and Sargis Roussel, 2012), showing that the relationship with information technology is not obvious for small organisations. Going beyond these possible difficulties, Rougès et al. (2009) review the studies which directly investigated the link with SMEs' performance. Among the twenty quantitative studies identified, the link between ICT and performance is very frequent, even if it is not systematic. Following Aral and Weill (2007), it is possible to consider two dimensions combining to create ICT resources: (1) "IT assets" which correspond to different equipment and investments and (2) "IT capabilities" which correspond to different in-house competences relative to ICT, combined with ICT practices developed in the organisation. The resulting ICT capability represents a combination of material and human resources (Bharadwaj 2000). Finally, we retain the following expression for our second hypothesis:

Hyp.2: The level of ICT resources of SMEs has a positive effect on their performance over time.

2.3 ICT as a specific investment for innovation

Do information technologies have an influence on the relationship between innovativeness and SMEs' performance? Previous, sometimes similar studies have produced contrasting results to this question which is central to our research. Indeed, among the four studies identified, two conclude that ICT have a positive accompanying role (Huang and Liu 2005; Dibrell et al. 2008), whereas the other two do not find a combined effect or even a negative effect (Kmieciak et al 2012; Raymond et al 2013). These different inconsistent results lead us to clarify the question of the role of ICT as a lever - or not - of the effects of innovation on

performance. The opposite results obtained by Raymond et al (2013) on ICT families, which are known as integrative, incite us to analyse what the study of certain specific categories of ICT can add to the analysis of the phenomenon. Our main research interest is in ICT dedicated to innovation, although we do not neglect the place that ICT can occupy in the company in a more general manner (hypothesis 2).

Different specific ICT can reinforce the innovation capability of companies or reinforce its benefits. In the context of product innovation, Pavlou and El Sawy (2006) identify three situations where new product development competencies can be enhanced by ICT: the use of project management and resource management systems; the use of knowledge management systems; the use of collaborative working systems. Tambe et al. (2012) analyse how practices of external information collection supported by ICT are a source of innovation (product) and of productivity. At the same time, Kmiecik et al. (2012) suggest the idea that certain ICT families allow a better understanding of the market, by facilitating exchanges with clients, who thus participate (via e-mails, discussion forums, social networks) in designing products corresponding to their expectations. Finally, ICT are widely recognized in the literature for their contribution to process innovation, as they lead to transformation of the company (Besson and Rowe 2012). In agreement with the research showing the positive role of specific ICT in innovation capability, we formulate our final hypothesis as follows:

Hyp.3: Accompanying innovation with ICT resources enhances the influence of SMEs' innovativeness on their performance.

3. A quantitative research method

3.1 Data collection

3.1.1 Questionnaire administration

The data used are taken from a survey carried out in 2008 by the M@rsouin Group, within the framework of the OPSIS observatory (Observation and Perspectives for the Information Society and Services). The survey concerns the use of IT by SMEs in the region of Brittany (France), from 10 to 250 employees, in the sectors of industry, commerce and services (excluding public services). The firms were chosen in order to obtain good final representation of respondents in terms of localisation in the Breton departments, of size and activity sector, relative to the regional economic framework (M@rsouin, 2009). Finally 1.992 replies were collected from SMEs. In the majority of cases, the respondent is the Company Director or the Administrative and/or Financial Director. The survey is based on a general questionnaire, which first asks the SME about its economic situation and then lists a wide range of equipment and its possible use within the firm, or with outside partners. A series of questions focuses on the company's innovation policy over the last 24 months, and its ICT support.

3.1.2 Financial data collection

The measurement of the impacts of ICT on performance has been carried out using numerous approaches, regularly comparing perceptual measures with objective ones, the latter being more difficult to obtain (Tallon and Kraemer 2007). Moreover, objective measures appear in a small minority of the work measuring SMEs' performance (Rougès et al. 2009). It was decided to opt for an objective measure. We thus completed the data from the survey with financial data and staffing figures, for the year 2010, which were collected via systematic transcription of information available web sites specialised in financial information.

3.2 Preliminary data processing

Based on 1.992 companies having replied to the questionnaire, several successive checks and filters were carried out. The SMEs whose financial data could not be obtained from the financial information sites were rejected. Moreover, the data consulted had to be checked in order to remove the SMEs for whom there could be a lack of coherence between the information reported and the information consulted from the analysis:

- A too large gap between the staffing figures reported and the staffing figures collected (more than 25%) indicated a risk that the financial data collected corresponded to another entity than the one targeted;
- The companies whose turnover collected via the web sites was over 50 million euro in 2008 were also rejected. In fact, these companies are no longer SMEs but Intermediate Sized Enterprises ;

Finally, the companies who did not reply to the questions concerning innovativeness and ICT support were excluded from the analysis. We were finally able to carry out the analysis based on a sample of 1.088 companies.

3.3 The model

We are testing the effect of firms' decisions about innovation and ICT resources on their performance. We are also testing the existence of an enhancing effect of ICT support for innovations on performance, through interaction models (Braumoeller 2004). Thus, we use a multiple linear regression with an interaction variable.

3.3.1 Performance, the dependent variable

In compliance with previous research (Bharadwaj 2000; Huang and Liu 2005; Aral and Weill 2007), one financial measure per ratio is retained. The operating margin is the result of the company's operating result divided by its turnover and multiplied by 100 ($100 \times OR/T$). This ratio allows us to take into account the SME's operational profit divided by its size, measured here by the level of sales. The performance ratio is calculated from the financial data of the year 2010, that is to say, two years after the answers to the questionnaire. The estimation of this *lag time*, between ICT investments and performance nevertheless remains difficult (Cardona et al. 2013). Similarly, the time lag between innovation and its impacts on company performance is very variable (Kafouros and Wang 2008). Small companies, little inclined to finance long term innovation projects, will gravitate towards projects likely to generate short term revenue (Kafouros 2005). A relatively short time lag of two to four years thus seems appropriate for the situation under study.

3.3.2 Explanatory variables

Innovativeness: Innovation capability is sometimes measured by the level of R&D investments (Huang and Liu 2005; Raymond et al 2013) but this measure is rather inappropriate for the small firms who rarely formalise their means of innovation, while they can develop innovation (Forsman 2011). An alternative approach consists of estimating the capability the enterprise has had in implementing different forms of innovation in over a recent time period. Thus, Subramanian (1996) stresses the fact that measuring innovativeness must be carried out in a multidimensional way and over a long period of time. We choose the most classical dimensions, with distinguishing between innovation capability for products or processes (Dibrell et al. 2008 ; Forsman 2011 ; Raymond et al. 2013): product innovations focus on a change in the products or services supplied to the client, while process innovations concern the way a company produces its products. Following Subramanian's (1996) recommendations, time is also taken into consideration: innovativeness is measured by the capability of having innovated in the last 24 months before the survey. In the specific case of our data, a Khi 2 test of the variable independence reveals dependency between the two types of innovativeness; we thus chose to consider an aggregate measure in the model. The variable innovativeness thus takes the value 1 if the company has developed new products, or services, or has introduced new processes in the last two years, or 0 if this is not the case.

ICT resources: The ICT resources of SMEs are characterised using two complementary dimensions (Aral and Weill 2007): IT assets and IT capabilities. IT assets correspond to investment in equipment and software by the company. In our research, an approach through the level of computerisation of functions is retained. For all the functions possible within a company (accountancy and finance, sales management, purchases, stock, logistics/distribution, Human Resources...) the questionnaire indicates whether each one is carried out in-house, outsourced or non-existent. When it is carried out in-house, the respondents are asked if it is computerised. The variable the level of computerisation of functions, which represents the number of computerised functions in the company over the number of functions carried out in-house, is a continuous variable, whose value is between 0 and 1. In-house IT capabilities correspond to the company's investment in Human Resources for IT. The variable IT capabilities can be of four types: 3 if the company has a specific IT service 2 if it has at least one part-time (or more) employee dedicated to IT (but no specific IT service) 1 if it has at least one employee with a Higher Education diploma in IT (but no employee specifically dedicated to IT) and 0 if it has none of these resources in-house.

ICT dedicated to innovation: An originality of the survey is that it distinguishes between ICT resources globally present in the company and those specifically used to support innovations in the company. ICT dedicated to innovation correspond either to investments in specific tools used to put product or process innovations into

place, or to the increased use of available tools, during this innovation activity. The two items were aggregated.

We introduce an interaction variable (Innovativeness X dedicated ICT) which combines innovativeness with support for innovations through investment in ICT or through more developed use of the technologies present in the company.

3.3.3 Control variables

Two control variables are added to this model. They allow us to complete the analysis of the sources of performance:

The dynamism of the market has three modes which correspond to the main market of the SME declared as being growing, stable or declining.

Activity sectors: From the French principal business activities code (APE Codes), twelve activity sectors are kept in our analysis (see table 1).

Table 1: Measures and descriptive statistics of the research variables (n=1088)

Variables	Items / Measures	Descriptive Statistics
Performance	Margin rates : (Operating result / Turnover) x 100	Mean : 3,41 Standard deviation: 9,25 Min :- 67,12 Max : 70,45
Innovativeness	<i>In the last 24 months, your company...</i>	
	<i>has developed new products/services</i>	yes = 395
	<i>has introduced new processes</i>	yes = 208
	<i>has developed new products/services or has introduced new processes (aggregate variable)</i>	yes = 450
ICT Resources	<i>Level of computerisation of functions: nb computerised functions / nb functions present</i>	Mean : 0,78 Standard deviation: 0,30 Min : 0 Max : 1
	<i>In-house IT skills :</i>	
	<i>There is a specific IT un service</i>	144
	<i>There is at least one part-time, or more, employee dedicated to IT</i>	231
	<i>There is at least one employee with a Higher Education diploma in IT in the company (not dedicated to IT)</i>	36
	<i>No in-house IT capabilities</i>	674
	<i>No reply</i>	3
ICT dedicated to innovation	<i>If there have been innovations (product or process), that is shown by ...</i>	
	<i>Investment in specific ICT equipment</i>	yes = 119
	<i>Greater use of ICT</i>	yes = 152
	<i>Investment in or greater use of ICT</i>	yes = 192
Market Dynamism	<i>Would you say that your main market is :</i>	
	<i>Growing</i>	395
	<i>Stable</i>	485
	<i>Declining</i>	143
	<i>no reply</i>	65
Activity sector	Industries categorisation carried out on the basis of APE codes supplied	agricultural & food ind. = 45 consumer goods ind. = 53 capital & automotive Ind = 98 Energy and IG = 104 Construction = 276 Car sales = 57 Wholesale = 89 Retail = 106 Transport = 70 Finance & Real Estate = 13 Business Services = 112 Consumer Services = 65

The whole of the items used in our analysis and the associated statistics are presented in table 1. One notes that in the last two years, a larger number of SMEs have introduced new products/services (n=395) than new processes (n=208). These figures confirm Hausman’s (2005) case studies showing that SMEs are more inclined to adopt new tangible products than new ideas or management practices.

4. Results

Table 2 presents the coefficients of the different variables, along with the significance level of the variables (one star for 10%, two for 5% and three for 1%). For multinominal variables, the reference mode is noted as “Ref”.

Table 2: results of the linear model (operating margin in 2010)

Explanatory variables	Modes	Estimated coefficients
Innovativeness	Yes / No	- 1,54 **
Innovativeness x dedicated ICT	Yes / No	1,88 **
IT capabilities	Specific service	-0,029
	Dedicated employee	-0,30
	Non-dedicated employee	2,02
	None of these capabilities in-house	Ref.
Level of computerisation		- 1,97 **
Dynamism of main market	Growing	1,92 ***
	Stable	Ref.
	Declining	0,78
Activity Sector	Agricultural and food industries	Ref.
	Consumer goods industry	- 3,71 **
	Capital and automotive goods industry	- 1,84
	Energy and intermediate goods industry	- 2,28 *
	Construction	- 2,14
	Car sales and repairs	- 2,63
	Wholesale	- 2,94 *
	Retail	- 1,77
	Transport	- 3,83 **
	Financial and real estate activities	4,09
	Business services	1,78
	Consumer services	1,02

The analysis of the results of the econometric model presented in table 2 leads us to disconfirm the first two hypotheses of our model (H1 and H2). Indeed, the significant and negative coefficient associated with the variable of innovativeness implies that the latter has a negative impact on SMEs’ performance. The effect of ICT resources not directly related to innovation is also unexpected: the model reveals a negative effect of the level of computerisation and an absence of effect of IT capabilities. On the other hand, the third hypothesis (H3) is validated: the significant and positive coefficient of the interaction variable implies that innovation, if it is supported by ICT improves SMEs’ performance.

Considered as a control variable for the model, market dynamism influences performance: SMEs whose main market is growing show better performance than those characterised by a stable main market; on the other hand a declining main market does not seem to affect the SMEs’ margin rates. Finally, the model reveals sectoral effects. Four activity sectors out of eleven are characterised by margin rates which are lower than those of the reference sector.

4.1 Innovativeness accompanied with targeted digital support is a source of performance

Our investigations validate the hypothesis concerning the combined effect of innovativeness and ICT on performance (H3), extending to SMEs the conclusions already brought to light in large companies (Huang and Liu 2005). This result is in keeping with the work of Dibrell et al (2008) who show that the positive impact of innovation must include investment in ICT. Without restricting our study to certain technologies or certain types of innovation, we highlight the positive effect of the innovativeness of SMEs on their performance, as

soon as they use ICT to accompany their innovations, whether they are of products or processes. We can thus talk of a targeted synergy effect between ICT and innovativeness.

Finally, it is interesting to note that supporting innovation by ICT is not understood only in terms of investment: according to our approach, a more extensive use of the technologies present in the company is considered as support and will contribute positively to performance.

4.2 Engagement in innovation or ICT reduces SMEs' performance

A more unexpected result is the direct effects of innovativeness on performance. Certain previous research has shown that a positive link between innovativeness and performance is not consistent. In particular, when the authors integrate a possible interaction between ICT and innovativeness, the effect of the latter on performance becomes more complex (Dibrell et al. 2008). One area of explanation for this result is the difficulties in terms of investment return on innovation activities in SMEs: implementing innovations has a significant cost for the organisation, but the commercial benefits remain uncertain. Thus, as Subramanian (1996) reminds us, companies classed in the category of "prospectors" (according to Miles and Snow's typology) are generally the most innovatory, but are not necessarily the most successful from a financial point of view.

The link between ICT and performance is also open to question. Our work shows that the presence of IT capabilities within the company has indeed no direct effect on performance, while the level of computerisation of the functions present in the company has a negative effect. This last result contradicts previous work which showed a positive effect (Dibrell et al 2008), or no effect (Huang and Liu 2005, Kmiecick et al. 2012). In the same way that innovation strategies are costly for SMEs, the cost of computerisation is perceived as high by SMEs, even though these technologies tend to become rapidly obsolete and hardly create strategic advantage (Chae et al. 2014).

The costs sustained by small structures in the context of their activities of innovation, or of their ICT policy, are indeed so high, in proportion to their size, that, if this expenditure is not undertaken to respond to a common need, they run the risk of having an impact on the company's financial results, without representing a sufficient profit.

5. Conclusion

In this research, we have investigated the spillovers of SMEs' innovativeness and of their ICT resources, along with the effects of support for innovation by dedicated ICT. Although the positive effect on firms' performance brought about by the combination of innovation strategies and the use of ICT has already been established in the literature (Huang and Liu 2005, Dibrell et al. 2012), we provide new results by bringing to light the negative effect of SMEs' innovativeness policies and computerisation on their performance. Future investigations can investigate more deeply the distinctions between the spillovers to expect from product or process innovations, and the distinction between the two forms of ICT support for innovation (ICT investments or ICT increased used).

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Chief Information Officers and Information Systems Failure: Towards a new Research Agenda

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Abstract: This paper describes the role of the CIO noting its evolution and enlargement since the beginning of the business computer era, and describes the technological and competitive advances that have shaped the evolution of the role over this time. Concluding that the role remains ambiguous in many organisations the paper proposes that this ambiguity has given rise to a range of issues specific to the CIO role that may contribute to the enduring problem of IS underperformance and failure. The nature of IS failure is then examined followed by an examination of the challenges faced by many CIOs related to this phenomenon. Noting the dearth of empirical studies on the relationship between IS failure and the CIO this paper makes the case for further inquiry in this area and proposes the use of process inquiry with a case study methodology for the study of the role of the CIO over the course of failing IS initiatives as a novel method for integrating inquiry in both domains.

Keywords: chief information officer (CIO), IS failure, process inquiry, and case study

1. Introduction

Despite over 50 years of study into the phenomenon the rate of IS failure remains alarmingly high. As the most senior IS officer in the organisation the CIO is ultimately responsible for the successful deployment of IS to meet the strategic objectives of the organisation however the CIO literature suggests that there may be a range of issues specific to the CIO role which continue to impact negatively on the success of the role, and which may also contribute to the enduring problem of IS underperformance and failure (McDonagh forthcoming).

This paper describes the evolution of the role of CIO from the early days of computing to the present. The nature of IS failure is examined and then discussed in the context of the CIO. A range of issues are identified, many of which are specific to the CIO role, which may be contributory factors in IS underperformance and failure. Noting the dearth of empirical studies on the relationship between IS failure and the CIO the paper concludes by making a case for the integration of process inquiry and the case study methodology for the study of the role of the CIO over the course of failing IS initiatives to provide a more holistic view of both the process of failing and the role of the CIO therein. It is proposed that this novel approach provides a dynamic dimension to the study of the CIO role that is not evident in extant literature and can make a significant contribution to both academia and management practice alike.

2. The role of the CIO

The role of CIO has undergone significant evolution and enlargement since the introduction of the computer as a business tool. During the early days of computing, in the 1960's and 70's, business computing was dominated by the mainframe computer which typically processed functionally orientated, transaction based systems (Ross & Feeny 2000), developed for specific areas of the organisation (McFarlan 1971; Nolan 1976). Data processing (DP) departments, were established to centralise computer operations for the organisation (Gibson & Nolan 1974) headed by a DP manager, who operated in a specialist functional manager capacity, with responsibility for managing the department and delivering new systems to time and budget (Ross & Feeny 2000).

During the 1980's the role of DP manager changed in response to a number of advances in IS capability and a changing competitive landscape which demanded IT led innovation. The DP manager (now called the MIS manager) became to be defined in terms of three responsibilities: *strategic responsibilities*: to create a shared business and IS vision among senior organisation management (Earl & Feeny 1994 2000) and to bridge the gap between organisational strategy and the use of IT (Benjamin et al. 1985; Stephens et al. 1992); *organisational responsibilities*: to facilitate and promote change and increasing adaptive capabilities across the organisation (Cross et al. 1997; Fiegenger & Coakley 1995), and support integration of the IS function into the line

(Davenport & Short 1990; Ross & Feeny 2000); and *technology leadership responsibilities*: to monitor the technology landscape and implement a standardised, enterprise-wide computer architecture (Benjamin et al. 1985) with high levels of service (Rockart et al., 1982; Ross & Feeny 2000). The term Chief Information Officer (CIO) was coined during this time to reflect the growing strategic nature of the role and its rising profile in the organisation.

The introduction of the public Internet in the mid-1990's (Ross & Feeny 2000) altered the structure and boundaries of many industries (Porter 2008) by re-aligning the competitive environment (Porter 2001 2008), changing the balance of threats and opportunities, and creating opportunities for strategic differentiation (Seely-Brown & Hagel 2003). The growing importance of the role of CIO that was mooted during 1980's became widely accepted as technology became deeply embedded as a key component in the pursuit of competitive advantage (Peppard et al. 2011; Porter 2001). The importance of aligning business and IS strategy has emphasised the need for an IS executive with the necessary skills and attributes to operate at strategic level within the organisation, who can champion the role of IS as an integral part of its overall strategy (Applegate & Elam 1992; Smaltz et al. 2006). Some authors suggest that the uniqueness of the IS speciality (Grover et al. 1993), and the breadth of organisational knowledge required, differentiates the CIO role from that of other senior executives (Lepore 2000; Thomas 1990) thereby making it one of the most critical senior executive positions in the organisation (Karahanna & Watson 2006; Thomas 1990).

The role of CIO continues to evolve (Preston et al. 2008; Remenyi et al. 2005) as advances in hardware and software technologies relentlessly drive a global digitised economy that is pushing the boundaries of both space and time (Dutta 2012), and changing the way organisations and consumers transact business (Arthur 2011). Today the CIO must continuously innovate to create value in the digital market place whilst balancing the ever present threats to privacy, security and cybercrime (Marston et al. 2011; Weill & Woerner 2013). However notwithstanding the criticality of the CIO role today, it remains that CIOs appear under constant strain due to the perception that the introduction and exploitation of IS is fraught with difficulty. The nature of this difficulty is such that many IS initiatives ultimately result in significant underperformance and failure, a situation that has prevailed throughout the computing era. It is as if the prospect of failure constantly looms large, a theme to which we now turn our attention.

3. The enduring nature of IS failure

IS failure is a recurring theme in both academic and practitioner literature since the beginning of the computer age (Avots 1969; Powers & Dickson 1973), however despite over 50 years of study IS failure continues to be a persistent and costly phenomenon. Studies of IS failure indicate an outright failure rate of IS projects of between 18% (Eveleens & Verhoef 2010) and 50% (McDonagh 2001). In addition many projects not considered to be outright failures fall far below expectations (Bloch, et al. 2012). Gartner estimate that total global spend on IS for 2014 will be \$3.8 trillion. Even a conservative estimate of the percentage of this amount that is spent on underperforming IS represents a significant figure, which is a motivation and justification for continued inquiry in this area (Drevin 2008).

3.1 Definition of IS failure

The concept of IS failure has not been well defined (Lyytinen & Herschein 1987; Nakamura & Kijima 2011), and there is no widely accepted explanatory model of IS failure (Sauer 1993). Based on a survey and classification of the empirical literature on IS failure Lyytinen & Herschein (1987) identified four distinct types: (1) *Correspondence Failure*: the system does not 'co-respond' to predefined design objectives, (2) *Process Failure*: a failure to produce a system at all or failure to produce a system within planned budgets and timeframe, (3) *Interaction Failure*: failure of the system to meet the needs of its users evidenced by the level of use and the degree of user satisfaction with the system, and (4) *Expectation Failure*: the inability of an IS to meet a specific stakeholder group's expectations. Sauer (1993) proposes that a failure occurs when the level of dissatisfaction with a system is such that there is no longer enough support to sustain it, an approach that also supports the notion that failure can happen long after the system is successfully implemented.

3.2 Some unique features of IS and failure

Failure is an inherent aspect of complex technological and organisational systems (Cook 2000; Sauer 1993). Failure is also an inherent feature of IS (Nelson 2007). IS are both innovative and inherently complex (Brooks

1987). Unlike hardware software is an intangible and abstract entity, therefore human cognitive limitations, exacerbated by bounded rationality and the tendency to satisfice, can lead to fallible decision making during specification and design, which can impact on the accuracy of software, resulting in failure (Sauer 1993). Furthermore, unlike the construction of a bridge or other such engineering endeavour, information systems can have a very large impact on the socio-technical equilibrium within organisations and therefore much more forces of work against the system may come into play (Bostrom & Heinen 1977). The typical lifespan of an IS innovation means there is usually a degree of uncertainty about what the final outcome will be, how the process of constructing the product will progress in the face of possible unforeseen situations (Sauer 1993; Boddy et al. 2009), and the potential for late detection of problems (Al-ahmad et al. 2009). The number of stakeholders affected by an IS initiative makes it difficult to satisfy all expectations (Sauer 1993; Boddy et al. 2009). Finally companies continue to inject technology without making the necessary organisational changes. Marchland & Hykes (2006) state that IS projects are mostly technology led, and that many organisations lack an integrated approach to organisational and technical change, and often design the social system around the technology.

4. The CIO and IS failure

As the highest ranking IS executive the CIO has ultimate responsibility for the successful deployment of IS to create value for the organisation. The importance of the role of senior organisational management (henceforth called the top management team, TMT) in this regard has also been acknowledged (Doll 1985; Young & Jordan 2008), as has the importance of the CIO in creating a shared vision as a precursor to successful IS and corporate strategy alignment (Chan 2002; Preston & Karahanna 2000). The literature however suggests that there may be a range of issues, specific to the CIO role, which continue to impact negatively on the success of the role, and which may also contribute to the enduring problem of IS underperformance and failure.

During the distributed era, as the role of CIO evolved in a more strategic direction, Fiegenger & Coakley (1995) identified two issues, the knowledge gap and the credibility gap, which they proposed were specific to the role of CIO, and which may impact on the success of an individual in the role. The knowledge gap refers to the lack of understanding among executive management of the nature and role of IS within an organisation, which is often exacerbated by the prevalence of technology orientated language unknown outside of the IS domain (Stephens 1993). The knowledge gap is not confined to executive management alone (Daft & Lengel 1984) in (Johnson & Lederer 2003). The knowledge gap may also explain why CIOs with a wealth of experience and successful careers sometimes struggle when they move to a new organisation (Peppard 2010).

The credibility gap relates to the difficulties many CIOs experience in trying to make the transition from functional manager to executive manager. CIOs elevated to the new role often lack the skill-set necessary to operate at senior level, along with the personal competencies required for the role (Fiegenger & Coakley 1995; Earl & Feeny 1994). Peppard & Ward (1999) identified a further issue which they refer to as a cultural gap which suggests that the perspective of IS management may be sometimes different from that of other executive management. All three gaps can undermine the effectiveness of the CIO in developing a professional relationship with the TMT thereby limiting the opportunity to engender trust and nurture common interests, promote the value of IS, and develop strategic business knowledge across the organisation, all of which are essential to the successful performance in the role (Spitze & Lee 2012). The CIO also continues to struggle to provide measurable evidence of the value of IS (Fiegenger & Coakley 1995; Peppard 2007).

All of the above can result in a failure on the part of the CIO to create a shared vision of IS across the organisation, which in turn can lead to a failure on the part of senior management to engage with IS during strategy formation (Jones et al. 1995) which may result in failure to identify high potential IS applications, difficulties in turning good ideas into action, and a lower return on IS investments (Chan 2002). It can also create a difficulty in assessing and prioritising IS investments (Karahanna & Watson 2006) resulting in a demand by the business for rapid deployment of applications to support business growth (Johnson 2002) at the expense of more strategic IS deployment, resulting in the creation of silo projects across the organisation that are not integrated into an overall corporate strategy (Kaerst-Brown 2005). Furthermore the failure of the CIO to ensure that IS is an integral part of the strategy making process often results in what should be a shared leadership of organisational change during IS deployment being abdicated to the IS function (Reich & Benbasat 2000; Ross & Weill 2002) on the erroneous assumption that the necessary organisational change (Brooks 1987;

Willcocks & Sykes 2000) will somehow follow the IS implementation. Lack of preparedness within the organisation can result in implementation cost overruns or outright failure (Kaarst-Brown 2005; Willcocks & Sykes 2000) which can contribute to, or reinforce, a negative perception of IS, and create a vicious cycle of dissatisfaction and disengagement on both sides (Peppard 2010). Failure to understand the strategic importance of IS can also lead to under resourcing of the IS function (Kaarst-Brown 2005; Willcocks & Sykes 2000) which can result in sub optimal IS architecture planning and staffing, and an over reliance on external expertise (McAteer & Elton 2000), with a consequent dilution of in-house knowledge and expertise.

5. Avenues for further inquiry

Extant literature on the CIO falls into four broad strands: (1) CIO role profile studies (Grover et al. 1993; Peppard et al. 2011); (2) CIO competency studies (Chun & Mooney 2009; Smaltz et al., 2006); (3) the CIO as a member of the TMT (Leidner & Mackay 2007; Tagliavini & Moro 2003); and (4) the role of the CIO in strategy alignment (Chan et al. 2006; Chan 2002). However much of the literature on the CIO is anecdotal or prescriptive in nature (Armstrong & Sambamurthy 1999; Smaltz et al. 2006), with limited empirical work examining the prescriptions made (Smaltz et al 2006). Research on the role of CIO tends to be represented more in the practitioner domain and the proliferation of books on the role exceeds that of any other senior executive role (Peppard 2010). Peppard (2010) also states that there is perhaps too much attention being placed on the individual incumbent in the CIO role and not enough on the environment within which the CIO operates. It also appears that too much emphasis is placed on the construction of generic role and competency profiles and not enough on how the role is actually performed. For example Enns (2001) states that literature has not explored the role of the CIO in the implementation process, and Woolridge et al. (2007) acknowledges gaps in existing research on the role of the CIO in projects, and call for further inquiry in this area. Furthermore despite suggestions that the role of CIO today is continuously under the cloud of failed IS initiatives (Peppard 2010) there is a dearth of empirical studies which provide any explanation about the relationship between IS failure and the role of CIO. Specifically there is a gap in extant literature in regard to how a CIO manages the range of complex process and organisational issues which have been shown to impact on IS initiatives. This represents a significant omission considering the complexity and strategic importance of modern IS initiatives, and that the CIO has ultimate responsibility for creating value for the organisation through the deployment of IS.

The authors propose that this gap can be filled through the use of process orientated case studies of the role of the CIO during failing IS initiatives. Process studies are widely used in the study of IS implementation and failure because they facilitate a deep understanding of the complex interaction of actors, events, contexts and the emergent conditions that influence the trajectory (process) of failure over time, and their impact on the object of inquiry (Pettigrew 1997). Other methods of inquiry may also be suitable to fill this research gap, however the authors contend that given that IS failure is a process itself (Wilson & Howcroft, 2002) the use of a process lens imposes a rigor on data collection and analysis that other qualitative methodologies may not. Using a case study as an overarching methodology for the conduct of a process inquiry facilitates the study of phenomena in real life settings thereby allowing the researcher to open the 'black box' of IS in order to better understand how it affects and is affected by the people who use it, and capture the dynamics of its trajectory within the context in which it occurs (Yin 2009).

Conducting a process inquiry using a case study methodology for the study of the role of CIO during the course of a failing IS initiative offers a rich source of data in both domains. Firstly such studies can contribute to the body of research on IS failure by examining the phenomenon in the context of the most senior IS role (the CIO), which is a novel approach in the study of IS failure. Secondly the research can make a contribution to the literature on the role of CIO by presenting a focus on how the prescriptions on the role, and the related competencies and attributes, are actually performed in the context of real life settings (a failing IS initiative). Such studies offer the potential for deeper understanding of the dynamic of the CIO role as they facilitate the uncovering of how the role is actually performed in context, and therefore facilitate a detailed explication of the competencies most critical at different stages of the failure process. Finally Sauer (1993) states that IS risk will not be brought under control through a single large breakthrough but in smaller piecemeal advances, and proposes the use of focused studies to promote risk containment. The study of the role of the CIO over the course of failing IS initiatives offers such a focus on a particular phenomenon relating to the wider IS failure domain.

6. Conclusion

Extant CIO literature indicates that there may be a range of issues specific to the CIO role that continue to impact negatively on the success of the role, and may also contribute to the enduring problem of IS underperformance and failure. This theme however is not explored in any level of depth, nor is it addressed in the IS failure literature, denoting a significant gap in our understanding of the role of the CIO, given the importance of the role, and the prevalence of IS failure.

On the basis of the above the authors propose that this gap may be filled through the use of process orientated case studies of the role of CIO during failing IS initiatives. It is argued that studies of this kind have the potential to increase the body of knowledge in both CIO and IS failure domains by providing a dynamic dimension to the study of the CIO role that is not present in extant CIO literature, and also contributes to the body of IS failure research by offering a novel study on the role of the CIO during the process of failure.

Considering that the work of the professoriate emphasises both the scholarship of discovery and the scholarship of integration (Boyer 1987), we believe that it is essential for any new programme of research to proactively discover and integrate new forms of knowledge that transcend the boundaries of traditional academic silos. While it is rather curious that academic literature in relation to the role of the CIO and the nature of IS failure has remained highly fragmented, it is the scholarship of integration that demands the development of a more holistic view of both the process of failing and the role of the CIO therein. Supported by a strong research design, the effective execution of such a study will most likely not only make a significant contribution to academia but also offer a basis for both informing and transforming professional management practice (McDonagh, forthcoming).

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A Quest for Theoretical Foundations of COBIT 5

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Abstract: COBIT, (Control Objectives for Information and Information related Technologies) as an IT Governance framework is well-known in IS practitioners communities. It would impair the virtues of COBIT to present it only as an IT Governance framework. COBIT analyses the complete IS function and offers descriptive and normative support to manage, govern and audit IT in organizations. Although the framework is well accepted in a broad range of IS communities, it is created by practitioners and therefore it holds only a minor amount of theoretical supported claims. Thus critic rises from the academic community. This work contains research focusing on the theoretical fundamentals of the ISACA framework, COBIT 5 released in 2012. We implemented a reverse engineering work and try to elucidate as much as possible propositions from COBIT 5 as an empiricism. We followed a qualitative research method to develop inductively derived theoretical statements. However our approach differs from the original work on grounded theory by Glaser and Strauss (1967) since we started from a general idea where to begin and we made conceptual descriptions of the empirical statements. So our data was only restructured to reveal theoretical findings. We looked at three candidate theories: 1) Stakeholder Theory (SHT), 2) Principal Agent Theory (PAT), and 3) Technology Acceptance Model (TAM). These three theories are categorized and from each theory, several testable propositions were deduced. We considered the five COBIT 5 principles, five processes (APO13, BAI06, DSS05, MEA03 and EDM03) mainly situated in the area of IS security and four IT-related goals (IT01, IT07, IT10 and IT16). The choice of the processes and IT-related goals are based on an experienced knowledge of COBIT as well of the theories. We constructed a mapping table to find matching patterns. The mapping was done separately by several individuals to increase the internal validity. Our findings indicate that COBIT 5 holds theoretical supported claims. The lower theory types such as PAT and SHT contribute the most. The presence and contribution of a theory is significantly constituted by IT-related goals as compared to the processes. We also make some suggestions for further research. First of all, the work has to be extended to all COBIT 5 processes and IT-related goals. This effort is currently going on. Next we ponder the question what other theories could be considered as candidates for this theoretical reverse engineering labour? During our work we listed already some theories with good potential. Our used pattern matching process can also be refined by bringing in other assessment models. Finally an alternative and more theoretic framework could be designed by using design science research methods and starting with the most relevant IS theories. That could lead to a new IT artefact that eventually could be reconciled with COBIT 5.

Keywords: IT governance, COBIT 5, stakeholder theory, principal agent theory, TAM

1. Introduction

This may sound a bit awkward, but IT academics often lag behind IT practitioners with the description, explanation and predicting of IT phenomenon's. The latter cannot always wait for good normative theories to build IT artefact's. Both communities have of course their own objectives and ways of working. Working with IT to build and implement information systems (IS) however is certainly not straightforward and a lot failures often darkens the blue skies predicted by IT suppliers and vendors (Avison et al. 2006, Conboy 2010, Dwivedi et al. 2013). On the other hand information systems are enablers for conducting a business today. In many industries, survival and even existence is challenging without extensive use of information and communication technology. No longer can we imagine going to work and conducting businesses without IT/IS (Laudon et al. 2012). In a world of cutting-edge product development, the struggle between speed and quality is over. Speed has won decisively. In today's highly competitive global markets, getting innovations out quickly can mean the difference between success and failure (Cross 2011).

COBIT, as an IT governance, management and audit framework is well-known in IS practitioners communities (ISACA 2012a). It would impair the virtues of COBIT to present it as a framework as such. COBIT analyses and describes the complete IS function and offers normative support to manage, govern and audit IT in organizations (Kerr and Murthy 2013). COBIT is even used in academic programs for learning graduate students the principles of governing IT in organisations (Alves et al. 2012, Cabukovski and Tusevski 2011).

Although the COBIT framework is well accepted in a broad range of IS communities, it is created by and for practitioners and therefore it holds only a minor amount of firm theoretical supported claims. Thus critic rises from the academic community (Ridley et al. 2008, Goldschmidt et al. 2009, Choi and Yoo 2009, Chen and Shen 2010). The quest for theoretical underpinnings is not only a pure academic matter or an art pour l'art exercise,

but can contribute to problems also raised by IT practitioners about COBIT. The main critic coming from this front is the huge amount of very complex descriptive guidelines and the strong accent on conceptual objectives. The 'what' is clearly specified but not so much the 'how'. This is good for IT auditors and risk managers, but clearly not so for IT managers and consultants. The authors of COBIT are well aware of these issues and have already anticipated within COBIT with the implementation of the Single Integrated Framework concept.

We agree with King and Lyytinen (2004) that theory is an input to a process of getting strong results, not an outcome. However the importance of IT/IS for organisations and society and the ever larger growing group of IS practitioners has much to gain in researched based educational programs strongly grounded in theoretical foundations. We asked ourselves if COBIT does have clearly theoretical foundations that can support some of the claims made in the framework. We focused on the process model of COBIT as well as on the principles and IT-related goals. This work is of value to strengthen a well spread practitioners framework with the rigor of a scholarly work albeit that the course of the trajectory, first the theory and then the practice is here just the opposite. However, there is no evidence that the large group of COBIT authors, reviewers and contributors should not have done an excellent job and certainly made a practical and pragmatic contribution to the IT/IS field.

So to say, we implemented a reverse engineering work and try to elucidate as much as possible propositions from COBIT as an empiricism. We followed a qualitative research method to develop an inductively derived theoretical framework. However our approach differs from the originally work on grounded theory by Glaser and Strauss (1967) since we have a general idea of where to begin and we made conceptual descriptions of the empirical statements in COBIT. So our data was only restructured to reveal theoretical findings.

The paper proceeds as follows: in section two we elaborate on the COBIT framework. In section three we make a suggestion of candidate theories and give a classification of the chosen theories according to the method of Gregor (2006). Section four describes our research method and in section five we bring a discussion of our findings. In section six we make our conclusion and give some recommendations for further research and some suggestions for refining our method of investigation.

2. The COBIT 5 framework

COBIT dates back to 1996 and was originated as an IT audit framework. In 2012 a new version of COBIT 5 was released (ISACA 2012a). In the rest of the paper we will use COBIT, however we did our investigation entirely with COBIT 5. As stated before COBIT is a business framework for the governance and management of enterprise IT and is almost entirely made by IT practitioners with an appetite for IT in larger organisations, mostly in banking, insurance and consultancy. COBIT is not a scholarly work. There were academics involved in the work of establishing the framework, but there is to the best of my knowledge no theoretical work done on the many claims in COBIT.

COBIT provides a framework that supports enterprises in achieving their objectives for the governance and management of enterprise IT. COBIT is based on five key principles that embodies these objectives and enables the enterprise to build an effective governance and management framework that optimises IT investments and use for the benefit of stakeholders (ISACA 2012a). Table 1 gives an overview of the five key principles of COBIT.

Table 1: The five key principles of COBIT

1: Meeting Stakeholder Needs
2. Covering the Enterprise End-to-end
3. Applying a Single, Integrated Framework
4. Enabling a Holistic Approach
5. Separating Governance From Management

Although the authors of COBIT posit that COBIT is not prescriptive, it suggest a process approach for the implementation of the framework, the COBIT Process Model (ISACA 2012b). Processes are seen as enablers or factors that, individually and collectively, influence whether something will work for IT governance or management. COBIT suggests that enablers (and thus processes) are driven by a goal cascade, i.e. higher-level IT-related goals define what the different enablers should achieve (ISACA 2012b). There are seven categories of enablers in COBIT: 1) principles, policies and frameworks, 2) processes, 3) organizational structures, 4)

culture, ethics and behaviour, 5) information, 6) services, infrastructure and applications, and 7) people, skills and competencies. In this work we limited our investigation to the processes. COBIT defines a process as ‘a collection of practices influenced by the enterprise’s policies and procedures that takes inputs from a number of sources (including other processes), manipulates the inputs and produces outputs (e.g. products, services)’ (ISACA 2012a).

There are generic processes for IT governance as well as for IT management. The structural overview and consistency of the processes aims at an alignment between the business and IT (De Haes and Van Grembergen 2010). COBIT is a structure of 37 processes divided in five domains. One domain is IT governance, the other four domains are IT management domains. Each process of COBIT has input, output, goals, key process activities, metrics, sub processes and related references. Table 2 gives the five domains of the COBIT processes.

Table 2: Overview of the COBIT domains

Domain	Type of Domain	Number of processes
Evaluate, Direct and Monitor (EDM)	Governance	5
Align, Plan and Organize (APO)	Management	13
Build, Acquire and Implement (BAI)	Management	10
Deliver, Service and Support (DSS)	Management	6
Monitor, Evaluate and Assess (MEA)	Management	3

3. The chosen IS theories

The choice for candidate theories was based on the work of Truex et al. (2006) that gives four recommendations: 1) considering the fit between selected theory and phenomenon of interest, 2) considering the historical context of the theory, 3) considering how the theory impacts the choice of research method, and 4) considering the contribution of theorizing to cumulative theory (Truex et al. 2006).

First we selected three theories from a long list of theories used in IS research (Larsen et al. 2014) and checked for the Truex criteria. The chosen theories are: Stakeholder Theory (SHT), Principal Agent Theory (PAT) and Technology Acceptance Model (TAM). In Table 3 shows an overview of the selected theories and the fulfilled recommendations of Truex. We added the seminal papers or the theories in the bottom row of table 3.

Table 3: The chosen theories according to the Truex criteria (Truex et al. 2006)

Truex criteria	Theories		
	SHT	PAT	TAM
Fit between theory and phenomenon	SHT fits very well with facts in COBIT. The first key principle of COBIT refers already to the broad phenomenon of stakeholders.	PAT focussed on a fundamental relation between two actors. An information system is a nexus of principal-agent relations: e.g. owner-manager, user-developer, auditor-CIO, ...	A substantial critic to COBIT is the ‘mechanical’ way the framework is constructed and the ignorance of the user as reflective human actor (Hoogervorst 2008). It makes it challenging to investigate how TAM could fit or not with the propositions of COBIT.
Historical context of theory	The concept of stakeholder has gradually grown from shareholder to a general concept of all actors that could have a stake in an artefact or organisation.	PAT is one of the cornerstone theories of organisations.	TAM is one of the only successful IS theories designed from within the IS discipline. Although the theory has been criticized by many, current relevant IS research is still using TAM.
Impact on the research method	SHT is a process theory which is compliant with the basic perspective of our research method (qualitative and a mixture of positivism and interpretivism).	PAT has two streams: positivistic agent theory and principal agent theory. We conducted the last stream (Eisenhardt 1989)	TAM is constructed as a variance theory. However the operationalization of the constructs (acceptance perceived ease of use and usefulness) can be also assessed from a process perspective.
Contribution to cumulative theory	SHT has been used in ten previous works in IS research (Larsen et al. 2014)	PAT has been used in 24 previous works in IS research and has links with other theories used in IS	TAM is one of the few genuine IS theories, in the sense that the theory is not borrowed from other disciplines. TAM has been used in 64

Truex criteria	Theories		
	SHT	PAT	TAM
		research (Larsen et al. 2014)	previous works in IS research and has a profound link with the DeLone & McLean Success Model (Larsen et al. 2014)
Seminal paper	(Frooman 1999)	(Jensen and Meckling 1976)	(Davis 1986)

SHT is a management theory that identifies groups and individuals that have a stake in an organisation (Frooman 1999). The theory helps to identify, understand and use in a strategic way stakeholders in an organisation. Traditionally stakeholders were stockholders or owners of an enterprise. PAT is one of the cornerstone theories of the firm. The theory is well developed as a variance as well as a process theory. The theory is very well related to the theory of Transaction Cost Economics (TCE). TAM is one of most developed IS theories and brings the human interactions and perceptions in the middle. It is a theory which has his roots in psychology but it is actually a genuine IS theory.

For each of the three theories we made an analysis and a classification according to Gregor (2006) and we developed a summary of components. In table 4 we show the fiche of the SHT component as an example. Similar fiches were made for PAT and TAM.

Table 4: Overview of stakeholder theory

Overview of Stakeholder Theory (SHT)	
SHT is a management theory that identifies groups and individuals that have a stake in an organisation (Frooman 1999). The theory helps to identify, understand and use in a strategic way stakeholders in an organisation. SHT explains how stakeholders can affect the organization. SHT gives answers to three key questions: 1) Who are the stakeholders (Mitchell et al. 1997), 2) What do the stakeholders want? and 3) How do stakeholders influence?	
Theory Component	Instantiation
Means of representation	Words, lists, tables and diagrams
Primary constructs	Questions, groups and individuals
Statements of relationships	Relations between the stakeholders and the organization
Scope	The relations of an organization
Causal explanations	SHT explains the relation between stakeholders and organization by stating how stakeholders will impose their will.
Testable propositions	Questions can be composed and tested by interviews
Prescriptive statements	Only for the questions 1 and 3

In summary we can consider SHT and PAT as theories for explaining, and TAM as a theory for explaining and predicting (Gregor, 2006).

4. The research method

To assess the degree of presence of any of the three selected theories in COBIT we designed a mapping tool. This tool is based on the ideas in ISO/IEC 15504-2 (ISO/IEC 2003). We do not use the tool as an capability determination instrument but as an assessment instrument. We developed a four layered scale to score the matching of a COBIT statement, keyword or proposition with theoretical components related to the three theories. The scale was constructed as follows

- Score N: (Not Present) There are no propositions, keywords or statements in COBIT that can be matched with components of one of the selected theories.
- Score P: (Present) There is a least one proposition, keyword or statement in COBIT that can be matched with one components of one or more of the selected theories.
- Score L: (Largely present) There is more than one proposition, keyword or statement in COBIT that can be matched with one theory.
- Score F: (Fully present) There is a strong match of several (more than two) COBIT propositions, keywords or statements with one theory.

We derived the propositions and keywords as suggested by Gregor (2006) from COBIT from three sources: 1) the five COBIT principles, 2) five selected COBIT processes (APO13, BAI06, DSS05, and MEA03) and 3) four selected IT-related goals (goal 02 'IT compliance and support for business compliance with external laws and regulations', goal 07 'Delivery of IT services in line with business requirements, goal 10 'Security of

information, processing infrastructure and applications’, goal 16 ‘Competent and motivated business and IT personnel’). We selected one IT-related goal from each dimension of the BSC (ISACA 2012b). In table 5 we give the pattern mapping for the five selected COBIT processes, principles and IT-related goals.

Table 5: Pattern mapping for five COBIT principles, selected processes and IT-related goals

COBIT Principles	Theories																				
	SHT							PAT							TAM						
	Representation	Constructs	Relationships	Scope	Explanations	Propositions	Statements	Representation	Constructs	Relationships	Scope	Explanations	Propositions	Statements	Representation	Constructs	Relationships	Scope	Explanations	Propositions	Statements
MSHN (1)	F	F	F	L	F	L	L	L	L	L	L	N	P	N	P	N	P	N	N	N	N
CE-to-E (2)	L	L	F	L	F	L	P	F	F	L	L	N	P	N	N	N	N	N	N	N	N
SIF (3)	L	L	L	P	P	P	P	P	P	P	P	N	P	N	P	N	P	N	N	N	N
EHA (4)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SGFM (5)	L	F	F	L	F	F	P	F	F	F	F	N	L	N	N	N	N	N	N	N	N
COBIT Processes																					
APO13	F	F	L	L	P	P	P	L	L	F	L	N	P	N	P	P	P	P	N	L	N
BAI06	P	P	L	P	P	N	L	P	P	P	P	N	N	N	P	P	P	P	N	L	N
DSS05	L	L	L	L	L	P	F	L	L	P	L	N	L	N	P	P	N	N	N	N	N
MEA03	L	L	L	L	P	P	F	L	F	L	L	N	L	N	N	N	N	N	N	N	N
EDM03	L	L	L	L	P	P	P	F	F	L	L	N	L	N	P	P	P	P	N	P	N
IT-related Goals																					
02	P	P	N	P	P	P	L	P	L	P	L	N	F	N	N	N	N	N	N	N	N
07	P	N	P	N	N	N	N	N	N	N	N	N	N	N	P	P	P	P	P	L	N
10	P	P	N	P	P	P	P	P	L	P	L	N	L	N	N	N	N	N	N	N	N
16	P	P	N	N	N	N	N	N	N	N	N	N	N	N	P	P	P	P	P	L	N

(1) Meeting Stakeholder Needs, (2) Covering the Enterprise End-to-End, (3) Applying a Single Integrated Framework, (4) Enabling a Holistic Approach, (5) Separating Governance From Management.

5. Findings and discussion

Based on the pattern mapping as shown in table 5 we brought all the mappings together in overall overview which is presented in table 6. The scores are now cumulated from the previous detailed scores as shown in table 5. The scores can now be read as follows:

- Score N: The theory is not present.
- Score LP: The theory is only partly present. Only three base components of the theory are present.
- Score P: The theory is present and the empirical findings are within the scope of the theory and there are causal explanations found.
- Score F: The theory is strongly present. There are testable propositions that can be derived or prescriptive statements present.

Table 6: Overview of IS theories presence in COBIT

	SHT	PAT	TAM
Meeting Stakeholder Needs	LP	LP	N
Covering the enterprise End-to-End	LP	LP	N
Applying a Single Integrated Framework	P	P	N
Enabling a Holistic Approach	N	N	N
Separating Governance From Management	LP	F	N
APO13 Manage Security	LP	LP	P
BAI06 Manage Change	P	LP	P
DSS05 Manage Security Services	LP	LP	N
MEA03 Monitor, Evaluate and Assess Compliance with external Requirements	LP	LP	N
EDM03 Ensure Risk Optimisation	LP	F	P
IT-related Goal 02	P	LP	N
IT-related Goal 07	N	N	P
IT-related Goal 10	P	LP	N
IT-related Goal 16	N	N	P

The strongest theoretical foundations in COBIT are coming for PAT. This will come as no surprise since PAT is theory that is often used to explain the elements of control in a governance versus management setting. There is also coupling in appearance between PAT and SHT. The dual appearance of PAT and SHT is remarkable in the COBIT principles. TAM is less present in COBIT. This can be due to the fact that TAM is a higher type of theory, with strong causal relations.

What we have noticed during our enquiry is that the IT-related goals can strongly determine the presence of a theory. This is the way around, a framework should be designed with a theoretical stance in the first place. As an example: IT-related goal 07 suggest to be based on TAM and brings the theory into the process BAI06. The same goes for the IT-related goals 02 and 10 that bring in PAT in APO13 and DSS05. A possible explanation can be given that when a goal is present in a process, the process is likely to be shaped to meet the goal. In that way a possible ‘hidden’ theory is unveiled in the process. In table 7 we combined the IT-related goals with the five selected processes. We did not go further in that direction, but this suggests a deeper investigation.

Table 7: Presence of IT-related goals in the selected processes (yes=present / no= not present)

	IT-related goal 02	IT-related goal 07	IT-related goal 10	IT-related goal 16
APO10	YES	NO	YES	NO
BAI06	NO	YES	YES	NO
DSS05	YES	NO	YES	NO
EDM03	NO	NO	YES	NO
MEA03	YES	NO	NO	NO

6. Conclusions

The classification of IS theories and the matching with the COBIT principles, processes and IT-related goals have shown that COBIT did not take off from a clear theoretical starting position. However the derived theoretical propositions from the selected theories were surprisingly present in the framework, albeit not always completely. The primary constructs, scope and statements of relationship of the theories are often found, but causal explanations are often absent. Some theories do not have very clear causal explanations, so type I and type II theories have a higher likelihood to be supportive for COBIT. This is the case for PAT.

As for the SHT we see that prescriptive statements are only limited present in COBIT. To fully implement SHT one could use the findings of Mitchell et al. (1997) to assess the influence of each stakeholder. Together with the findings of Frooman (1999) the framework could be enriched with the way how stakeholders try to execute their influence. This could lead to better or more fine-tuned metrics.

The strong appearance of PAT and SHT in COBIT is probably due to the fact that both theories are lower types of theories according to the classification of Gregor (2006). Also COBIT was originally built as an IT audit guideline, so control and stakeholders are key elements there.

TAM is the less present theory of the selected theories in COBIT. To act according to TAM large changes will be necessary. We suggest a more intensified application of TAM into the COBIT processes. The ease of use and

the usefulness are such important constructs for the acceptance of technology, and this should be noticeable in COBIT. We consider it as a drawback that COBIT does not take TAM more into account. This high level theory has yet proved to be very valuable.

IT-related goals always suggest the presence of an IS theory. But this touches the fundamental problem of COBIT: what is the initiator of a descriptive or normative statement? For us, academics it should be a theory and not a set of well agreed practical statements. However the goals cascade mechanism in COBIT forces the authors to make causal statements, derived from the principles down to the IT-related goals. Although this a common research practice, it is in no way supported by a theoretical context delivering theoretical propositions to support the deduced steps.

The implicit presence of a theory in an IT-related goals, makes that the framework cannot be forced into favourable statements. So the normative character of COBIT should come from the theories in the first place. However this means that deducing practical propositions from theories can lead to complete other goals. It is not impossible that the stakeholders from an organization put goals in place that cannot be reached. As an example we can take IT projects that in a traditional perspective should be managed according the old-style trinity of constraints in budget, time and quality. However we see in reality that more than 50% of all IT projects do not fit in such a pre-designed management model. Other theories, such as sense making (Cicmil and Hodgson 2006) and real option management (Benaroch 2002) are popping up to counter this dark side of IT management. These theories should be much more embraced by IT practitioners communities.

The generalization of our results can be an issue. We think we made a generalization from empirical statements to theoretical statements or a ET-generalization according to Lee and Baskerville (2003). (Lee and Baskerville 2003). This is a type of generalisation in the sense of the analytical or theoretical generalisation of Yin (2003). (Yin 2003, Dube and Pare 2003)

This research has offered a positive answer to our research question if COBIT could be more founded with IS theories. However the quest to these theoretical foundations have raised a multitude of new questions. First of all we could ask what other theories are present in COBIT? When we disseminated this work to a limited group of peers some suggestions of candidate theories pop up, such as Resource Based Theory, Transaction Economics, and Structuration Theory. These theories, who have been used many times in IS research should be researched to see if they can contribute to this work or to a more general contribution of a cumulative theory. Second we can pose some questions to our assessment model of scoring the presence of a theory in COBIT. We believe that this model can be fine-tuned. Third, it is not impossible that our research method can be of use for other practitioners frameworks which are also created without a firm theoretical foundation (e.g. ITIL).

Finally we must think about the managerial contribution of doing this sort of theoretical work. This brings us to the question if COBIT should not be adapted to a more intensive use of IS theories and thereby gain a stronger validity. It is our believe that IS scholars and practitioners should try to work more closely together. After all, our discipline of information systems is still shaped by a very practical kernel of IT artefacts and systems and is still in an urgent need for good describing, predicting and explaining theories.

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Implementation and Benefits of Real-Time Business Intelligence

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Abstract: While traditional Business Intelligence (BI) environments have for some time assisted organizations with their information requirements, they have become increasingly incompatible with the pressures of current business environments. They are geared towards analysis of historical information, and limited in their ability to close the latency gap between information and action. This has encouraged a movement towards real-time BI (RTBI) systems. Although these overcome latency aspects of traditional BI, and offer many value-adding benefits to organizations, their implementation has been hampered due to technological complexities, and has required changes to the business environment, and high costs to put them in place. Justification of IT investments in general remains a problem as they provide many intangible benefits incompatible with traditional (financial) IT benefits measurement models. For these reasons, the research set out to investigate and understand the technological components and organizational changes surrounding RTBI implementation. To further facilitate justification, application areas and benefits of RTBI were also explored. Data was collected by conducting semi-structured in-depth interviews in organizations across several industries that had implemented or were implementing RTBI systems. A qualitative thematic analysis approach was then used to test findings that had emerged from literature, and to also investigate the issues further. The study confirmed that RTBI is likely to require major changes to technical architecture, which may involve acquisition of new tools and technologies. Several issues and requirements at the business level also need to be addressed. The research also explored a wide range of practical RTBI applications and analytics that were being applied across industries. Process intelligence was found to play a fundamental role in many of these analytics. The study reveals that RTBI has the ability to offer significant and measurable improvements, help organizations remain competitive, and in the long run, drive strategic business objectives from a grass roots level.

Keywords: business intelligence, real-time BI, BI maturity, analytics, process intelligence, operational BI

1. Introduction

For the fifth successive year, Business Intelligence (BI) and Analytics was rated the most important technology and application issue for CIOs (Kappelman, McLean, Luftman & Johnson 2013). In this survey Big Data is the 5th most significant IT investment, with data velocity comprising one of its “three Vs” (Villars, Olofson and Eastwood 2011). Initially storage and processing constraints meant that data for BI was typically kept at a summary level (daily, weekly, monthly etc), and there was a significant time delay (latency) in creating and using these summaries. Transaction-based analytics or data mining was generally not done on real-time data, other than for areas like fraud detection. BI was typically at a strategic or tactical level. Cost-effective advances in storage and processing have now facilitated BI at operational and process levels, with increased interest in real-time BI (RTBI) and analytics. This research aims to uncover many of the issues involved in implementing RTBI systems, by interviewing key people involved in such implementations across a range of organisations.

A brief literature review next summarises key aspects of real-time implementation of BI. Details of the research methodology used then follow. Analysis of the interviews then exposes pertinent issues surrounding RTBI implementations, and the paper concludes with a brief discussion and conclusion.

2. Background

Figure 1 illustrates the motivation for an organisation to move towards RTBI, suggesting that three different latencies reduce the business value of information (Hackathorn 2004). For example, ETL (extract, transform and load) processing often occurs in overnight batch runs (Seufert & Schiefer 2005). This means that the results of BI and analytics cannot link back into business processes immediately or automatically (Azvine, Cui & Nauck 2005; Sahay & Ranjan 2008), and provide timely action. When analytical processes are linked in real time to business activity monitoring (BAM), it is possible to take corrective action before problems materialize (Seufert & Schiefer 2005). Reducing action time in order to increase business value is therefore the critical objective for RTBI (Eckerson 2004). Ioana (2008) sees RTBI as an evolutionary process towards operational BI using process intelligence.

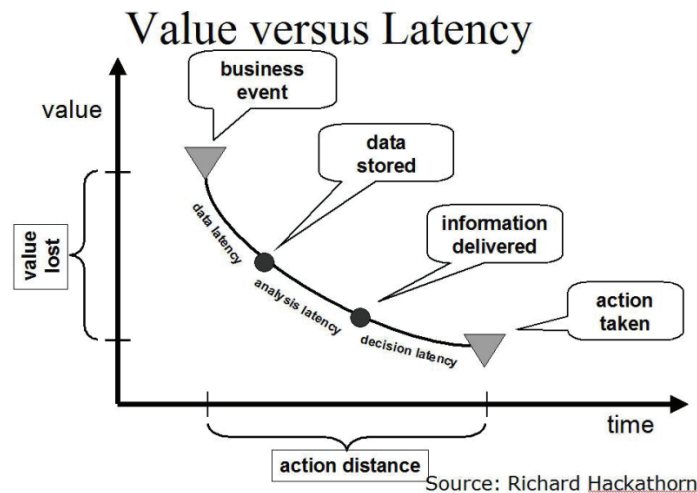


Figure 1: Business value vs latency (Hackathorn 2004)

Watson, Wixom, Hoffer, Anderson-Lehman and Reynolds (2006) note the business-driven purpose of RTBI is to increase revenues and decrease costs. Advances in RTBI applications have also helped to manage, automate and synchronize many of the business processes of customer relationship management (CRM) (Goldenberg 2008; Grigori *et al.* 2004). However, data will only need to be as fresh as its respective business requirements (Ioana 2008; Watson *et al.* 2006). Consequently the terms “right-time” or “near real-time” may be more appropriate than real-time.

Implementing a RTBI system may require several additional components to a typical BI architecture (Acker, Gröne, Blockus, & Bange 2011; Hang & Fong 2010; Tank 2012) such as in-memory analytics and service-oriented architecture (SOA). Agrawal (2009) suggests that adoption of RTBI is hindered because of lack of clarity on technology requirements, and the substantial costs. Schneider (2006) stresses that benefits of business decisions made under low latency must outweigh the significant investment in achieving RTBI (Ward, Daniel & Peppard 2008), and Seufert and Schiefer (2005) list seven ways in which RTBI can generate value. RTBI implementation is unlikely to be successful unless the organisation has reached a relatively high level of BI maturity (Rajterič 2010).

3. Research approach

Because of the lack of published information on local RTBI implementations, the study was exploratory, interpretive and inductive, aiming to uncover and understand the key issues involved (Klein & Myers 1999). A purposive sample of organisations with involvement in the RTBI area was therefore chosen. Seven senior business and IT management staff were interviewed from South African companies in financial services, retail, energy, transport and IT consulting. Respondents were given advance information of the types of questions that would be asked, and ethical requirements and confidentiality were observed. Semi-structured in-depth interviews of an hour or more enabled most important areas to be covered, while enabling an open flow of conversation, and for respondents to volunteer points on areas not conceived of beforehand. Interviews were recorded digitally and then fully transcribed. A process of thematic analysis (Braun & Clarke 2006; Thomas 2006) was used to code segments of text, create categories, and iteratively combine and summarise these into themes. Thomas (2006 p5) states the importance of finishing with “three to eight summary categories”. The six themes that emerged were: technological considerations, organisational considerations, users, analytics, benefits and the investment process. Each of these had a number of sub-themes.

4. Analysis of themes and sub-themes

The main emergent themes and their sub-themes are now discussed, with illustrative quotes. Given space restrictions the theme on the investment process will not be covered; some other themes will receive limited attention.

4.1 Technological considerations

In this section, various fundamental technological elements of a RTBI system will be explored. Although it was found that BI architectures will vary depending on their context, their underlying technical structures share common components.

4.1.1 Integration

While it is common for organizations to run multiple systems to support their various business functions, they need to be integrated in a BI environment. Information can no longer be kept in isolated repositories but must be consolidated in order to provide a unified view. Integration is a key component in creating a technical landscape that supports RTBI.

“... there’s been difficulty with getting information out based on non-integrated systems, and have therefore had people in the organization with different versions of the truth”

The high dispersal of systems around the organization also made integration more difficult. For many large organizations, such as retailers and banks, legacy systems were found to still support many business functions. Some expressed difficulty in integrating them because they are not really designed for real-time.

“...in a retail environment, your legacy stuff is all typically flat-file based. So it’s a bit more of a challenge moving retailers into real-time”

4.1.2 Message-bus or enterprise service bus (ESB)

The message-bus is a key component of a RTBI architecture as it provides the means to integrate an organization’s systems and route their data into a repository. This addresses many of the challenges that come with the integration process, and includes integrating internal and external systems (including legacy systems) into one space in such a way that it does not impact business systems.

“ESB is really the communications between the different ... systems, as a basis, so it’s an integration layer”

“So all of our 65 ERP systems speak through your central ESB”

The implementation of a message-bus can be seen as one of the initial steps to configuring a RTBI architecture. The value of a message-bus comes not only from its ability to integrate systems, but because the real-time data flowing through it can be intercepted. While doing this, a host of analytics can be applied to it, but it also needs to be compared with historic data in order to contextualize it.

“...it can get information, or transactional information, the moment something happens”

“The beauty of an ESB is that you can inspect that stuff as it flows through”

4.1.3 Data

All companies had large amounts of operational and transaction data, often using this for analytical purposes. The importance of a master data management environment was stressed.

“There is also a lot of master data management implementation as well to normalize your master data across all the systems in order to move into real-time”

Some were looking at combining their transaction data with social network data, but noted problems in dealing with the less-structured data analytically.

The frequency with which information is distributed should be aligned with how often that information is actually being used to make decisions. For instance, delivering information that is refreshed hourly when an organization only makes decisions once a day will be of no benefit. This may also result in additional costs incurred from making those load changes.

“I can change something every 5 minutes, but if you’re only using it to make decisions every 2 days then it doesn’t make a difference”

The ETL process is one of the major reasons for latency. In order to achieve a real-time environment it was noted that ETL processes should not be used to fix incomplete data. Instead, using business rules, data should be validated at its source (host systems).

"You can't have these sophisticated ETL processes which are going to try and fix deficient information...your business rules should be on your systems and not on your ETL processes"

4.1.4 Architecture

The points and technologies mentioned above indicate different architectural requirements, with the use of the message-bus and an operational data store (ODS) being key.

"you're creating a whole new level of aggregation which requires different technology"

This can be described as a five stage process: data is created at its host system (1), it is then integrated and brought into the message-bus (2), it is intercepted at the message-bus for analysis (3), and it undergoes ETL processes (4) before it is consolidated into the DW (5). In order to harness real-time analytics, the ODS sits between the host systems and the DW and intercepts data flowing through the message-bus and then compares it in real-time against historic snapshots or target values from the DW.

"... you can intercept information at the [message-bus] and compare it with historic data to start a business event or to alert a situation"

Many organizations apply BAM analytics, where they can directly monitor business activities as they are executed at their host systems. In some cases, BAM was also applied to monitor integration and ETL processes to ensure that they are being executed correctly, and in-memory analytics was also being used, independently of the DW:

"...looking at solutions that are sitting on top of your transactional systems with in-memory capabilities."

The need for on-going flexibility was also mentioned:

"So it's an ever-learning environment, and you grow on top of that"

4.2 Organisational considerations

The following organisational issues were mentioned regularly during the interviews:

4.2.1 BI / DW maturity

Several organisations noted the importance of first evaluating their maturity in the BI and DW space. If not mature here, they were more likely to run into obstacles when attempting RTBI. Mature organisations were also likely to have more historic information in their DW, useful for analytics and comparing with real-time data.

4.2.2 Business process re-engineering (BPR) and change management

In a real-time environment, where data can drive business processes, the need for configuration and re-engineering of processes is a likely requirement.

"... first of all it's going to change a bit of our business processes"

This may become a major task, and change management may be needed for two things: to facilitate business process reengineering and also to help individuals accept changes in their business environment. In one organisation this was needed when a policy holding users responsible for data quality was introduced.

"master data management ... is very change-management oriented because ... [you're] pushing the responsibility of the quality of the data into the organization, they're often quite resistant to that because you're making them responsible for the quality of data"

4.2.3 Skills and support

RTBI implementation will require the skills to put it in place and also to support it. In addition, it may require that IT staff become more knowledgeable of the business itself.

"The people implementing it also need to understand the business"

It may be challenging to actually bring those skills together and manage them.

“... if you’re going to move into real-time BI, in a large environment / corporate, you’re going to have to have the integration teams, the guys who put in integration and ESB etc., they have to work very closely with the BI guys. You’ve got to mesh those skills, which itself, internally in an IT department, is a big challenge”

4.2.4 Business rule definitions

As one respondent commented:

“... if your definitions (your golden standards) aren’t defined, you’re going to have a serious problem about even getting to the single version of the truth because no one has defined [those] business rules”

This can be a challenging task because business rules are context-specific, and every organization needs to assess its own requirements and objectives first, e.g.

“... on-time flights; where do you start to measure it? Is that when the last passenger is on the plane, or from the time you’re given permission to take off etc”

4.2.5 Requirements and driving force

One of the organisational aspects mentioned most was the driving force behind going real-time – either addressing business problems, or harnessing opportunities. One organisation wanted to have real-time metrics on employee work satisfaction. Another wanted to take a proactive approach towards fraud. A retailer wanted real-time visibility at the point of sale (POS), and to integrate information silos in service level areas. In all cases these need to contribute to a business plan to justify the investment.

4.2.6 “Build or buy” and costs

Decisions whether to build or buy solutions featured strongly in the interviews. The general view, from organizations that are not in the software development industry, is that

“...we try and buy everything; it’s just a lot less expensive for us”

Some, however, had to tailor a solution by purchasing several components and integrating them.

“... there are situations where there is nothing on the market; ... that allows us to do it in the fashion we wanted to do it in”

“... aren’t vendors out there that have got to that level of sophistication”

This will require the appropriate skills needed to then configure the solution.

“so [often] there is no one vendor that has everything”

“Sometimes the solution becomes purchasing one or two items and plugging them together and coming up with a solution”

Vendor research and assessment is an important part of this process. Notable factors included vendor maturity, skills, and availability of support.

“[do they have the] skills available to support it?”

Apart from the build or buy decision, common costs include investment in infrastructure and architecture, as well as resources that are spent on consulting, training, and support.

“There are a lot of initial investments before you can reap the benefits”

This supports the need to identify feasible realization of measurable business benefits from real-time BI that can justify the costs involved.

4.3 Application areas and analytics

This summarises some areas in which RTBI and analytics were found to be applied.

4.3.1 Process intelligence

This proved to be a significant value-generating aspect. Having visibility at the lowest (transaction) levels allows organizations to garner important knowledge and can also help them to understand, monitor, and control their business processes, leading to process improvements.

“At our operational [process] level is where we have a need for real-time BI, and that is really where it is valuable for us.”

Typically, systems that produce data must be integrated and consolidated into the message-bus. It is at the message-bus where real-time data can be intercepted and analyzed.

“... we had to kind of build a pick-up service that runs on the tills and intercepts the transactions to bring them down”

Monitoring this real-time data on its own however, provides little insight. As mentioned earlier, it needs to be combined with historic or projected data, targets or indicators to put it in context.

Through business activity monitoring (BAM) users can make informed and timely decisions at the operational level, and subsequently help to improve tactical and strategic performance measures. In the airline industry for example:

“You may have revenue guys wanting to know sales figures, profit, and number of seats available, the load factor (how busy the flight is), and the IT department will want to know if the systems are up etc.”

This includes key performance indicators (KPIs), which may be dynamic:

“You see it needs to be a dynamic KPI so that the threshold is ... continuously updated based on your history. e.g.: refreshed each day based on the last 12 weeks”

Dashboards are used extensively.

“[we have an] executive-level dashboard, a holistic view, and then breaking that down into different divisions and departments and things like that”

The detection of anomalies is highly advantageous because it provides organizations with actionable information in a timely manner, and can be applied in numerous places.

“We’re also able now ... to create alerts when x or y happens; they will send an email or they can do certain things [like] send it out and alert the person”

Anomaly detection was applied for fraud detection at two organisations. When potentially malicious activity is detected, it can be addressed in a timely manner and, ideally, resolved proactively.

“... if an address change was affected in the last month and there is a withdrawal of money, we want an alert raised”

4.3.2 Predictive analytics

This predicts trends and future behaviour by deriving patterns from a mix of historic and live data. All organisations were using it to some extent in different applications such as sales and demand forecasting. Some related applications follow.

4.3.3 Fraud detection and forensics

Because fraud is a time sensitive issue, if it can be detected early enough, it can be prevented.

“So now obviously going into the more proactive mode, we can stop the money from leaving the building, which is a different ball game then”

RTBI only enables this kind of environment; finding the fraudulent transactions however, is based on learned business rules.

So it’s very easy to run through a set of transactions and look at authorizing and initiator; if somewhere it’s the same person, and that’s your exception that you would follow up on. So we’ve got a team that sort of builds these things”

4.3.4 Dynamic pricing and yield management

These dynamic pricing decisions are often quite complex because they have to factor many variables to determine an optimum price. The airline industry respondent explained:

"Airlines are generally dynamically priced. For example, our booking systems are intelligent in that they can sense if the demand for a flight increases; so should the price. And it can dynamically adjust that"

A retailer also included price comparisons as part of their pricing decision process, thus ensuring that they stay competitively priced.

"... we monitor our competitors and we receive those prices which we store and do price comparisons". "... you can adjust them [price] in the store"

4.3.5 Demand monitoring and forecasting

This uses mathematical techniques on historic data and real-time information from the supply chain.

"With real-time on our till, we've been able to do things like shelf-gap monitoring, so you can monitor stock-out situations"

"they can receive their stock within a 24hour period instead of a 48hour period and keep the in-stock situation higher. So the bottom line is we would be that much more profitable"

4.3.6 Supply chain improvement

The petroleum supplier's logistics management is a complex task. Many of these processes however, can be improved in a real-time environment.

"... a big focus in our supply chain into Africa, so we're looking at moving of product from South Africa into [Country A] for example, wanting to understand what is our transport time by boat from here to the harbour in [Country A], what is our delay time, their harbour time, offloading, transporting ..."

4.3.7 Customer relationship management (CRM)

Although this was in use by all organisations in a general sense, they were still starting to explore its use in a real-time environment, and mentioned future possibilities rather than current applications.

4.4 Users

RTBI users at different levels of the organization are likely to have different information requirements as well as different data latency demands, and it is important to understand these. At strategic and tactical levels data latency required is generally similar to that of traditional BI. But operational managers and users need low latency transaction data, as for the financial forensic analysts:

"Typically you need the transaction data (the payment transaction) and something about the policy, the policy owner ... at times you need inception data"

User training was also needed as data was different to that of traditional BI, and to make sure:

"...that people understand what it is they're looking at and to make sure they are truly ready to receive what they're looking for"

Change management may be required to overcome resistance and assist cultural change:

"It's been a process of getting them to accept looking at a screen when they assess the situation in terms of their business; it hasn't been their culture"

RTBI offers users most value at the operational level, in terms of decision-making. Further, decisions can be taken faster without having to refer every decision to a superior.

"... there was very little micro decision-making on stock and replenishment [before real-time BI]. So the last 7 or 8 years has completely been turned on its head. There's a lot more responsibility at lower levels"

4.5 Benefits

Many of these have already been alluded to, and others will be briefly mentioned, such as visibility:

“... they’re able to see what’s happening in the business long before they get the financials at the end of the month or year”

With the new information available, learning and discovery has increased.

“... there’s lots to learn, I mean as you move, and are now receiving information you can monitor with real-time, you start to learn more about the business because you get different visibility on the business”

Prediction has increased and the impact of different possible scenarios is being assessed.

“... reporting has also changed from being backward-facing to being a whole lot more forward-facing ... saying what is going to happen”

Similarly there has been a move from being reactive to proactive:

“At our operational level is where we have a need for real-time business intelligence.... For example we want to see if a flight is delayed so we can react immediately”

There has also been an increase in adaptive, automated decisions in the operational systems, e.g.

“...our booking systems are intelligent in that they can sense if the demand for a flight increases; so should the price. And it can dynamically adjust that”

5. Discussion

This briefly covers some of the issues that emerged from the analysis.

The Technological theme revealed a few key aspects for RTBI. Integration of systems assumed an even greater role, with unsuitability of some legacy systems being noted. Apart from the increased velocity of the BI data, variety that included unstructured and social media data would add to the difficulties of management and metadata. In order to achieve RTBI, a new flexible architecture was needed, which could accommodate concepts of BAM, an ODS and the important message-bus.

As with any BI implementation, Organisational issues proved highly significant. Up front, detailed requirements had to drive a sound business case that would justify the investment. Sensible decisions on build versus buy were needed. BPR with clearly defined business rules and change management would probably be required, as would a new set of skills for both IT and users.

A varied range of RTBI applications was mentioned (See Table 1), with process intelligence generating many analytics applications and capabilities.

Table 1: Summary of application areas and related analytics

Application Area	Analytics
<i>Process intelligence</i>	Analysis and visibility
	Business activity monitoring
	Situation and anomaly detection
	Prediction
	Business process improvement
	Automation
<i>Fraud detection</i>	
<i>Supply chain optimization</i>	
<i>Dynamic pricing & yield management</i>	
<i>Customer relationship management</i>	
<i>Demand monitoring & forecasting</i>	

According to those interviewed, RTBI provided a solid list of benefits, as shown in Table 2.

Table 2: Summary of real-time BI benefits

Theme	Outcome
<i>Real-time Business Information</i>	Increase visibility
	Deliver actionable information
	Improved decision-making
	Decentralized decision-making
<i>Learning and Discovery</i>	New information
<i>Prediction</i>	Accurate forecasting
	What-if scenarios
<i>Proactive Responses</i>	Proactive alerting
	Proactive decision-making
	Lower risk, Maximize opportunity
<i>Automation & Adaption</i>	Information into action
	Anomaly detection & automated alerts
<i>Business Process Improvement</i>	Adapt to changes in business environment
	Better use of resources

Many of these could be classed as intangible, but they increased organisational ability to improve profit and decision making and reduce risk in various ways. The main impact of these benefits on the business user was at the operational level, requiring in many ways a different mind-set, training and change management.

6. Conclusion

The research aimed to uncover and understand the key issues involved in RTBI implementation, using a purposive sample of South African companies in different industries. Results clearly cannot be generalised to all companies, South African or otherwise, but hopefully create a greater understanding of many of the factors that should be borne in mind when embarking on RTBI. As with the currently much-hyped theme of big data analytics, careful attention should be paid to the real benefits that might be achievable with RTBI, in relation to the current BI maturity of the organisation, and the costs involved. Companies should also consider carefully whether “near real-time” or “right-time” is appropriate for them and their business environment.

Further research could be done to examine how the availability of RTBI has impacted on the decision processes of a wider set of organisations. It could also look specifically at organisations that are seriously attempting to apply RTBI to the “big data” situation of expanded velocity, volume and variety, using machine-generated and unstructured data as well as structured data.

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The use of Mobile Technology to Manage Child Health Information: An Irish Study

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Abstract: The Child Health Information Tracking Application (CHeITA) was developed as a mobile application to enhance information sharing for parents/guardians and to facilitate better collaboration with health care professionals. Currently, there is no standard, single process for tracking vital infant health information from birth weight to vaccinations in Ireland. Subsequently, this project was undertaken as a collaborative research project between a group of Nursing and Midwifery and Information Systems (IS) researchers to develop a mobile solution for capturing, storing and leveraging this information thus providing a single unified view of infant information which can be used to support health care professional decision making when the need arises. During this first phase of research, this mobile android application was built and made available to parents of infants less than one year allowing them to capture a full, complete and real-time instance of their child's health information. A qualitative questionnaire was then conducted in order to further understand if such an application would be used to manage this type of information in the future. CHeITA was positively received by the fifty-five study participants. However the lack of availability of infant data on a longer term basis was met with disappointment, as the mobile app was only supported for a short time period as part of the pilot study.

Keywords: child health information tracking application (CHeITA), android application, mobile technology, eHealth and user experience

1. Introduction

The potential for mobile technologies to support clinical care in the community is immense (Boulos, 2011). Research contends that mobile solutions can increase the effectiveness of healthcare visits, allow timely collection of patients' data, speed up internal operations saving time and costs, and, eventually, improve the efficacy of communication with health care professionals (Mania and Eandi, 2011). Notwithstanding the exponential growth in the development and utilisation of health related technologies, a universal electronic child health record (EHR) is not yet available in Ireland. The difficult economic situation and subsequent lack of resources means that this is unlikely to be addressed in the near future. However, it is widely acknowledged that EHRs result in improved caregivers decisions and patient outcomes (Blumenthal and Tavenner, 2010). Health care professionals, particularly primary health care professionals are well aware of the challenges precipitated by a situation where a universal health record is unavailable. In the meantime there are opportunities for developing systems based on existing technology and current best evidence in terms of paper based records.

Subsequently, this study was undertaken to tackle a small part of this health record issue, by developing a child (infant) health information tracking application where users i.e. guardians, health professionals such as public health nurses, , GPs and consultants can leverage a unified view of infant data at every stage of development. Health information for vaccination tracking purposes and capturing additional relevant data such as antibiotics administered and a complete childhood illness record can be facilitated. In support Ambinder (2005) contends that EHRs "should allow sharing of information about patients between any authorized providers" (p57) as well "as reduction of medical errors, reduction of lost or redundant paperwork and support for reimbursement for our work" p(60). This study provides an excellent opportunity to act as a 'proving' ground for a unified, real-time view of an infant's health information record, facilitating the changing human behaviours of both the healthcare providers and the parents/guardians themselves most significantly endeavouring to "place patients at the heart of the care process" (HIQA, 2012) . This paper is structured as follows; the next section considers the uses of mobile technology in healthcare. Subsequently usability factors for mobile application design are presented and some consideration is given to securing health data using mobile technology. From this, the research methodology is outlined and a background to the Irish health system is presented. The findings from

the questionnaire are discussed. Finally, the researchers consider the limitations of this study as well as providing conclusions and opportunities for further research.

2. Theoretical foundation

Mobile phones are playing an increasingly important role in personalised healthcare: The Mobile Health 2012 report notes that 50% of smartphone owners use their devices to get health information and 20% of all smartphone owners have installed healthcare apps (Fox and Duggan, 2012), while Klasnja and Pratt (2012) assert that *“Mobile phones are becoming an increasingly important platform for the delivery of health interventions”* (p.184). While all mobile phones provide basic call and messaging services, smartphones essentially provide the functionality of a desktop computer in a smaller package with a touchscreen (Patrick et al, 2008). In addition, smartphones provide connectivity over a cellular radio interface, as well as WiFi and Bluetooth. Positional awareness is provided by GPS sensors, accelerometers and gyroscopes. Cameras (frequently multiple) are also typical.

Modern smartphones facilitate the download and use of a large range of mobile applications (apps) from online stores. In the case of devices running iOS, Android and Windows operating systems, apps are available from the Apple App Store, Google Play Store and Windows Store respectively. These stores typically organise apps into categories such as Games, Productivity, Business, Entertainment, Lifestyle and Medical to name but a few. At the time of writing, the Google Play Store (<http://play.google.com>, 2014) lists 26 major categories of app with some categories (in particular Games) also having subcategories. In contrast, the Windows Store lists 20 top categories, not necessarily equivalent to those in the Google Play Store. The extant literature notes that a formal taxonomy of mobile apps is needed. In particular Nickerson et al. (2007) advocate a method of classifying mobile apps into ordered groups as a means of overcoming the problems researchers face when confronting the “overwhelming” number of apps in existence. Nickerson et al’s 2007 paper goes further in specifying a number of categories and dimensions of apps, specifically: *“Mobile telemedicine: synchronous, interactional, non-transactional (a set of steps may have to be followed based on patient condition), private (limited to patients of a hospital or a nursing home), individual, non-location-based (mobile telemedicine is suppose [sic] to free-up locational constraints), identity-based (patient-centric care or consultation by experts)”*.

Thus a mobile telemedicine app may be said to be patient – centric, not location dependent, individual and private. However, this taxonomy, refined by Nickerson et al in 2009, does not address the diagnostic or non-diagnostic nature of medical apps in general, nor does it consider the risk factors associated with diagnostic medical devices or applications. The classification of medical apps from a clinical point of view is derived from the classification of medical devices, which is in turn based on the risk that device presents to the patient. In addition a distinction is drawn between non-diagnostic devices, diagnostic devices and devices that alter the function or structure of part of the human body (FDA, 2013a). FDA (2013b) further refines their approach to determining whether a mobile app is a medical device. Critically, it states that: *“When the intended use of a mobile app is for the diagnosis of disease or other conditions, or the cure, mitigation, treatment, or prevention of disease, or is intended to affect the structure or any function of the body of man, the mobile app is a device.”*

Additionally, FDA (2013b) specifically articulates the following exclusion:

“This guidance does not address the approach for software that performs patient-specific analysis to aid or support clinical decision-making.”

While the issues surrounding classification and certification of medical apps are therefore complex, medical apps which are non-diagnostic, non-treating and which do not support clinical decision making are not regarded by the FDA as medical devices. The issues surrounding the design and development of this particular category of medical apps are less focused on regulatory matters and more focused on design and usability.

2.1 Designing for health related mobile apps

Recent studies indicate that mobile applications are designed to provide a number of services to the patient, these include tracking health information, involving the healthcare team, leveraging social intervention, increasing the accessibility of healthcare information and utilising entertainment (Klasnja and Pratt, 2012). The usability of mobile health systems is a key factor in the acceptance and diffusion of such technology in disease management and wellness promotion. Research contends that four factors need to be addressed in terms of mobile design 1) user-friendliness, 2) usability, 3) user competence, and 4) confidence (Lun, 1995). Additionally

Tarasewich (2002) distinguishes mobile apps from desktop applications in terms of user environment, context, user attention, mobility and speed of interaction. These environmental factors also need to be addressed. Usability in particular is contingent on context, characterised as location, available communications infrastructure, the user's social setting and the user's emotional state (Tarasewich, 2002). Ryan (2005) articulates a model of mobile application context, concluding that the software environment on the device as well as the user's physical environment contributes to the usability of the application.

Consequently a health related mobile application must take into account the competence of the user and the user's confidence in using such an application, as well as considering the software environment on the device itself, the user's emotional state and the user's own environment.

2.2 Data security and mobile applications

Enabling secure access to health records from mobile devices is of particular importance because of the high security and privacy requirements for sensitive medical data (Dmitrienko et al., 2013). Adherence to data protection legislation is compulsory when patient records that include any identifying fields are stored in any electronic system. In the case of mobile applications developed for use within the European Union, the applicable directive is EU Directive 95/46/EC (EU, 1995) Subject to Article 29 of this Directive; a Data Protection Working Party published an opinion on apps on smart devices in 2013. In summary, this opinion articulates four principles governing user privacy and security:

1. A transparent privacy policy;
 2. Free and informed consent by the user;
 3. Adequate security measures to prevent unauthorised processing of or access to personal data;
 4. Limitation of purpose, in other words the data are used only for the stated purpose.
- (EU, 2013)

Ensuring these four principles are adhered to in practice requires a number of technical solutions. In particular, first use of any such app must present a consent form, a login / logout should be implemented to prevent unauthorised access and user data and health records must be securely encrypted. Where access to the records by a third party is not required or consented to, then the encryption scheme provided for access to the records to be limited to the mobile app user only. Consequently any records to be stored on a server (within the EU) should be encrypted before the data are transmitted from the mobile device. Decryption should only be possible when the user logs in again to the app and even then data are only decrypted on the mobile device. The next section considers the research approach pursued as part of this study.

3. Research approach

Fifty-five users tested the CHEITA application and completed the survey assessing the usability of the android application. The exploratory questionnaire was created to gain a picture of the CHEITA user experience. It contained a mixture of open-ended and Likert scale questions (see Appendix 1). This sample comprised guardians/parents of infants one year old and younger.

A mixed-mode of delivery was used to access respondents. This delivery method included both offline and online versions to access a greater number of respondents and to mitigate the bias of online delivery alone. Online questionnaires can suffer from both technological and selection bias (Eysenbach and Wyatt, 2002), but they can also allow for greater access to populations. Selection bias or the 'volunteer' effect, which can also occur in offline populations is when more respondents fill out your questionnaire because they have a particular interest in the topic (cf. Evans and Mathur, 2005, Eysenbach and Wyatt, 2002). Using two forms of delivery the questionnaires may act as a form of triangulation. Both forms of the questionnaire were identical in design and in the order of the questions.

The offline version was distributed at a local shopping mall, this encouraged diversity in the sample. Participants were required to use CHEITA and then complete the questionnaire. The online questionnaire was distributed using snowball sampling. Snowball sampling or chain sampling is a method where the sample size is increased through referrals from individuals who have or know others who have characteristics which are of interest to the research (Biernacki and Waldorf, 1981). It is one of the most widely used sampling techniques in qualitative research (Noy, 2008) and is especially useful for sensitive issues (Biernacki and Waldorf, 1981)

and for populations which may be difficult to reach or hidden (Atkinson and Flint, 2001). Initially the online questionnaire was made available via Facebook and subsequently the questionnaire was posted on two well-known public Internet forums aimed at both expectant and new mothers. Surprisingly, online questionnaire completion was low at approximately 5 per cent. This low response rate is possibly due to the level of 'buy in' required by the users, as they were required to download and use the app before they completed the survey.

The questionnaire contained two main types of questions, questions which could be analysed using descriptive statistics and opened ended questions which required more detailed analysis. While qualitative forms of analysis are more labour intensive than quantitative schemes, they do offer a greater degree of explanatory power when a researcher is investigating the meaning behind a user's actions (DeSanctis and Poole, 1994), which is needed for this exploratory research study. The following section provides a brief background to this study,

4. Background to the study

The Health Service Executive (HSE) is the national provider of healthcare services in Ireland. Ireland is a prime location for developing and testing an app such as CHelTA as the birth-rate in Ireland remains the highest in Europe (ESRI, 2012). The high birth-rate and the tough economic situation coupled with an overstretched healthcare system provide a strong rationale for leveraging innovative technologies to improve the accessibility, storage and maintenance of patient (e.g. infant) data.

A new mother is a vulnerable group in society and the need to ensure complete security of this data is taken very seriously. The proposed technical solution meets international best practice in terms of security. The necessary processes and procedures (i.e. data encryption, password protection, assigned roles/permissions with controlled access) have been implemented in CHelTA 1.0 to ensure that no patient's data will be accessible to those without the relevant permissions.

The user requirements for CHelTA were elicited from GP and Public Health Nurse (PHN) best practice in the Cork region. CHelTA was developed specifically for the Android platform using Java and PHP. In line with EU directive, each user is required to read and agree to a privacy policy (EU, 2013) before they log on to the CHelTA app for the first time. In terms of data security, all data is securely encrypted on the mobile device and stored in encrypted form in a cloud-hosted service as illustrated at a high level in Figure 1.

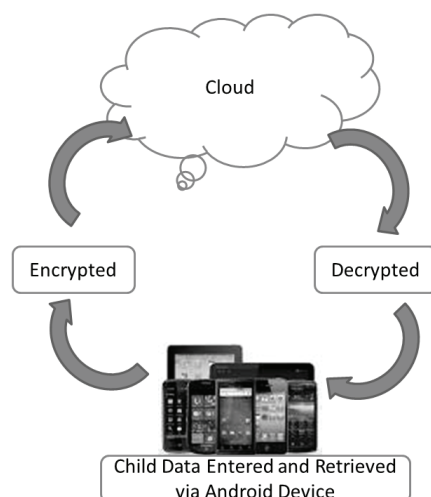


Figure 1: High Level view of CHelTA app

No facility exists to decrypt the data in the cloud; this is only performed on the device. The existing encryption uses an MD5 hash. While this is sufficient to protect against all but the most well-resourced of attacks, the MD5 hash will shortly be replaced with a more secure SHA-2 scheme. Patient data is stored on cloud servers within the European Union in compliance with current Irish data protection legislation.

5. CHEITA 1.0

CHEITA version 1.0 was developed to track infant data from 0 to 3 months. This includes personal details, general health history of the family, regular GP visits, vaccinations and vital development statistics such as weight, height and head circumference. These data fields were derived from best-practice booklets currently used by Public Health Nurses (PHNs) as part of the initial home visit and subsequent visits to the GP and PHN over the subsequent months of infant development. Interestingly in the Republic of Ireland, from region to region this book differs and in some areas the PHNs hold the records and in others, parents hold the records, demonstrating inconsistency. In CHEITA version 1.0, six screens were developed to capture infant data; Figure 2 presents a screenshot of the CHEITA vaccination screen.



Figure 2: Vaccination screen (CHEITA Application Version 1.0)

Vaccination is a fundamental part of infant health information management. As part of the Irish health system, an infant's immunisation programme is administered over thirteen months as outlined in table 1 below.

Table 1: Infant immunisation schedule Ireland (HSE, 2013)

Age	Where	Vaccine
Birth	Hospital / Clinic	BCG
2 Months	GP	6 in 1 + PCV
4 Months	GP	6 in 1 + Men C
6 Months	GP	6 in 1 + Men C + PCV
12 Months	GP	MMR + PCV
13 Months	GP	Men C + Hib

This data is held in a booklet by the parent/guardian separate to the infant development tracking booklet. This data is also typically captured in the GP's own system, in order to track the batches of drugs administered to each child. Nonetheless from the perspective of a parent/guardian, it is very difficult to remember this booklet for every immunisation appointment and subsequently it may be challenging to maintain this booklet in a safe place for future use i.e. when the child attends school and will be immunised further. Needless to say, for these reasons vaccination tracking was deemed an integral feature of CHEITA 1.0.

5.1 Findings

The majority of the respondents were aged between 26 and 45 years old and they all were owners of a smart phone although these varied across Windows, Android and iOS platforms. As CHEITA 1.0 was developed for Android, the data collection was undertaken with some test Android mobile phones and tablets to ensure to attract the greatest number of participants. As part of this study, it was established that each of the participants is a parent/guardian to an infant under the age of one year with their babies being born in the Irish health system. Interestingly, approximately 85 percent of all the respondents held a third level qualification.

Figure 3 illustrates the breakdown of the 55 participants across the different types of mobile phone usage, approx. 85% indicated that they made calls and texts, approx. 54% engaged in social media usage and the same percentage indicated that they downloaded apps to their phone while approx. 65% of survey respondents used their phone to browse the Internet.

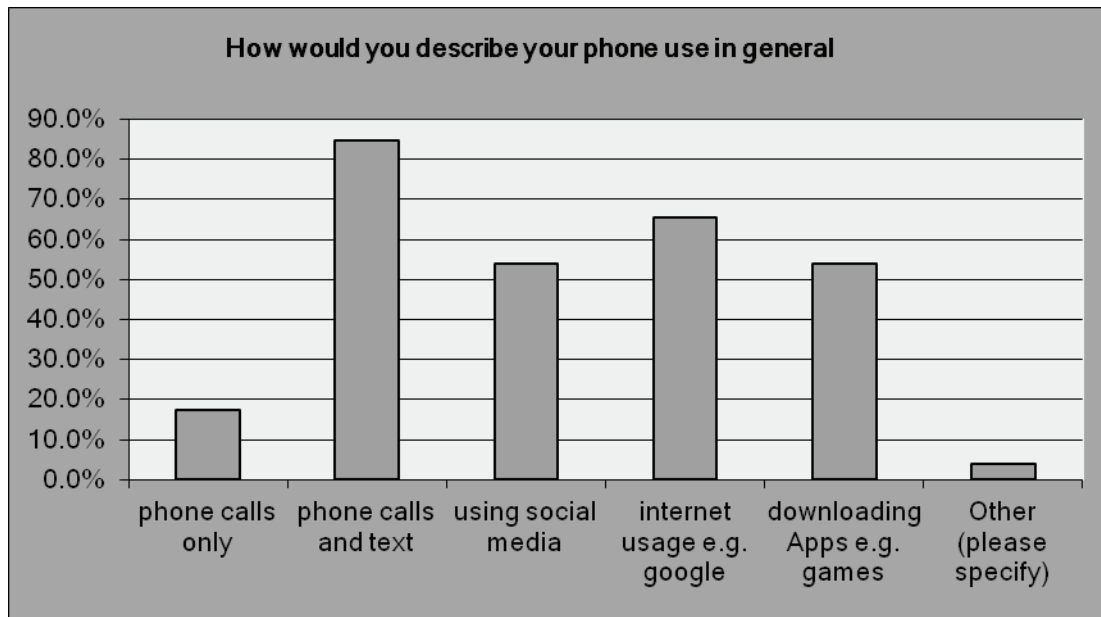


Figure 3: Mobile phone usage across participants

From Figure 3 it may be observed that mobile phones usage is moving beyond the traditional, to provide users with pervasive Internet access noticeably among a more mature demographic.

5.2 Design and usability

As the use of a mobile app is a significant departure from the current infant data tracking processes currently in place, one of the key objectives of the survey was to further understand user needs when accessing and managing infant data. With this in mind, many of the questions posed focussed on the design and usability of CHEITA 1.0. From the 55 respondents, 21% strongly agreed and 73% agreed (94%) that the app in its current design was visually appealing. This finding was surprisingly high as the app was piloted as a minimum viable product (MVP) and there was an expectation that the general look and feel required further refinement. CHEITA also received positive feedback in terms of navigation and ease of movement from page to page, with 99% of participants agreeing that it was easy to navigate the app in its current format. In addition, 98% of respondents either strongly agreed or agreed that the app was easy to understand.

Furthermore, it was deemed important to understand how long it would take users to familiarise themselves with CHEITA and as part of the questionnaire participants were asked to indicate how long it took them to identify key features and important content. However due to the data collection method undertaken in the local shopping mall, time limitations for engaging with some participants was an issue. This is openly acknowledged as a limitation to this study. Subsequently, this question was only answered by 4 of the 55 respondents where 50% strongly agreed (2 participants), 25% agreed (1 participant) and 25% disagreed (1 participant). It is difficult to derive any conclusions based on the low number of responses to this question. In line with the results presented, over 90% of the participants either strongly agreed or agreed that the language used in the CHEITA mobile app was easy to understand and that the content provided by CHEITA met user expectations. Of the 55 participants only 43 participants provided an answer to the question regarding completing tasks in a reasonable amount of time. Again this lack of response may be attributed to the limited amount of time each of the respondents spent using the app in the data collection setting. However, of the 43 respondents all agreed or strongly agreed that they were able to complete their tasks i.e. capture and store their infant data, in a reasonable amount of time.

Of the 55 participants, 53 completed the question regarding the degree of importance of the data captured by the CHEITA application. One hundred percent of the 53 participants indicated that CHEITA captured

information that was important to them. Most notably, the participants did not identify significant issues with the security of the infant data captured and stored by CHEITA 1.0. Ninety percent of respondents indicated that they felt confident and secure in the use of this health app. Furthermore, 85% were positively disposed to sharing their infant’s health data with a healthcare professional as illustrated in Figure 4.

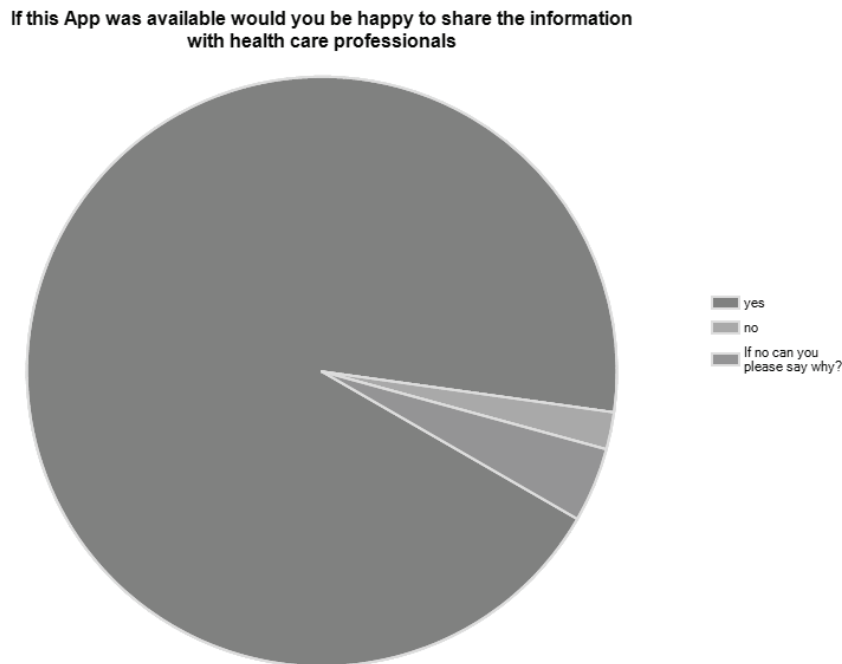


Figure 4: Willingness to share infant data

The dark grey shading in Figure 4 positively indicates the respondent’s willingness to sharing infant data with a health professional. One respondent suggested that infant data should be made available to the relevant healthcare professional in a read only format such as a pdf, thus identifying the sense of ownership and control that a guardian may feel regarding their child’s health data. In terms of gauging the general attitude toward the use of a mobile application to manage infant data, the respondents were asked to rate the efficiency and effectiveness of capturing and storing infant health information in this manner. Ninety eight percent of respondents either agreed or strongly agreed with this statement therefore providing significant support for the further development of a child health information tracking application of this nature in the future. A number of study respondents provided additional feedback and recommendations in terms of improving the application under consideration. These included the addition of new features, user interface improvements and cross platform compatibility as described in Table 2 below. Two respondents included comments on how CHEITA could be used with healthcare professionals.

Table 2: Synthesis of recommendations CHEITA 1.0

Factor	Participant Data
User Interface Design Improvements	<ul style="list-style-type: none"> • "interface could be more user friendly would be nice to plot child information along percentile charts used by PHNs" • "improvement visually of the app"
Suggested App Features (General)	<ul style="list-style-type: none"> • "developmental milestones i.e. speech, physical" • "Would add another moment for special moments and pictures. Sort of like a baby book on your tablet"
Sleep Feature	<ul style="list-style-type: none"> • "would be interesting to also see information on sleeping" • "Sleep would be a good addition"
Feeding Feature	<ul style="list-style-type: none"> • "record feeding times and provide an historic view" • "feeding tracker"
Cross Platform Accessibility Usage in conjunction with health professionals	<ul style="list-style-type: none"> • "good to be able to extend beyond one cell platform (i.e. to windows phones)" • "show health professionals only a read-only or .pdf doc of the information" • "would have to be used in conjunction with healthcare professionals e.g.PHN, GP etc. with confirmed back-up system"

The recommendations outlined in Table 2 have been considered, the project team acknowledge the need for an improved user interface, while additional developmental milestones beyond the 0-3 month period would need to be included as new features in the next version, in order to attract significant medical interest beyond the scope of a pilot.

6. Conclusions and future research

There are a number of limitations that need to be addressed as part of this study. Firstly, it was difficult to attract user buy-in in terms of engaging with guardians/parents in the use of the app and subsequently requesting their feedback via questionnaire, particularly when CHEITA 1.0 was run as a pilot and the data was not available beyond a limited time period. The lack of long term support for the application acted as a disincentive to our user group. Secondly, CHEITA is a platform specific (Android) mobile application which limited the availability of the user group as iPhone, Windows users could not engage with the pilot. Another limitation of this study was the limited time spent engaging with the respondents. While the data collection approach ensured that the selection of appropriate participants for this study, the time spent by each respondent using the app was quite limited. Ideally for CHEITA 2.0, access to a maternity unit and/or Public Health Nurse (PHN) clinics would provide a suitable opportunity to engage with the parent/guardian, facilitate the download of the app and provide a four week engagement period with the app before eliciting their feedback.

Nonetheless, the response to the CHEITA user experience was largely positive, the findings support Fox and Duggan’s (2012) assertion that there is a significant increase in the popularity of health related mobile applications. Notably, data security was not flagged as a concern for the user group. Over 90 percent of users signified that they would be happy to share the child health information captured by CHEITA with the relevant health professionals. Over ninety percent of those surveyed indicated that CHEITA was easy to use and easy to understand. An overwhelming 98 percent of the fifty-five users surveyed indicated that they would like to use the CHEITA application in the future.

Phase 2 of CHEITA will involve attracting funding to support the development of additional functionality (i.e. extending the scope of the project to include child infant data beyond three months and also providing a broader base of functionality to include family medical history, feeding, sleep and growth profiling) based on user feedback. Additionally, user interface development is integral to the potential opportunities for enhanced user engagement. Further database development is required in order to provide a more reliable data structure that could be leveraged if the application was made available to a wider audience.

As part of the next phase, it is imperative that strategies are developed to bring this technology to the attention of health care professionals and more significantly the Irish Health Services Executive (HSE). There is more work to be done to make the case that this technology and the underlying principal of a single, unified child health record is integral to the provision of efficient, effective health services. In the longer term, it is our intention to triangulate the stakeholder involvement in CHEITA 2.0 by conducting data collection via further surveying of parents/guardians as well as conducting focus groups with healthcare professionals in order to gathering their feedback on the application and its usability.

Appendix 1: SAMPLE CHEITA 1.0 survey (questions - mix of open ended and likert scale, 1 strongly disagree to 5 strongly agree)

Email Address
What make of mobile phone do you use?
Date of birth of your baby
Type of delivery
What is your baby's gender?
Present feeding method
What is your age?
Where are you living?
Educational level attained
What is your nationality?

How would you describe your phone use in general?
When using the App how did you access the internet?
This App is visually appealing
It is easy to move from one page to another
The overall organisation of the App is easy to understand
It took a short amount of time (approx 15 minutes) to identify the key features and important content
The language used is easy to understand
The content provided meets my expectations
I am able to complete my tasks in a reasonable amount of time
This App captures information that is important to me
Overall the App is easy to use
This App works well on my smart phone
This App inspires a feeling of confidence and security when I use it
The App provides appropriate alerts and notifications to support my needs as a user
Did you share the App with any health care professional
If this App was available would you be happy to share the information with health care professionals
I think that an App is an efficient way of capturing and storing health related child information
I think that an App is an effective way of capturing and storing health related child information
I would like to be able to use this App in the future
In order to improve this App, we would welcome your feedback/recommendations

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A Weak-form Expert Evaluation of Customer Profiling Models

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Abstract: In this paper, we evaluate two models that were used for customer profiling: 1) a market basket analysis (MBA) model and 2) a customer segmentation model. The models were based on actual customer purchasing data from a large department store for the period 2007-09. A weak-form evaluation method, consisting of qualitative interviews of experts from the department store, was used. The questions focused on information quality according to the DeLone and McLean framework and were derived from the Doll and Torkzadeh model, i.e., they covered content, accuracy, format, and ease of use aspects. Seven experts from the case company took part in the evaluation process. Before the actual interview, the experts were asked to fill out a questionnaire regarding their background and current access to timely sales information, i.e., how often and how useful the information was that they were receiving at the moment. Later, during an interview, the evaluator discussed the questionnaire with each respondent. Then, the experts were presented with information on their customers' buying behavior based on the results from the two models, i.e., the MBA- and the segmentation model. After each presentation, the experts were asked to respond to fifteen statements and four open-ended questions. All in all, the information gained through the MBA- and segmentation analyses was rated highly (4-5/max 5) by the experts. The experts considered the information gained with help of these models to be valuable and useful for decision making and for making strategic planning for the future. This implies that the models could be of valuable use for managers working within CRM, e.g., planning marketing campaigns, product range planning, service development, planning of store layouts, operative and strategic planning, and for further developing loyalty programs.

Keywords: weak-form evaluation, qualitative interviews, data mining, market basket analysis, customer segmentation

1. Background

Department stores today are facing increasing competition from many sources, including other department stores, specialty stores, and e-commerce. In this increasingly competitive market it has become even more important for retailers to understand the needs of their customers. Through widespread implementation of customer relationship management (CRM), companies have been striving to become more customer-centric. The aim of CRM is to create added value for both the companies and their customers, by integrating data from sales, marketing and customer support to obtain a better understanding of customers' needs (Heinrich 2005; Datta 1996; Chalmers 2006).

The key element within CRM is thus customer information (Buttle 2004; Rygielski et al. 2002). Today, production of data, as well as the capacity to store the produced data, is growing rapidly, constantly outpacing companies' abilities to analyze them. While, different data mining methods have been applied since the 1990's, many approaches have been difficult for the average manager to interpret and use. Visual analytics is an emerging field that aims to bridge this gap. As a multidisciplinary field, within visual analytics vast amounts of different kinds of data in different formats are analyzed in a process where human judgment, visual presentations and different kinds of interaction techniques are combined (Keim et. al. 2008; Thomas and Cook 2006). The aim of visual analytics as a part of data mining is to turn large amounts of unstructured data into useful information. Advanced computer applications are used for the information discovery process allowing decision makers to fully concentrate on the analytical process and to visualize the information useful for them (Keim et. al. 2008). Thus, the use of interactive visualization methods is integral to visual data mining.

Within CRM, the area of analytical CRM relates to advanced modeling and profiling of customers based upon demographic and transaction data. One important application within this area is market basket analysis (MBA). MBA typically uses association rule mining to analyze transaction data and identify products that are purchased together, so-called baskets. Results from this type of analysis are used, e.g., for planning store layouts, catalogue design, upselling, and designing marketing campaigns (Olson and Delen 2008). Another important application within analytical CRM is segmentation, where customers with similar profiles or requirements are identified and grouped together (Lingras et al. 2005). Segmentation is a suitable approach for gaining an overview of the customer base. Through segmentation, the manager gains a description of the

main types of customers and is able to identify key customers and their needs (Buttle 2004; Lingras et al. 2005).

In this paper, we evaluate two models that were used for customer profiling: 1) an MBA-model and 2) a customer segmentation model. The models were based on actual customer purchasing data from a large department store for the period 2007-09. The MBA-model was built using the Apriori algorithm and the segmentation model was built using the self-organizing map (SOM). The objective of this study is to evaluate and determine the added value of the two models for decision makers at the department store.

The rest of the paper is structured as follows: In Section two, we describe the methodology used in this paper. The data and the two models that are evaluated in this paper are described in Section three. The evaluation of the models is discussed in Section four. We present the results in Section five, and in Section six we conclude the paper and discuss future work.

2. Methodology

The overall research process that this evaluation pertains to, i.e., the creation of the MBA and segmentation models, follows the design science research (DSR) paradigm. The goal of DSR is to find innovative solutions to relevant and practical problems with the help of primarily technological artifacts. DSR is an iterative process based upon two ongoing cycles; the build and evaluate cycles. Both cycles are integral and equally important activities in the DSR paradigm, as the actual functioning of the artifact must be proven (March and Smith 1995; Hevner 2007; Gregor and Hevner 2013). One difficulty with design science is that the evaluation of the performance of a solution or an artefact is dependent on the environment it is working in. Progress is achieved when more effective technologies replace the existing ones (March and Smith 1995). In our research, we have built two models to support experts in customer profiling tasks. According to the DSR frameworks for selection of the most suitable evaluation strategy and method (see, e.g., Venable et al. 2012 and Pries-Heje et al. 2008), our study belongs to the Ex Ante/Ex Post – Naturalistic category. Therefore, field study utilizing experts and potential end users was selected as an appropriate evaluation setting.

Different ways to evaluate the usefulness of information systems has been extensively discussed in the literature. For example, over 100 different measures used to evaluate IS usefulness were identified by DeLone and McLean (1992). The authors systematically analyzed 180 IS success studies that they had collected, and divided these measures of IS usefulness into six categories: *system quality*, *information quality*, *information use*, *user satisfaction*, *individual impact* and *organizational impact*. The model is causal, indicating that system quality and information quality influence user satisfaction and information use, in turn influencing impact. Based upon a multitude of studies in the field, the authors have updated and enhanced the framework in DeLone and McLean (2003). The authors add the factor service quality, remove information use and individual and organizational impact, and replace them with intention to use/use and net benefits. The authors note that the choice of which variable to use is, of course, dependent on the objective of the study. The model has been widely applied and validated in the literature (see, e.g., Ong and Lai 2007; Eklund et al 2008; Aggelidis and Chatzoglou 2012), and clearly shows the causal importance of the factor of information quality in terms of IS success.

In the setting of this study, the focus is on measures of information quality and information use of models that the users cannot directly interact with at this stage. Therefore, one potentially applicable model is the End-User Computing Satisfaction (EUCS) framework, developed by Doll and Torkzadeh (1988). According to the authors, the five most important factors in assessing user satisfaction with information are: *content*, *accuracy*, *format*, *ease of use*, and *timeliness*. The Doll and Torkzadeh framework was used in this study because it focuses more on information quality and use than many other available models, and was, therefore, found to be more suitable for this study (Doll and Torkzadeh 1988).

3. Two models for customer profiling

The models presented in this study were based on actual customer purchasing data from a large department store for the period 2007-09. Data mining methods were used to identify patterns in the customers' buying behavior. The extracted patterns describe the customer's behavior and purchasing habits, in this case, mainly connected to the women's department in two major department stores of the national chain.

3.1 The market basket analysis (MBA) model

An important task for CRM managers is to determine which products are purchased together, i.e., to perform MBA. The most well-known method within MBA is the Apriori algorithm (Agrawal, Srikant 1994; Olson, Delen 2008; Rajaraman, Ullman 2011). The Apriori algorithm tries to identify frequent item sets, i.e., in an MBA setting, products that appear together significantly more often than would be statistically expected beforehand. For more detailed information on the Apriori algorithm, see e.g., the work of Agrawal and Srikant (1994).

The aim of the MBA model was to gain information on customers' purchasing behavior. The analysis seeks to answer questions such as:

- How many products are purchased together in one shopping transaction (basket)?
- Which products are bought together?
- From which departments are products in a shopping basket combined?
- Which clothing brands do the customers combine?

For the MBA model, we used a large market basket data set in the form of a sparse matrix, with transaction data from a two year period. The data consists of 16 million transactions, (i.e., baskets) and in total 39 million product purchases (i.e., individual line items), with an average of 2.43 purchases per transaction. The total number of products is 557,000 and the total number of customers is 1.5 million. Almost 50% of the transactions contained only one product, i.e., almost every other customer bought only one product per visit to the department store.

An implementation of the Apriori algorithm based upon smart preprocessing of data was used for the analysis. The outcome of the analysis was tables expressing the number of products in a shopping basket, the connection between products according to existing relations in the transaction data, dependency diagrams that show the relationships between different departments and the connections between different product brands.

3.2 The customer segmentation model

Another important task for CRM managers is to have an overview of their customer base, i.e., to perform customer segmentation. A well-known unsupervised artificial neural network (ANN), the Self-Organizing Map (SOM) (Kohonen 2001), was used for the customer segmentation task. The SOM is a widely used unsupervised data mining method for data-driven clustering. With the SOM it is possible to explore relationships in multidimensional input data by projecting them onto a two-dimensional topological map. The topological properties of the SOM mean that similar data are located close to each other on the grid, preserving relationships but not actual distances (as opposed to, e.g., multidimensional scaling). The SOM is a highly visual, non-parametric and very robust method that requires very little preprocessing of data (Kohonen 2001).

The purpose of the customer segmentation analysis was to group customers according to their behavior and demographical abilities. The analysis seeks to answer the questions:

- Who buys?
- Which products?
- For how much (€)?
- How often?

The data used for the segmentation model consist of two parts; 1) demographic background information, and 2) purchasing transaction data describing the purchasing behavior of the customers. The demographic data are obtained through the loyalty card program of the retailer, and transaction data are taken from the retailer's transaction systems. The training dataset contains over 1.5 million customers (almost 30% of the population in Finland), i.e., 1.5 million rows of data.

First, the data were transformed into a suitable format using SPSS Modeler. The SOM model and analyses were performed using Viscovery SOMine. SOMine provides means for both data preprocessing and

visualization of the results. The outcome of the analysis was a segmentation of the whole customer base. The formed segments were visually presented using topological maps and information, and statistics for each segment were presented. The outcome of the customer segmentation has been published in the Knowledge Service Engineering Handbook (Vanharanta et. al. 2012).

4. Evaluation of the models

In this study, the proposed models are not yet implemented and functioning systems, and therefore, the users will not be interacting with the systems themselves. Therefore, we have chosen to evaluate the quality of the information extracted from the two models for customer profiling, instead of the technical properties of the models. The evaluation is performed using a weak-form evaluation method, consisting of interviews of experts from the department store. The interviews are based on an adapted version of the five most important factors defined in the EUCS model (Doll and Torkzadeh 1988). They covered *content, accuracy, format, and ease of use* aspects. As we in this case are evaluating a static model, the timeliness-aspect could not be measured. In addition, the factor “ease of use”, in this case refers to the benefit and usefulness of the information.

For the interviews, two questionnaires and two PowerPoint presentations were created. The first questionnaire was sent to the respondents beforehand. Its purpose was to collect background information on the respondents and to map the current situation regarding available information on customer profiling. During the interviews, the PowerPoint presentations were used for communication of the results of the analyses gained with the two models, i.e., the MBA and customer segmentation models. The second questionnaire was used for the evaluation of the potential usefulness of the analyses. The questionnaire was administered in Finnish, which is the official company language.

Seven specialists, of eight originally contacted, were interviewed between May and July 2013. The interviews took from 45 minutes to one hour and consisted of 1) discussions of the initial background questionnaire, 2) presentation of the results from the two analyses, and 3) the evaluation of the potential usefulness of the results gained from the analyses with the two models. The interviews were recorded.

The experts were asked to evaluate the potential use of the outcomes of the 1) MBA and 2) segmentation analyses by answering fifteen statements (on a Likert-scale of 1 to 5/ max 5, or *strongly disagree, disagree, neutral, agree, and strongly agree*) and four open-ended questions.

5. Results

The results of the evaluation consist of background information on the respondents and evaluation of the information quality of the two models on customer profiling.

5.1 Demographic information on the respondents

The first questionnaire was used for collection of background information on the respondents. The seven respondents were between 30 to 64 years old (see Table 1). They had differing backgrounds ranging from economics, sales, marketing, and management. Their titles at the company were head of sales, store manager, product range manager, head of division, and concept manager. Their areas of responsibility were all linked with women’s clothing, management of the department store, and product sourcing. The respondents had been working at the department store chain between 8 and 26 years, of which three persons less than 2 years and one person for 25 years. All of the respondents were familiar with IT tools and different reporting software, but only few of them had any experience with advanced tools used for analyzing data.

Table 1: Age distribution of the respondents

Age class (years)	18-29	30-39	40-49	50-64	65+
Respondents (N=7)	0	2	3	2	0

According to the respondents, information on customers and their shopping behavior is distributed to some extent, but several of the respondents think that the information is on a too general level to be useful in their actual work. In particular, the experts are in need of information in support of management tasks. The respondents receive information on sales daily, while other information is updated on a monthly or annual basis. In their work, the respondents use both their own expertise and information on customers retrieved from the retailer’s database.

When the respondents were asked what kind of information they would need in their line of work, they responded that they would need information such as brand loyalty studies, studies concerning customer segment purchasing behavior in and out of campaigns, and information on how to reach customers through marketing. Information supporting product portfolio selection and services was also called for. In general, there was a clear need for more precise information and information, on a deeper and more specific level.

5.2 Evaluation of the market basket analysis (MBA) model

The results of the MBA evaluation are presented in Table 2. For each statement, the table shows the number of the respondents that responded with a certain rating. The MBA model was rated according to statements assessing four different factors: *content* (5 statements), *accuracy* (3 statements), *format* (4 statements), and *benefit/ usefulness* (3 statements). Overall, the MBA analysis received good ratings from the experts measured in terms of both average and median. In particular, the accuracy and format of the MBA received high ratings (median values between 4 and 5). The content and usefulness of the analysis was also generally highly rated (median 4-5), but in particular statement 2.4 (The analysis provides new information) received a lower rating, likely because the used data was from 2007-09. Overall, the respondents were clearly pleased with the information quality of the MBA model.

Table 2: The results of the MBA evaluation

	Average	Median	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Do not know	N
2. Content									
2.1 The analysis gives important information.	4,1	4	0	1	0	3	3	0	7
2.2 The results of the analysis respond to my needs.	3,6	4	0	2	0	4	1	0	7
2.3 The analysis gives useful information.	3,7	4	0	2	0	3	2	0	7
2.4 The analysis gives new information	2,9	2	0	4	1	1	1	0	7
2.5 The information extracted from the analysis is sufficient.	3,7	4	0	2	0	3	2	0	7
3. Accuracy									
3.1 The results of the analysis are correct.	4,6	5	0	0	1	1	5	0	7
3.2 The results of the analysis are reliable.	4,7	5	0	0	0	2	5	0	7
3.3 I am satisfied with the accuracy of the analysis.	4,3	4	0	0	1	3	3	0	7
4. Format									
4.1 The results of the analysis were visually clearly presented.	4,7	5	0	0	0	2	5	0	7
4.2 The results of the analysis are easily read.	4,7	5	0	0	0	2	5	0	7
4.3 The results of the analysis are easily understood.	4,7	5	0	0	0	2	5	0	7
4.4 Overall, I am satisfied with the format of the analysis.	4,3	5	0	1	0	2	4	0	7
5. Benefit and usefulness									
5.1 The results of the analysis correlate well with my own understanding regarding the customers of the department store.	4,7	5	0	0	0	2	5	0	7
5.2 The results of the analysis were useful.	3,3	4	0	3	0	3	1	0	7
5.3 I can benefit from this kind of analysis in my work.	4,3	4	0	0	0	5	2	0	7

In addition to the structured, Likert-scale statements above, the experts were asked to respond to four open-ended questions in order to assess how they would like to see the models used and developed in the future.

Firstly, the respondents were asked how they would see that the presented models could impact upon their work. Several respondents (3/7) emphasized that the models would provide support for product display

planning, and would also provide support for tracking changes in sales based upon display changes and marketing efforts. Product range planning was also mentioned by several of the managers (3/7). Two managers mentioned decision support in general, focusing on new perspectives and support for “gut-feeling” decisions. One respondent also mentioned that the MBA model would directly support cross-selling efforts.

Next, respondents were asked what information about customers and their shopping behavior they feel is missing from the MBA model, i.e. how should the MBA model be improved in order to be even more useful. The respondents specifically mentioned brand loyalty information, product group level comparisons, and department level analyses. One respondent raised the interesting question of how many customers paid at several different cash registers during the same shopping visit, something that has not at all been addressed previously in our models.

The respondents were also asked how often they would like to see the MBA analysis updated. Most respondents (5/7) responded with either once or twice a year, but two respondents would have liked to see the results updated considerably more often. One of these respondents specifically mentioned marketing cycles as the motivation for needing the updates 5 times in a year. This indicates differences related to the job descriptions of the respondents; the respondents involved in marketing campaign planning and product procurement are likely more interested in timely MBA data than floor level managers.

Finally, the respondents were asked in what form they would like to see the results presented. All respondents emphasized the use of graphical displays and brief reports, e.g., PowerPoint presentations. One of the respondents mentioned also the visualization of how the gained information changed with time, which is an important aspect to think about when implementing a system that gives updated reports on timely information. It is obvious that the respondents do not want to spend a lot of time going through long daily reports, instead requiring visually intuitive and simple presentations.

5.3 Evaluation of the customer segmentation model

The results of the segmentation analysis evaluation are presented in Table 3. The same statements as for rating the MBA model were used for rating the segmentation model. Overall, the experts rated the segmentation analysis highly. The accuracy and format of the segmentation analysis received the highest ratings (median values between 4 and 5). The content and usefulness of the analysis was also generally highly rated (median 4-5). Overall, the respondents were clearly pleased with the information quality of the segmentation analysis model.

As for the MBA model evaluation, the experts were asked to respond to four open-ended questions concerning the use of the model.

Firstly, the respondents were asked how they would see that the presented models could impact upon their work. Some of the respondents (2/7) emphasized that the models would provide support for product range planning, marketing and service. One respondent also mentioned that the segmentation model would directly support short term actions, and in the long run, strategic planning. One manager mentioned decision support in general. This can be seen as a strong support for the visual analytics capabilities of the model.

Next, respondents were asked what information about customers and their shopping behavior they feel is missing from the segmentation analysis model, i.e., how should the segmentation model be improved. The respondents specifically mentioned brand loyalty information and information concerning average frequency of visits. In addition, more information on profitable and potential customers with different shopping behavior was of interest for the respondents. One respondent raised the interesting question of how information has changed with time since the presented analysis, when there have been made changes in the product range and developments in services.

The respondents were also asked how often they would like the segmentation analysis to be updated. Most respondents (5/7) responded with either once or twice a year, while two respondents would have liked to see the results updated once a month.

Finally, the respondents were asked in what form they would like to see the results presented. All respondents emphasized the use of graphical displays and brief reports, e.g., PowerPoint presentations and maps. Visualization of how the gained information changed with time was also mentioned by the respondents. Again, the respondents required visually intuitive and simple presentations, instead of long written reports.

Table 3: The results of the segmentation analysis evaluation

	Average	Median	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Do not know	N
6. Content									
6.1 The analysis gives important information.	4,6	5	0	0	0	3	4	0	7
6.2 The results of the analysis respond to my needs.	3,7	4	0	2	0	3	2	0	7
6.3 The analysis gives useful information	3,6	4	0	2	0	4	1	0	7
6.4 The analysis gives new information	3,1	4	0	3	0	4	0	0	7
6.5 The information extracted from the analysis is sufficient.	3,4	4	0	3	0	2	2	0	7
7. Accuracy									
7.1 The results of the analysis are correct.	4,6	5	0	0	0	3	4	0	7
7.2 The results of the analysis are reliable.	4,7	5	0	0	0	2	5	0	7
7.3 I am satisfied with the accuracy of the analysis.	3,7	4	0	2	1	1	3	0	7
8. Format									
8.1 The results of the analysis were visually clearly presented.	4,3	5	0	1	0	2	4	0	7
8.2 The results of the analysis are easily read.	4,4	5	0	1	0	1	5	0	7
8.3 The results of the analysis are easily understood.	4,7	5	0	0	0	2	5	0	7
8.4 Overall, I am satisfied with the format of the analysis.	4,4	5	0	1	0	1	5	0	7
9. Benefit and usefulness									
9.1 The results of the analysis correlate well with my own understanding regarding the customers of the department store.	4,4	5	0	1	0	1	5	0	7
9.2 The results of the analysis were useful.	4	4	0	1	0	4	2	0	7
9.3 I can benefit from this kind of analysis in my work.	4,3	4	0	0	0	5	2	0	7

6. Conclusions and future work

All in all, the information gained through the MBA- and segmentation analyses was rated highly (4-5/max 5) as to content, accuracy, format, and ease of use aspects by the experts. Most of the respondents would like the analyses to be updated once or twice a year and they preferred to receive the information as brief reports with graphical displays including details on occurred changes in time. The experts considered the information gained with help of these models to be valuable and useful for decision making and for strategic planning. This can be seen as a strong support for the visual analytics capabilities of the model, and therefore, be of valuable use for managers working within CRM.

The respondents were very interested in gaining deeper and more specific information regarding both MBA and segmentation to support their daily work. Also, changes in time were of high interest. Based upon the expert evaluation, it is possible to develop the analyses further according to their needs and in this way extract more valuable and useful information. As the results of the weak-form evaluation were positive, there is support for further developing the models into system implementations.

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Patient-Centred Healthcare: Stakeholder Views of Cloud Computing on Information Sharing and Communication

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Abstract: Today it is well recognized in many societies that healthcare demands will be greater than corresponding supplies. In Sweden, as in many other countries, there is a growing interest to find new strategies for balancing the ever-changing expectations for healthcare with available capacities, competencies and capabilities that can contribute to a desired healthcare. Society's growing level of connectedness and grade of satisfaction with online applications and data storage outcomes is in high anticipation in regards to fast and easy information access. Patients need for better information sharing and communication in healthcare focus attention to the unbalance of required and available facilities and drives public demand for developing an effective healthcare system. In order to contribute to patient-centred healthcare the aim was to create better understanding of how professional healthcare stakeholders view the impact of cloud computing on information sharing and communication. Data was collected through a literature study and seven interviews with representatives from cloud computing suppliers, developers at national, regional and local level as well as medical staffs in Swedish healthcare. Discussing the views we found a split understanding among stakeholders. They were separated in different islands with no or very little communication and thus, with different goals and ambitions for healthcare. Thus, patient's needs for respect, security and a fully responsible healthcare are not fulfilled. The wrong is not in the technique Rather, in order to reach shared understanding and a common goal for patient-centred healthcare medical staffs, patient and family need to be included in the development. In this sense, the situation is not good or bad and nobody is right or wrong. Rather, there are problems to be solved by healthcare developers who should balance patient needs for better information sharing and communication in healthcare and public demand for patient-centred healthcare with the cloud supplier capabilities.

Keywords: cloud computing, communication, information management, patient-centred healthcare, stakeholder

1. Introduction

Healthcare encounters several serious problems. To cope with patient's needs, to improve life quality, patients' outlook for better and reliable care, it is progressively hard in the face of cost limitation, deficiency of healthcare professionals, and an aging community (LGS Innovations 2013, Young 2003). Edes (2010) adds that the increase in number of aged patients and increase of the cost of healthcare caused disquieting of healthcare financial analyst and legislation authorities. Growth of scientific knowledge relative to source and means of controlling disease, and increase in public acceptance of disease control as a possibility and responsibility of public health shaped the modern public health system. The role of the health department in enhancing community's health varies among stakeholders, citizens and professionals working in this field (Lin 2001). The emergence of a patient-centred healthcare system came in early 1950's and in early 90's it was included in healthcare research policy (Jayadevappa and Chhatre 2011). Today, patient-centred healthcare not only includes improvements in patient hospital care, home care and rehabilitation, but it also includes the development of an effective healthcare system (Ekman 2014).

Nowadays, citizens use devices such as smartphones and tablets to stay in-touch and connected with family, friends, and work (Carincross 1997, Rainie 2010). Society's growing level of connectedness and grade of satisfaction with online applications and data storage outcomes is in high anticipation in regards to fast and easy information access (Osterhaus 2010). In medical settings, cloud computing (CC) offers among others a potential to facilitate access to electronic medical records, which accelerates treatment and even saves lives (Gottlieb et al. 2005, Ovum 2012). It is facilitated by a network structure and the implementation of improved healthcare solutions, which allow quick and secure communications and information swap between patients, family members, and caregivers (LGS Innovations 2013). However, healthcare is a market that has generally resisted jumping into the technology explosion that takes place "in the cloud". It is reflected in 32 % of healthcare organizations using CC and 68 % not using such systems (Ovum 2012). In spite of other kinds of

businesses being more familiar with CC, the healthcare industry choosing CC is on the rise as it can give many benefits.

Healthcare developers across Europe are drawn to the possible advantages that CC can bring and they are willing to apply the technology for reducing costs and for increasing efficiency. However, European Chief Information Officers, CIO: s realize that prior to using CC they need to identify potential challenges and risks such as strict security and data protection, as requested by for instance the Swedish Patient Data Act (Foley & Lardner LLP 2012, Piai and Duffy 2012, Patientdatalagen 2008:355).

Developing the accuracy and efficiency of healthcare systems is currently an appealing alternative, which is being implemented by many healthcare sectors. It is argued that decision makers benefit from CC for fiscal planning of healthcare services. Despite the benefits of adopting the new technology many stakeholders in healthcare are still hesitating to apply it. Therefore, providers are struggling to find solutions to process and provide information in a cost-effective, efficient and secured manner. However, building citizens, patients and medical staffs trust is not an easy way (Ejenäs 2012, Andreasson and Winge 2009). Healthcare industry has thus, two modes of operation. First, in providing for people's healthcare needs and fulfilling their demands and second, in expressing healthcare industry needs and demands to CC providers. Thus, healthcare authorities and developers have to responsibly consider and thoughtfully balance patient need for better information sharing and communication in healthcare and public demand for patient-centred healthcare with the supply of CC providers.

In this paper we focus on the professional stakeholder involved in the development of patient-centred healthcare, not the patient. In order to contribute to patient-centred healthcare the aim is create better understanding of how professional healthcare stakeholders view the impact of cloud computing on information sharing and communication. The structure of this paper starts with the research method followed by a theoretical frame covering patient-centred healthcare and cloud computing. The empirical study is reflected in the professional stakeholder views of cloud computing on information sharing and communication followed by discussion and conclusion.

2. Methodology

In order to create understanding of cloud computing on information sharing and communication in Swedish healthcare among a wider group of stakeholders a qualitative approach was chosen as it provided opportunity to explore their views on the present situation (Järvinen 2004). The empirical study was based on primary data collected through seven interviews with stakeholders such as cloud computing suppliers, developers at national, regional and local level in Swedish healthcare as well as medical staffs. Semi structured questions were formulated to provide some open way of answering to the interviewees (Kvale 1996). The theoretical frame was based on a literature study covering patient-centred healthcare, patient experiences of healthcare, development of patient-centred healthcare, stakeholder information sharing and communication and cloud computing in healthcare.

3. Patient-centred healthcare

The word 'patient' originates from Latin meaning 'one who suffers'. A patient is someone who is ill or injured and receives medical treatment and is a recipient of healthcare services (Oxford dictionary, Wikipedia). Patient-centred healthcare is defined as a process which respects preferences, needs, and values of the patients from bio psychosocial perspective rather than a purely bio medical perspective with building a strong relationship among the patients and the medical staffs (Greene et al. 2012). The new focus on patient-centred healthcare includes development of organizational units and departments, which affects many system and organizational levels. Thus, it also includes relations between professionals, managers and top management; see Figure 1 (Lindström et al. 2012).

3.1 Patient experiences of healthcare

In the report by Bowin et al. (2012) patient experiences of healthcare are reflected in eleven case studies, which describe their contacts with different care providers. The study is based on a process analysis of healthcare and home care with the aim to develop a better-suited economical model in support of patient-centred care. Ineffective, delayed and inaccurate healthcare actions together with uncoordinated actions and actions not being followed up demonstrate lack of communication between responsible healthcare

organizations, its units and medical staffs. There are also unclear responsibilities for care and after care as well as no coordinated judgement of patient's needs that demonstrate the insufficiency in the present situation. As an effect, care is not happening, multiple symptoms are treated individually and referrals are lost for instance. The fact that patients have to repeat their sickness story each time a new healthcare contact is made demonstrate lack of or weak information sharing between responsible healthcare organizations, units and medical staffs. When patient's relatives carries personal or medical information between hospitals, primary care, pharmacy and home care or between long time care and primary care units that too demonstrates the insufficiency in the present situation (Bowin et al. 2012).

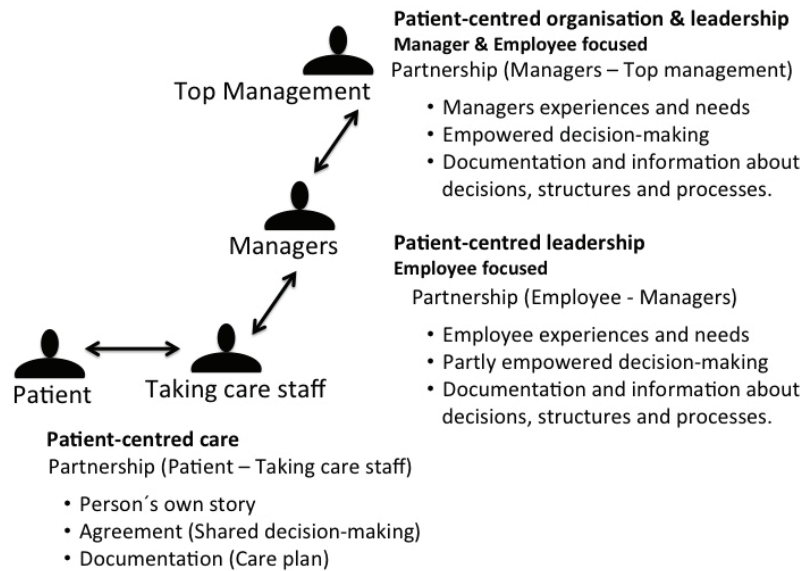


Figure 1: Partnerships in patient-centred healthcare adapted from Lindström et al. 2012

3.2 Development of patient-centred healthcare

Patients need for better information sharing and communication in healthcare focus attention to the unbalance of required and available facilities and in turn, drives public demand for developing an effective healthcare system. The healthcare institutes are stable social structures with specific rules and regulations that maintain the social order and activities, but in a continuous change (Ledderer 2010). The process development in the healthcare industry is in practice. Development of organizational processes is also one of the important actions taken by the businesses to focus employees on processes that provide importance to the customers. When redesigning the work procedure it is very important to ask the actors of the process, what extent their departments encourage them to do things like: share ideas for improvement with people in other disciplines, involve everyone who would be affected by making that decision, finally the help others do their work without caring about their own work (Majchrzak and Wang 1996). Andreasson and Winge (2009) argue that the more traditional way of planning and development in healthcare needs to be more holistic. This can be achieved when there is an interest showing from the professionals and care providers to focus on the patient's needs and information technology. There is an on going transformation of patients to consumers of health, illness and healthcare information in that 75 % of Internet users utilize web technologies to their search. The use of technological devices to promote patient-centred care systems enhances the understanding of the fundamental design issues related to the role of information and communication technologies in healthcare system (Ranerup 2010). Also, the development in the mobile applications and devices for power of changing consumer behavior should not be underestimated (Ejenäs 2012).

3.3 Stakeholders in patient-centred healthcare

The notion of stakeholder is explained as one who is involved in or affected by a course of action. It is a person with an interest or concern in something, especially a business. A stakeholder can also be a group, organization, member or system (Merriam-Webster, Oxford Dictionary Wikipedia, Mitchell et al. 1997).

In patient-centred healthcare relevant stakeholders are patients, their families, clinicians, health systems, executives, suppliers and other enterprise concerned groups. Their information sharing and communication is most significant to patient-centred healthcare development (Magoulas et al. 2012). They should be given the opportunity to engage in aligning perspectives on issues of quality and value in the process i.e. what counts and how it should be accomplished (Epstein and Street 2011, Checkland 1985) for instance, the use of IT systems to support some kind of nosiness in organizations and to improve processes within and between organizations (Nilsson 2005).

4. Cloud computing

The use of Internet and communication technologies is supposed to be the ideal way to disseminate information both locally and globally (Castells and Cardoso 2005). Cloud computing for instance facilitates the foundation of a network structure and the implementation of improved healthcare technology solutions, which allow quick and secure communications and information swap between patients, family members, and caregivers (LGS Innovations 2013). National Institute of Standards and Technology (NIST), defines cloud computing as a model for enabling convenient, on demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction (Peter et al. 2009).

In terms of services offered by organization using CC, there are three services, Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS)(Babar et.al. 2011). Also because of different level of security, CC comes in three forms, public cloud, private cloud, and hybrid clouds (Denjoy 2012). There are five indispensable characteristics that must be realized in CC. These are on-demand self-service, broad network access, resource pooling, rapid elasticity, and measured services (Peter et al. 2009).

Table 1: Main benefits to adapt cloud computing

Technical	Enterprise	Patients	Environmental
Speed Scalability Alignment	Costs saving Management effort	Timesaving Updated medicine Advanced treatment	Power consumption Carbon emission Land using

There are also four main benefits to adapt CC. These are technical, enterprise, and environmental benefits, see Table 1. At the same time, there are reasons to avoid CC. These are security data location and privacy, Internet dependency, performance, and latency, availability and service levels and difficulty in migrating current enterprise applications (Smyth 2009, Crowe Horwath LLP 2012).

What are the benefits in using CC in healthcare? Denjoy (2012) explained these benefits as cutting cost and high efficiency in which cloud computing can reduce comprehensive costs, raise access, and provide scalability and flexibility for healthcare services. Also, health records as a service provide easy and fast access to information for both patients and healthcare teams, and the ability to fit out end-to-end management issues, is enabling patients to bear responsibility for their health. In addition, accelerating business intelligence and data visualization in which digitizing patient information produces useful knowledge, creates the baseline for evolution of new efficiencies and equipped better visions to boost more informed decision making processes. Finally, cloud allows enhanced security safeguards comparing to hospital IT services (Denjoy 2012).

There are also technical and non-technical challenges associated with using CC in healthcare. Availability, data management, scalability, and privacy are examples of technical challenges. Examples of non-technical challenges are usability, end users experiences, data ownership, privacy, trust, legislation, standards and organizational change (AbuKhoussa et al. 2012). The support of e-services can provide a more process-oriented approach and a collaborated support to communicate with each other (Andreasson and Winge 2009).

5. Stakeholder views of cloud computing on information sharing and communication

Although a patient is a major stakeholder, in this paper we focus on the professional stakeholders that are involved in the development of patient-centred healthcare. Thus, we are interested in CC suppliers, National developers, Regional developers, Local developers and Medical staffs as demonstrated in Figure 2 and what their views of cloud computing on information sharing and communication are.

5.1 CC suppliers

When the suppliers were asked about the main reasons behind adopting CC, their answer was that adopting CC is positive due to cost efficiency, flexibility and time to market. Regarding the issues in the deployment of CC, it can be addressed from different levels i.e., from IaaS, PaaS and SaaS depending on how you look at it. However, the effects of CC on Information sharing in patient-centred healthcare are fast information access to large data volume, fast time to market and patient capability to participate and access from home and everywhere. On the other hand, improvement of information sharing and communication in a patient-centred healthcare is dependent on software solutions for connecting different information sources and easy to access and share.

According to the CC suppliers, the support that CC provides to healthcare decision makers and professionals in patient-centred healthcare is coming from the fact that the data is accessible to decision makers and professionals in healthcare system. While the limiting factors for using CC are legislation for handling sensitive data and the old structure.

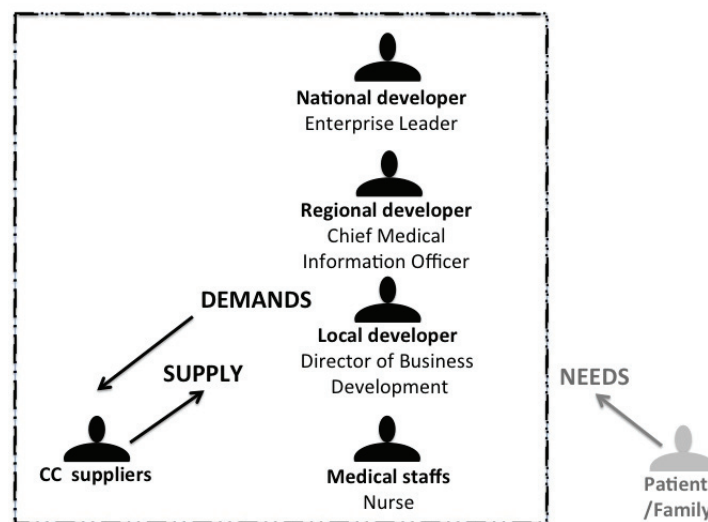


Figure 2: Professional stakeholders in development of patient-centred healthcare

5.2 Healthcare developers

Regarding adopting CC, the regional representative focused on security aspects and the difficulty of the transition to go from the old system to a new one. The local representative was positive about adopting CC for its flexibility, safety and low cost, while the national level representative added scalability factor. Concerning deployment of CC, the regional representative explained the possibility to have much higher quality, knowledge collaboration, avoiding the geographical location as limitation of information and limit waste of resources. On the other hand, the local representative suggested relative interaction with different types of organizations and actors so that it is a safer and more dynamic technique. However, you can still steer the information, which is a positive point. In this context, the national representative focused on availability of information sharing with all stakeholders i.e.: 1) Activity and service level, 2) Process level and 3) Technology level.

With regards to improving information sharing and communication in a patient-centred healthcare, the regional representative mentioned that CC is already sharable and reachable. While the national representative focused on involving patients in the care process and its information management.

As with the support CC can provide to healthcare decision makers, the regional representative said that the support comes from providing wide information about the patient, which facilitates making a good decision. Where the local representative declared that they don't have a good decision-making that pays attention to the patient and relatives or other actors outside the healthcare system. They have lack of information that is

why they do not have CC in healthcare process yet. Also, The national representative answered that the support comes from easily available information, which helps them to create new ways for management.

Concerning the limiting factors for using CC, the regional representative centred on security issues and the local representative centred on the lack of knowledge and understanding as a limiting factor.

When it comes to the Involvement of everyone affected by a decision in the decision making process, the local representative answered that they are not doing that and the patient is not involved at all in this process and only the organization is involved while the ideal picture is to have equal impact for the patient, family or friends and professionals.

When asked to what extent do they and their sub staffs focus on technological devices to promote a patient-centred healthcare process where patients become more of a consumer of care, The local representative declared that now they are far from that because of having so much old technique.

5.3 Medical staffs

When the medical staffs representative was asked about adopting CC the answer was that they had no idea about it. Instead, they talk about information technology (IT) in relation to healthcare, medical law and Social Services. They use IT to document the meaning of these laws.

The representative maintained that whereas safety is important for patients, getting information quickly is important for employees. Also, the main effect of IT is to maintain security. The nurses and doctors have their own information and documentation; they cannot access each other's information. It is also important to let patients feel confident about the privacy of the information about them. The representative expressed that they are in the "Stone Age" when it comes to communication and collaboration. Everything concerning the patient may not transfer and they have to read about the patients before visiting them. Moreover, the other representative mentioned lack of security and that they are "far from the patient process" as only nurses can access the journal. Furthermore, they have no system that can communicate with each other. Each manager is responsible for his/her own information without sharing with others.

Table 2: Summary of the stakeholders views

Stakeholder Interview question	CC suppliers	Healthcare developers National, Regional, Local level	Medical staffs
Main reasons to adapt CC	- Cost efficiency - Flexibility - Time to market	N: Scalability. R: Security aspects and the difficulty to go from the old system to a new one. L: Flexibility, safety, low cost.	- Used IT (instead of CC) in relation to health, medical law, Social Services Act.
Deployment of CC	- Can be addressed from IaaS, PaaS and SaaS	N: Security and legal requirements. R: Legal and security aspects. L: flexibility, safety, and low cost.	- Patient safety is important. - Employees getting information quickly is important.
Affect of CC on information sharing	- Fast information access to large data volume - Fast time to market - Patient capability to access from everywhere	N: Information sharing with all stakeholders. R: Higher quality, knowledge collaboration. L: Safer and more dynamic technique.	- Nurses and doctors cannot access each other's information. Privacy
Improvement of CC on information sharing and communication	- Software solutions for connecting different information sources.	N: Involving patients in the care process and its information management. R: CC is already shareable and reachable.	- In the "Stone Age" regarding communication and collaboration

Stakeholder Interview question	CC suppliers	Healthcare developers National, Regional, Local level	Medical staffs
Support given by CC to healthcare decision makers and professionals	- Data is accessible to decision makers and professionals in healthcare system.	N: Easily available information to create new ways for management. R: Wide information about the patient. L: No good decision-making.	
Limiting factors for using CC	- Legislation for handling sensitive data and the old structure.	N: Difficulties of transformation from traditional IT perspective to CC taking into consideration the legal aspect. R: Security issues. L: Lack of knowledge and understanding as a limiting factor.	Lack of security.
Involvement of everyone in the decision making process		L: Only the organization is involved, the patient is not.	- Far from patient process. - Nurses have no system that can communicate with each other.
Focus on technological devices		L: Far from that.	- No information sharing.

6. Discussion

Patient needs for better information sharing and communication in healthcare drives public demand for developing an effective healthcare system. In order to contribute to patient-centred healthcare the aim was create better understanding of how professional healthcare stakeholders view the impact of cloud computing on information sharing and communication.

CC suppliers presented an ideal view of CC. National developers had a clear idea about suppliers' ideal view of CC for cost reduction. On the other hand they also considered legal and security aspects about patient information. Regional developers had a good idea about CC. They too considered legal and security aspects about patient information and migration difficulties. Local developers had less idea of CC. Migration difficulties, legal and security aspects were not apparent, but flexibility and low cost was. Medical staffs did not have any idea of CC.

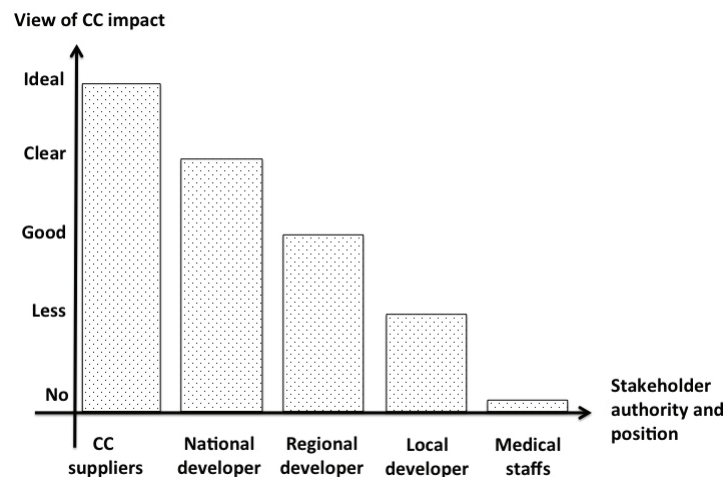


Figure 3: Stakeholders' views on cloud computing impact

CC suppliers demonstrated a clear vision for future information sharing and communication through CC. National developers had a good idea about the vision of all stakeholders sharing information. Whether as regional developers demonstrated an understanding of the vision for healthcare staff collaboration and for involving patients in their care. Local developers and medical staffs did not understand how CC could improve

their situation. Medical staff viewed themselves as being in the “Stone Age” when it comes to communication and collaboration through information technology because nurses and doctors cannot access each other’s information.

Discussing the views we found a split understanding among stakeholders. They are separated in different islands with no or very little communication and thus, different goals and ambitions for healthcare. This goes with patient experiences of healthcare presented in chapter 3.1. When the patient and family members are faced with a lack of information sharing and communication it forces relatives to act as information “brokers” to healthcare. Thus, patient’s needs for respect, security and a fully responsible healthcare are not fulfilled. The wrong is not in the technique as there are many good opportunities for saving money and becoming more effective. Rather, in order to reach shared understanding and a common goal for patient-centred healthcare medical staffs, patient and family need to be included in the development. In this sense, the situation is not good or bad and nobody is right or wrong. Rather, there are problems to be solved by healthcare developers who should balance patient needs for better information sharing and communication in healthcare and public demand for patient-centred healthcare with the cloud supplier capabilities.

7. Conclusion

The conclusion is that stakeholders’ views of CC on information sharing and communication in healthcare vary from an ideal, clear view to no view at all. Their positive response and reaction to the impact of CC is increasingly proportionate to authority and position. The security issue is of vital concern to the developers, whether as medical staffs view the patient privacy issue as an important factor that make them hesitate and refrain the impact of CC. Stakeholders are separated in islands with different goals and ambitions for healthcare and no or very little information sharing and communication between them. Thus, there is a split view among stakeholders involved in the development of patient-centred healthcare.

A future study could be made for exploring patients’ views of cloud computing impact on information sharing and communication in Swedish healthcare.

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Applying Quality Function Deployment Method for Business Architecture Alignment

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Abstract: Strategic alignment is an important issue for business architecture. The alignment concept may have many facets, but this paper mainly focuses on such aspects of an enterprise as behaviour and resources. Stakeholder concerns and customer values must define the right priorities and goals for the elements of value configuration, capabilities and resources. The right projects must be launched to develop and improve key business architecture elements. This paper suggests the model-oriented method for business architecture alignment, which uses proven matrix-based Quality Function Deployment (QFD) methodology for analysis, decision making and communication. This method can complement standard diagramming enterprise architecture methods. Although QFD was initially created for product design, it has many applications in strategy deployment. But in spite of a longstanding history, elements chosen for “strategic” QFD vary and are poorly aligned with existing business architecture concepts. In order to clarify the link between the suggested QFD method and business architecture elements, a meta-model is suggested, which specifies the contents of the matrices. The suggested meta-model is based on the existing reference ontologies and meta-models for strategic management. This ontological foundation supports knowledge sharing and applicability of the business architecture alignment method. Tool support (EAM-tool plugin) and method applications are also covered in this paper.

Keywords: business architecture, strategic alignment, coherence, strategy modeling, QFD

1. Introduction

The necessity to have meaningful links between strategy and enterprise architecture in order to improve business performance has long been acknowledged. Yet recent evidence indicates a lack of business strategy insights in the enterprise architecture domain. At a 2011 enterprise architecture webinar, 176 practitioners were asked whether they understood their business strategy. Among them, 1% stated they had no business strategy, 6% did not know the state of their business strategy, 16% stated the business strategy was not clearly communicated, 44% stated the business strategy was not understood or supported, and only 33% stated their business strategy was well understood (Burton, Allega, 2011). However, even a good understanding of business strategy is not sufficient. Everyday operations, transformation efforts, performance measures and personnel behaviour at all levels must be aligned with strategy.

The problem of ‘alignment’ is not new (Labovitz, Rosansky, 1997), as shown in the work of many researchers across a variety of domains. The need for alignment arises when distinct disciplines influence each other and their coordination is required to achieve certain goals. The concept of alignment was popularised by Henderson and Venkatraman (1993), who studied strategic alignment in information systems. Their 2x2 framework on business/IT alignment became a fundamental reference for a substantial body of related research. Kaplan and Norton’s Balanced Scorecard and Strategy Maps (Kaplan and Norton, 2004) has continued this trend. Similarly, in a study of visionary and long-lasting companies, Collins and Porras (2000) found that processes, practices and behaviours were both mutually supporting and aligned. Research also has shown that the alignment of strategic priorities between managerial domains (e.g., general management and manufacturing management) enhances performance. Joshi et al. (2003, p. 353) summarize these findings as follows: “Alignment of [strategic] priorities is presumed to contribute to enhanced organizational performance, just as misalignment is expected to undermine performance.”

Although strategic alignment covers many areas, the focus of the current paper is on the behaviour (or activity) view of business architecture. The main questions are:

- How to make enterprise activities strategy-focused
- How to build strategy-oriented transformation and improvement plans
- How to align a performance measurement system

- How to translate business model concepts into everyday business operations

These questions were inspired by the paper of de Bruin and Rosemann (2006) on strategic alignment of business process management. The authors identified the set of so-called capability areas, which are essential for the operational achievement and measurement of the strategic alignment of BPM. These include having a process improvement plan, linking strategy and process capability, maintaining an enterprise process architecture, utilising effective process measures and consideration of process customers and stakeholders.

A business architecture (and EA in general) alignment method needs one important feature: since architectural work is model-based, the method requires quite a high degree of formality. Business alignment methods used in strategic management are traditionally natural language-based, usually accompanied by schematic representations. In such a form, establishing meaningful, traceable links between elements, as expressed by enterprise models and enterprise architecture, is unattainable due to the ambiguity of the formalisms. Therefore, business strategy formulations need to be formalized, thus transforming their notions and rules from natural language to a process-able form. The degree of formalization may vary according to the purpose of use, from manual to fully automated.

So the aim of the current paper is to suggest a model-oriented method for business architecture alignment, which solves the following tasks:

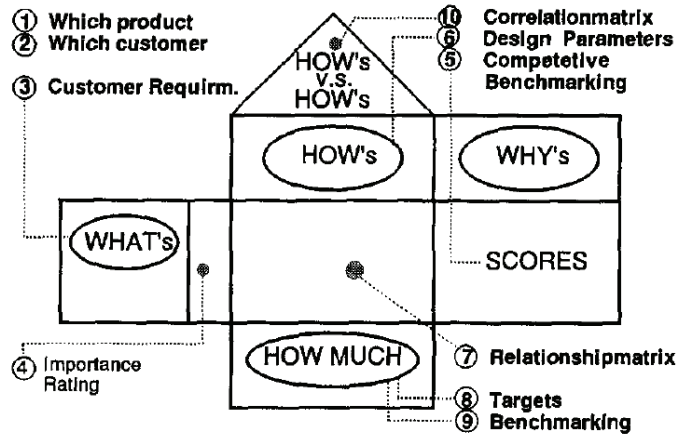
- Align business architecture with stakeholder's concerns and customer value proposition,
- Prioritize firm's behaviour (or activity) at different levels, particularly value configurations and activities, business capabilities and processes,
- Align performance measurement system (process measures and goals must be aligned with business and corporate level balanced scorecards),
- Identify and prioritize development projects for strategic programs and improvement plans (portfolio of development projects and programs).

There are methods, which successfully solve these tasks separately (as will be presented in the related work section), but there is a lack of architectural methods for integrating these tasks. The Quality Function Deployment (QFD) method is a good possible solution. This is an old proven method for product design, which is also adapted for other areas, including strategic management. QFD provides a system of design matrices, which combine clear, visual representation of relationships with simple calculations (quantitative) to support decision making.

The paper is structured as follows: Section 2 describes QFD and its role in strategic management; Section 3 suggests the alignment method (the system of matrices and step by step process); Section 4 provides the foundation meta-model behind the system of matrices; Section 5 gives a brief description of the IT support (ORG-Master); Section 6 describes application of the approach; Section 7 presents related work and Section 8 concludes the paper.

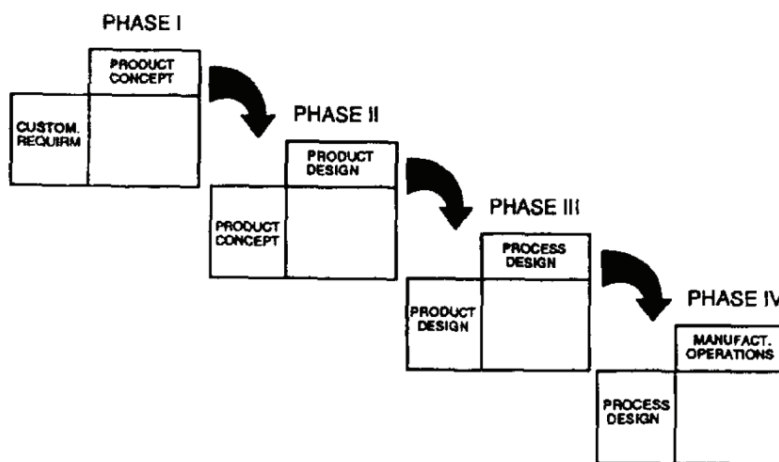
2. QFD and its role in strategic management

QFD can be defined as "a system for designing a product or service based on customer demands and involving all members of the producer or supplier organization" (King, 1989). It enables organizations to be proactive rather than reactive in product design. Through the structured QFD process, the design team is forced to consider what the customer wants, then identify possible ways of achieving that end rather than concentrating on technical aspects of design. There are four phases in a QFD exercise: design, detail, process and production (Guinta, 1993). These phases help in channelling design teams towards customer satisfaction. "Each phase has a matrix consisting of a vertical column of *whats* and a horizontal row of *hows*. *Whats* are customer requirements; *hows* are ways of achieving them. At each stage, the *hows* that are most important, require new technology, or are of high risk to the organization, are carried to the next phase" (Guinta, 1993), see figure 1, a. This matrix is also called "The House of Quality" (Hauser, Clausing, 1988). Through the QFD process, customers' requirements can be translated to critical design characteristics, component characteristics, process control characteristics and operational instructions (figure 1, b). The result is a better design, shorter product development cycle, better product quality, and lower cost.



Source: Govers, 1996

a. Basic QFD structure or "The House of Quality"



Source: Govers, 1996

b. Cascade of QFD charts

Figure 1: QFD basic ideas

When QFD is used in strategic planning we have a different perception of these concepts. The customers' requirements can be interpreted as the corporate or business (top management's) requirements. They are internal customers rather than external customers. The team members in QFD exercises should be mostly top management and all other functional level managers in the strategy formulation stage, and implementation engineers for action plan formulation. The decision attributes are sometimes strategic objectives or tactical policies rather than specific target values of product design variables. It is, therefore, more difficult to quantify and develop a mathematical model for evaluation. The first to document the application of QFD to the softer issues of strategic decision making was Sullivan (1988). He proposed a method for policy management using QFD as a way to translate company objectives into the means to achieve these objectives, rather than the conventional approach in which, he argues, upper management consider only results and leave the methods employed to the ingenuity of middle management and engineers.

Table 1 and 2 summarize some strategic QFD approaches; for a more extended overview see Hunt, Xavier (2003).

Table 1: Single matrix strategic QFD applications

Reference	Whats	Hows
Sullivan (1988)	Means	Objectives
Uber, Gigler, 1994	Organization goals	Corporate programs

Table 2: Multiple QFD matrix approaches to strategic decision making

Reference	1 st level Whats	1 st level Hows / 2 nd level Whats	2 st level Hows/ 3 nd level Whats	3 st level Hows/ 4 nd level Whats	4 st level Hows
Day (1991)	Company vision	Business objectives	Strategies	Action plans	Responsibilities
Crowe and Cheng (1995)	Business strategies	Functional strategies	Manufacturing strategies	Action plans	Detailed tasks

3. The business architecture alignment method

The suggested method applies the multiple QFD matrices approach to the business architecture alignment and augments existing diagram-based modeling methods with decision making capabilities. The alignment process varies depending on the level of business model change (radical, evolutionary, no change). The term ‘business model’ is used in accordance with (Osterwalder, 2004).

Alignment process is structured with 3 levels (Table 3):

Level 1. *Business model innovation through resource development* implies a radical change in the business model. Such a change *typically* requires serious modifications to resources and corresponding investment projects (resource development). This level *typically* correlates with long range planning. The main alignment objects at this level are: customer values and other stakeholder concerns, the products and services portfolio, the key firm’s activities, the key resources and corresponding development projects.

Level 2. *Business model evolution through capability development* implies incremental changes in the business model, which are *mostly* associated with the growing key capabilities. This level *typically* correlates with midterm planning. The main alignment objects at this level are: customer values and other stakeholder concerns, goals addressing customer value proposition, the firm’s capabilities together with the corresponding development goals, measures and projects.

Level 3. *Operations excellence through process development and improvement* implies making the current business model as efficient as possible. This is typically accomplished through (business) process development and improvement projects. This level *typically* correlates with midterm planning. The main alignment objects at this level are: customer values and other stakeholder concerns, value activities and processes and also the corresponding goals, measures and projects.

Table 3: Different levels of business model change

Level	Alignment methods	Development means
1. Business model innovation through the resource development	Basic methods (especially for visualization): Business Model Canvas, Capability heat maps, Strategy maps, Balanced Scorecard etc. Supporting analytical decision making methods, which help to prioritize and choose elements for basic methods: Strategic Quality Function Deployment etc.	Resource development projects Programs (capability development, product launch, market growth)
2. Business model evolution through the capability development		Capability development projects
3. Operations excellence through the process development and improvements		Process development and improvements projects

Every level of business model change has its own management objects. The suggested business architecture alignment process uses the system of QFD matrices (“Houses of Quality”). Every matrix links elements of business architecture of two types. One type plays a “What” role and the other type a “How” role. Figure 2 simplified example matrix helps to translate Customer value proposition objectives into Primary capability objectives and prioritize them.

Legend: ● - Strong (9) ○ - Medium (3) △ - Weak (1)	Primary capability objectives Weight / Importance	Procurement					Production			Delivery			...		
		Lower cost of ownership	Just-in-time delivery	High-quality supply	New ideas from suppliers	...	Reduce defect rates	Lower cost of production	Reduce cycle and process time	Improve fixed asset utilization	...	Deliver responsively to customers	Lower cost-to-serve	Delivery with no defects	...
Customer value proposition objectives															
Perfect Quality	0,3		△	●	△	●							○		
Speedy, Timely Purchase	0,2		○		△			●			●				
Excellent Selection	0,1			○	△										
Competitive Prices	0,2	●			△		●		○				○		
Low Total Cost	0,2	△			△	△	△						○		
Importance weight		2,0	0,9	3,0	1,0	2,9	2,0	1,8	0,6		1,8	1,2	0,9		
Relative weight (%)		11	5	17	6	16	11	10	3		10	7	5		

Figure 2: Example QFD matrix for business architecture alignment

Table 4 summarizes the system of QFD matrices. All the concepts in this table are integrated within the meta-model (see section 4). Figure 2 matrix corresponds to the bold-border cells.

Table 4: Multiple QFD matrix contents for business architecture alignment ('meta QFD matrix')

Level	1 st level Whats	1 st level Hows/ 2 nd level Whats	2 st level Hows/ 3 rd level Whats	3 st level Hows/ 4 nd level Whats	4 st level Hows
1. Business model innovation through the resource development	Customer values and other stakeholder concerns	Products/ Services	Activities	Resources	Resource development projects Programs
2. Business model evolution through the capability development		Customer value proposition objectives	Primary capability objectives	Support capability objectives	Capability development projects
			Primary capabilities	Support capabilities	
3. Operations excellence through the process development and improvement		Objectives from Customer and Financial perspective	Primary process objectives (Internal perspective)	Support process objectives (Growth perspective)	Process development and improvement projects
			Primary processes	Support processes	

The business architecture alignment process for the 2-nd level of business model change (Business model evolution through capability development)

Every step corresponds to a specific matrix from Table 4.

1. House of Quality #2.1: Aligning customer values and other stakeholder concerns with customer value proposition objectives

HoQ#2.1 helps to create a complete list of customer value proposition objectives, identify the most important and critical (importance + gap) objectives. These important and critical objectives may then be represented on a Strategy map (Kaplan and Norton, 2004).

Customer values and other stakeholder concerns are inputs to HoQ#2.1 and are gathered and prioritized through surveys, customer complaints, interviews, focus groups, etc.; they represent the WHATs in HoQ#2.1. Customer value proposition objectives can be either an input to HoQ#2.1 (if we use it just as a decision support tool), or can be created within the HoQ#2.1 workshop (if we use this matrix as a design tool). Typically it will be something in the middle.

2. House of Quality #2.2: Prioritizing primary capabilities based on the customer value proposition objectives

The prioritized customer value proposition objectives generated in HoQ#2.1 (for different strategic business units) are the inputs to HoQ#2.2 (the WHATs). The capability map (a hierarchy of capabilities) is another input for this step.

3. House of Quality #2.3: Prioritizing primary capability objectives based on the customer value proposition objectives

HoQ#2.3 is represented on the figure 2. Objectives with high weight/importance may be represented on a Strategy map (Kaplan and Norton, 2004), they also require measures.

4. House of Quality #2.4: Prioritizing support capabilities based on the priorities of primary capabilities

The prioritized primary capabilities generated in HoQ#2.2 (for different strategic business units) are the inputs to HoQ#2.4 (the WHATs). The capability map (a hierarchy of capabilities) is another input for this step.

5. House of Quality #2.5: Prioritizing support capability objectives based on primary capability objectives

These important and critical objectives may be represented on a Strategy map (Kaplan and Norton, 2004), they also require measures.

6. House of Quality #2.6: Identifying and prioritizing capability development projects based on capability objectives

The alignment process presented above and Table 4 are associated to business system. They can be used in order to design and deploy business strategy and policy. The similar approach can be used at the corporate (corporate strategy and policy) and functional (functional strategy and policy) levels. This multi-layered approach rests on the idea of pattern-based enterprise functional decomposition (Kudryavtsev, Grigoriev, 2011).

4. The meta-model behind the system of matrices

In order to define the concepts in the suggested method (Table 4 and the alignment process) and specify the structure of business architecture model we developed the meta-model. Such a meta-model can also improve teaching and training of business analysts and architects (Gavrilova, 2010). This meta-model (Figure 3) is based on the following reference meta-models and ontologies (Osterwalder, 2004; Azevedo et al, 2011; Meertens et al, 2012; Giannoulis et al, 2012; Roelens et al, 2013).

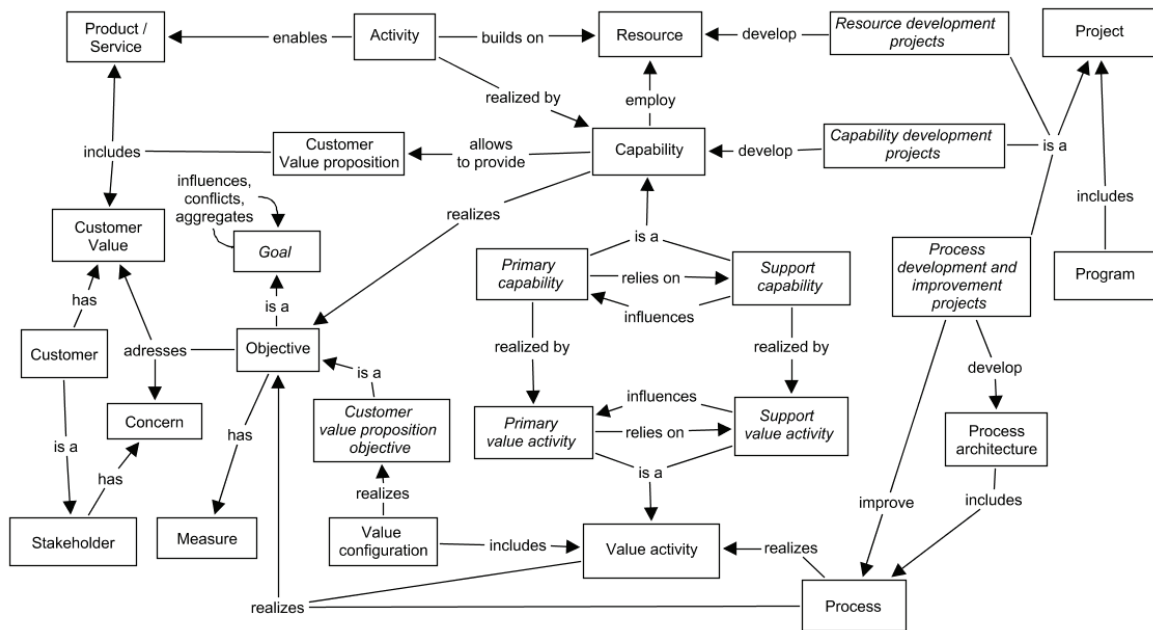


Figure 3: Business architecture alignment meta-model

The definitions of core elements of the metamodel:

Objective – a measurable goal that is used for building balanced scorecards (Giannoulis et al, 2012), where *Goal* is an end state that a stakeholder intends to achieve (Azevedo et al, 2011).

Capability – an ability to execute a repeatable pattern of actions. A firm has to dispose of a number of capabilities to be able to offer its *value proposition*. Capabilities are based on a set of Resources (Osterwalder, 2004). Similar to the *Capability offer* in (OMG, 2012).

Value proposition – Offered set of products and/or services that provide value to the customers and other partners, and competes in the overall value network (Roelens et al, 2013).

Resource – human skills, tangible means, and intangible means under control of an organization by being bought or licensed, which are combined within the value chain of activities (Roelens et al, 2013). They are the source of the *capabilities* a firm needs in order to provide its *value propositions* (Osterwalder, 2004)

Value configuration – an arrangement of one or several *activity(ies)* in order to provide a *value proposition* (Osterwalder, 2004; Giannoulis et al, 2012).

5. The IT support (ORG-Master)

The suggested method is partially supported by the enterprise architecture modeling tool ORG-Master (Grigoriev, Kudryavtsev, 2013). It supports domain-specific modeling concept (Koznov, 2011) and provides visual modeling tools as plug-ins. Org-Master includes the following modules: Ontology-based enterprise model editor, Reporting and query module, Diagram editor, Integration wizard, Modeling process (method engineering) wizard. Classifications and matrices are the main knowledge representation mechanisms in ORG-Master. Classification/hierarchical list - the representation format for entities, hierarchical relationships between them and values for the properties of entities. Matrix - the representation format for relationships between entities from classifiers. Advanced matrix editing capabilities of ORG-Master suit QFD-based method very well. Partial support for the business architecture alignment method implies qualitative work with matrices. The special QFD-plugin supports quantitative part of the method. This plugin exists for previous version of the ORG-Master and is being developed for the new one.

6. The application of the approach

The suggested method and meta-model are used by Business Engineering Group company for business alignment, business model management, strategic business process management and capability management

projects. This methodology or its parts helped to develop and deploy the corporate strategies for 5 companies, business strategies for 7 companies and functional strategies for 4 companies in Russia.

7. Related work

There are many works related to strategic alignment. With respect to this paper, we can identify the following categories: alignment methods for business behaviour / activities, diagram-based languages for strategic alignment, integrating meta-models and QFD applications in the architecture development process. Brief overview and limitations of these categories are represented below.

7.1 Alignment methods for business behaviour / activities

There are papers, which set links between goals / objectives and business processes (Kavakli, Loucopoulos, 1999; De Bruin, Rosemann, 2006; Burlton, 2010), goals / objectives and capabilities (Hafeez et al, 2002), goals / objectives and development projects (Meskendahl, 2010). This category provides interesting partial solutions – some papers from this group combine a high level of formalization (which is sufficient for modeling) with step-by-step methods, but they must be integrated somehow in order to satisfy the requirements from the introduction. Some authors from this category (e.g. Burlton, 2010) use similar matrices in their work (e.g. The Process / Stakeholder Value Matrix), but their use is much more limited. The current method divides value activities (which are realized by processes) into two categories – primary and support. Separate matrices are then used for them. It therefore provides more meaningful (direct) relationships in matrices.

Diagram-based languages for strategic alignment

Diagram-based languages for strategic alignment such as Archimate with its extensions (Meertens et al, 2012) and VDML (OMG, 2012) provide a good bridge between business model, strategy and operational activities. Their meta-models stimulate better understanding, while their viewpoints are useful for communications and visualization. But their diagrams are less convenient for the relationship analysis and prioritization operations, such as the strategic importance calculations, choice and prioritization of capabilities. It is especially important when libraries of reusable elements are used. So the suggested QFD matrix-based methods can augment diagrams and add discipline to the requirements decomposition process. However, these diagram-based languages require methods.

Integrating meta-models

Integrating meta-models (Meertens et al, 2012; Giannoulis et al, 2012; Roelens et al, 2013) are extremely helpful for reference, standardization and automation purposes. We used them for business architecture alignment meta-model development.

QFD in the architecture development process

There is also an example of QFD application for enterprise architecture management (Gammoh et al, 2010). But it provides insufficient description of business architecture components, which are used in QFD matrices, and is tightly linked to enterprise business architecture (Whittle, Myrick, 2004). Mike Clargo (2002) also actively uses QFD for systemic management. But his method is not aligned with such concepts as ‘capabilities’ and ‘business model’, besides it does not provide enough formalization (such as meta-model etc).

8. Conclusion

Strategic alignment is a critical success factor of any organization. This concept can be decomposed into a set of requirements: stakeholder concerns and customer values must be aligned with enterprise goals and value proposition; business model innovation, evolution and excellence must be driven by the right portfolio of development and improvement projects; firm’s capabilities and processes must be prioritized; low level goals and measures must be aligned with higher level ones; business capabilities and processes must have well grounded goals and measures.

The paper suggests the model-oriented method, which helps to achieve such an alignment. It takes the proven QFD-method from quality management and integrates it into the structured business architecture management methodology. The method provides a system of matrices and can be used together with

standard graphical EA languages either to support decision making, or to cope with the complexity of big diagrams. The suggested method addresses alignment during business model innovation, evolution and while trying to achieve operational excellence within the same business model. It can be applied at the level of corporation, business unit or at functional level.

In addition to the method, the paper provides the meta-model, which specify the structure of business architecture models – object of alignment. On one hand this meta-model helps to clarify contents and meaning of QFD matrices, on the other hand, it can be used as a reference tool, since it is aligned with many standard languages and meta-models (e.g. unified business strategy meta-model (UBSMM)).

The IT support and applications of the method are also covered in the paper, since they have been successfully validated in real-life projects.

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Critical Success Factors for Implementing ERP in the Curriculum of University Business Education: A Case Study

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Abstract: Higher education, especially in business, could potentially benefit from implementing Enterprise Resource Planning Systems (ERP) in the classroom. However, implementing ERP systems in teaching has turned out to be a challenge to some universities. The research question is: Which major Critical Success Factors (CSF) for implementing ERP in business match major success factors stemming from a case study about implementing ERP in the curriculum of university courses? Ten top CSFs from the business context are selected as the major part of the theoretical framework (Finney and Corbett, 2007). A case study method regarding a major vendor of ERP and its university network is applied with some elements of action research. The researcher has been given the opportunity to access online information as well as participate in meetings, online and face to face, and conferences since 2007. Multiple sources of evidence are used, including observations, meeting notes and downloaded documents from public as well as partner websites. The sample is based on the opportunity to get access to the software corporation, innovative professors and business partners, primarily in Western Europe and the USA. Data has been coded and analysed in the software NVivo. The study identifies the following major Critical Success Factors for implementing ERP in a university education context, in order of coding density: (I) champions, (II) networking (like user groups, seminars and conferences) (III) curriculum development as well as (IV) learn and innovate. Champions in the university context (I) can be related to the business CSF (10) project champion. Networking (II) in the university context can be related to (5) project team: the best and brightest as well as (4) training and job redesign. Curriculum development (III) could be related to (4) training and job redesign. Learn and innovate (IV) in universities can be related to the business CSFs (2) change management and (3) Business Process Re-engineering (BPR). Five out of ten business CSFs can be clearly related to the case study regarding successful implementation in university curricula. The missing business CSFs in the case study are (1) top management commitment and support, (6) implementation strategy and timeframe, (7) consultant selection and relationship, (8) visioning and planning as well as (9) balanced team. Findings cannot be generalised statistically. However the findings/themes can be generalised thematically. The main contribution of the research concerns a matching between CSFs in business and CSFs for implementing ERP in university business curricula.

Keywords: implementation, ERP, higher education, business education, critical success factors

1. Introduction

Enterprise Resource Planning (ERP) Systems *integrate* functional areas of organisations as well as supporting processes (Davenport, 1998; Kumar and Hillegersberg, 2000). ERP is perceived as having a pivotal role in enterprise management (Shaul and Tauber, 2013). The software part of the market is a multibillion dollar industry (Chellappa and Saraf, 2010). ERP is used in a wide range of industry segments (Chellappa and Saraf, 2010). Olhager and Selldin (2003) performed a survey in the manufacturing industry showing that 74.6 percent of the firms had installed ERP software. 27.5 percent of the respondents answered that estimated ERP system life is 5 to 7 years. 22.8 answered 7 to 10 years and 24.8 percent specified over 10 years. ERP Systems are thus long-term investments for companies and of strategic importance.

There is ample research on Critical Success Factors (CSFs) for implementing ERP in business. Shaul and Tauber (2013) perform a review of 341 articles, which indicates the scientific impact of the area.

According to some sources, implementation of ERP systems in the curriculum of university courses is still in early stages in many cases. Becerra-Fernandez, Murphy and Simon (2000) state that "There are few academics that have intimate knowledge of the strengths and weaknesses of ERP". Magnusson et al, (2009) assert that implementation is still limited. Hawking et al. (2008) as well as Zornada and Velkavrh (2005) state that universities struggle in finding out how to use ERP in their curriculum. In the Swedish national database "Studera.nu", only 9 courses and programmes are found if you search for the keyword "affärssystem" (ERP) out of 1553 courses listed for "Business, marketing and administration" (Studera.nu, 2013). Antonucci et al (2004) report that implementation success varies in universities.

There are pioneers such as the Sante Academy in Gothenburg (Sante Academy, 2014), coordinating a Swedish network of universities as well as providing software hosting and curriculum material for members paying an

annual fee. There is an ERP studio in Linköping University (Linköping University, 2013). HEC Montreal is widely known for its ERPsim suite of simulation (HEC Montréal, 2014).

The paper's research question is: Which major Critical Success Factors (CSF) for implementing ERP in business match major success factors stemming from a case study about implementing ERP in the curriculum of university courses?

Scientific literature is used to compare to the case study.

2. Theoretical framework and previous research

In the area of IT implementation in organizations there is a wealth of scientific publications. Ramamurthy and Premkumar (1995) investigate organizational factors influencing the implementation of Electronic Data Interchange (EDI). The factors include innovation adoption factors from Rogers (1995) as well as top management support, task scope, IT maturity, organizational learning process and suitable project managers/champions. Cooper and Zmud (1990) wrote an influential article. Lai and Mahapatra (1997) is a meta-analysis of scientific articles. Wildemuth (1992) concerns the adoption of intellectual technologies such as software. Barnett and Siegel (1988) concerns client/server technology adoption. Chengalur-Smith and Duchessi (1999) as well as Morris and Venkatesh (2010) focus on ERP.

Critical Success Factors for implementing ERP in business has been studied widely. Shau and Tauber (2013) review 341 articles to develop a comprehensive taxonomy of CSFs in the area of ERP. The aim of this paper is not to perform a systematic critical literature review. Instead, an article is selected to identify top CSFs (Finney and Corbett, 2007). In Dezdar and Sulaiman (2009) CSFs in Finney and Corbett (2007) are related to Nah et al. (2001) and Somers and Nelson (2004). The rankings of factors vary somewhat.

In this paper, the *top ten CSFs* in Finney and Corbett (2007) are used to analyse research data. The references used by Finney and Corbett (2007) are not included. For the top two factors (1 and 2) 25 references are mentioned in Finney and Corbett (2007).

(1) *Top management commitment and support* is at the top of the list. This includes the need for management to anticipate any challenges that might be encountered in the project. Also, there is a need for managers who are involved in strategic planning but also are technically orientated.

(2) *Change management* includes that a change management program is part of the project. User acceptance of the project and positive employee attitudes need to be considered. Education of users can be part of this domain. Opinion leaders need to be identified and committed. Negotiations might be needed. IT should be seen as support, not be the primary focus of the project.

(3) *Business Process Re-engineering (BPR) and software configuration* are essential to succeed in business implementation of ERP. BPR results in a complete description of how a business will operate after an ERP package is in use. This includes matching goals/requirements and implemented system. Business process modeling might be performed as well as using different vendor development tools. ERP interface issues as well as the need to plan technology infrastructure and data requirements are part of this factor.

(4) *Training and job redesign* includes that it is necessary to consider changed job descriptions resulting from the project. Training can include project team training and user training as well as hands-on IT skills. Planning of training facilities is another vital consideration as well as how staff may need to be restructured and the need for modifications of compensation plans.

(5) *Project team: the best and brightest* needs to be considered. People with a proven reputation should participate on a full-time basis. The team needs to possess the necessary skills at a detailed level when conducting project planning. Team members need training in many cases.

(6) *Implementation strategy and timeframe* includes to divide up the project in phases. A key decision concerns whether implementation should be centralized versus decentralized. Also, multi-site issues might need consideration.

(7) *Consultant selection and relationship* is a factor. ERP consultants need in many cases to be part of the implementation team. In the relationship between customer and consultant organization, sufficient knowledge transfer is needed to lower the risks of dependency on the vendor/consultant.

(8) *Visioning and planning* includes that a business vision to the organization is formulated. The vision is related to clear goals and objectives as well as a clear link between business goals and IS strategy. The goals

should also be measurable. Planning should include risk and quality management as well as be related to project tasks. Learning from internal and external best practices for ERP implementation is essential.

(9) *Balanced team* means that the implementation team spans the organization's different functions. Furthermore, a balance of business and IT skills is favouring success.

(10) A *project champion* is an individual critical to ERP projects with strong leadership skills as well as relevant business, technical and personal managerial abilities.

3. Method

The case study method is employed, to some extent with a time perspective as well as using multiple sources of evidence (Yin, 1989: 23). The case study approach can lead to new knowledge (Eisenhardt, 1989).

Akkermans and van Helden (2002) employ in a case study a similar approach to this paper by using a ranked list of CSFs published by Somers and Nelson (2001)

The project also can be related to the concept of action research, similar to case studies, where the researcher by actively participating in projects gets access and in-depth knowledge but also some limitations on what can be reported (Gummesson, 1991).

3.1 Data sources

The author has been given the opportunity to access information on ERP for higher education provided by a Software Corporation and its network of business partners and universities. The author has not access to information available to business partners or confidential internal information.

The Software Corporation the researcher cooperates with is one of the top global software companies, with a leading position for over 25 years. The Software Corporation is in the global list of the top 10 vendors of ERP software. The portfolio of the Software Corporation includes server software, personal computer software as well as software for mobile devices.

The Software Corporation has more than 5.000 business partners around the world in the area of ERP, with more than 200.000 customers, according to company sources. In the marketing material from the case study company there are references to more than 1.500 institutions of higher education linked to the company university network.

Members of the academic network have to apply to be accepted by the Software Corporation. The Software Corporation and existing members of the network actively recruit new members through different information channels. The author actively participates here (2013 and 2014). The requirements are low to become a member, although there are two levels. Many of the products and services are offered for free. There are two advisory committees from academia to recommend the Software Corporation, North America as well as Europe Middle-East and Africa (EMEA). The author is part of the EMEA advisory council since 2012.

Some information has been provided to university professors by the Software Corporation, labelled as confidential and thus not used. Also, the Software Corporation has trusted the author with information to receive advice thus limiting the readiness to critique the company.

The amount of information that potentially could be used in the research reported here is substantial and multi-faceted. Purposeful selections of material have been performed during several years (approx. since 2007), without a systematic sampling strategy. Marketing material has been analysed cautiously. Material that is not relevant to the research question has been omitted.

77 files have been selected for analysis. Potentially there are many more. Some files are more analysed than others. The researcher has participated in two international conferences in 2012 and 2013, taking notes. Notes have also been taken by the author during online meetings of the EMEA advisory committee 2012-2014 (10 documents). The online meetings were approx. one hour. Other documents have been downloaded such as minutes from company managers, selections from conferences and social media.

3.2 Data analysis

Information has been analysed in NVivo, a qualitative data analysis software (QDAS). A comprehensive and critical study on QDAS can be found in Sinkovics and Alfoldi (2012). QDAS might help handle the dual challenge of complexity and trustworthiness in qualitative research in business and management. QDAS does not however, guarantee research quality.

When coding in NVivo the user selects a part of a document and assigns one or more codes, e.g. “top management support”, “business case” and “champion”. A coded item can be composed of a sentence, a paragraph or largest section of text. Files stored as images can be coded by selecting different areas, e.g., some PDF files are scanned documents. It is also possible to code video and audio recordings in NVivo, which has not yet been tested by the author

The codes can be structured in a tree. When double-clicking on a code in NVivo, all related sections from various sources are listed in a new interactive window. In that way, it is easy to navigate information. If the user is interested to go to the source document for a coded part found in a search/selection, it is easy to click on that part to jump to the passage in the source document. When displaying a document, so called coding stripes can be displayed to show the coding.

The coding density of the research material can indicate the importance of topics. Coding density takes into account the number of documents and coded sections in each document. It is also possible to visualise graphically the importance of different topics for one source document or a whole range of codes.

The reliability and validity of the analysis with QDAS is highly dependent on the skills of the researcher. One way to increase reliability and validity could be to let another researcher perform the same analysis. Then the two separate processes and results can be compared. This has not been performed due to limited resources.

The main results of this project have been presented to the Software Corporation in the fall of 2013 as well as professors and business partners both face-to-face and online. Comments have been positive and have, it seems, influenced the policies of the Software Corporation, e.g., to focus more on research in Europe in 2014 since professors are in many cases promoted on scientific performance. The author has posted preliminary results of this research in the company’s public website.

The qualitative approach with some quantitative elements is not possible to generalise statistically. However, thematic generalisations can be made. Robert Yin says that you can generalize analytically from case studies, not statistically (Yin, 1989:21). Information from the case study needs to be scrutinised carefully, e.g., findings might not be representative for universities that are not interested to adopt ERP in business education. Findings of the studied Software Corporation and its network might not be valid for other networks. The studied professors are to a high degree innovators or early adopters thus not representatives for early majority, late majority and laggards.

4. Results and analysis

The programme to cooperate with universities of the Software Corporation in the area of ERP dates at least back to 1996, when a company that was purchased by the Software Corporation in 2001 started a network to promote ERP to colleges and universities (Company source, JD). Most pioneer professors were in accounting.

A challenge was mentioned by a manager of the Software Corporation’s academic network in ERP (JBT) during a conference in October 2013. It is difficult for ERP business partners to find qualified personnel. They have to hire people from competitors. For students to be employed, they need sufficient experience. It is not enough with theoretical knowledge and limited experience. The mismatch between supply and demand in the ERP workforce market might be due to the difficulties of universities to implement practical work in ERP in their curriculum. At the same time, the researcher’s experience is that the teaching material for business people has to be adapted and expanded for university courses. The theoretical perspectives in university education are not stressed in business teaching material. Also, students do not have to learn all the details needed in business.

Furthermore, university professors are not business people. In a restricted web conference conversation, a professor commented a post from a manager of the Software Corporation, “academics can be worse than cats to herd” (October 2013). Implementation principles in business might not be valid for university education. A professor from Holland (HVH) stated in the fall of 2012 that accounting classes have not been updated with accounting practice where information technology has been used for decades, “we are confronted with old fashioned courses”.

In Canada, according to a professor (EB; Spring 2014) Accounting Information Systems (AIS) are losing ground in the accounting curriculum. There are many challenges such as course material to develop, teach, and update. Furthermore, AIS is demanding on resources and on educators. Moreover, academics’ strong focus on mainstream research as a key criterion for the “recruitment, tenure and advancement of professors does not work to spur the development of AIS courses and related materials”. Another factor mentioned is increasing requirements on the number of topics for accounting courses.

The following figure illustrates the coded material in NVivo of the case study related to implementation, a tree map of nodes. Implementation can also be called adoption and engagement.

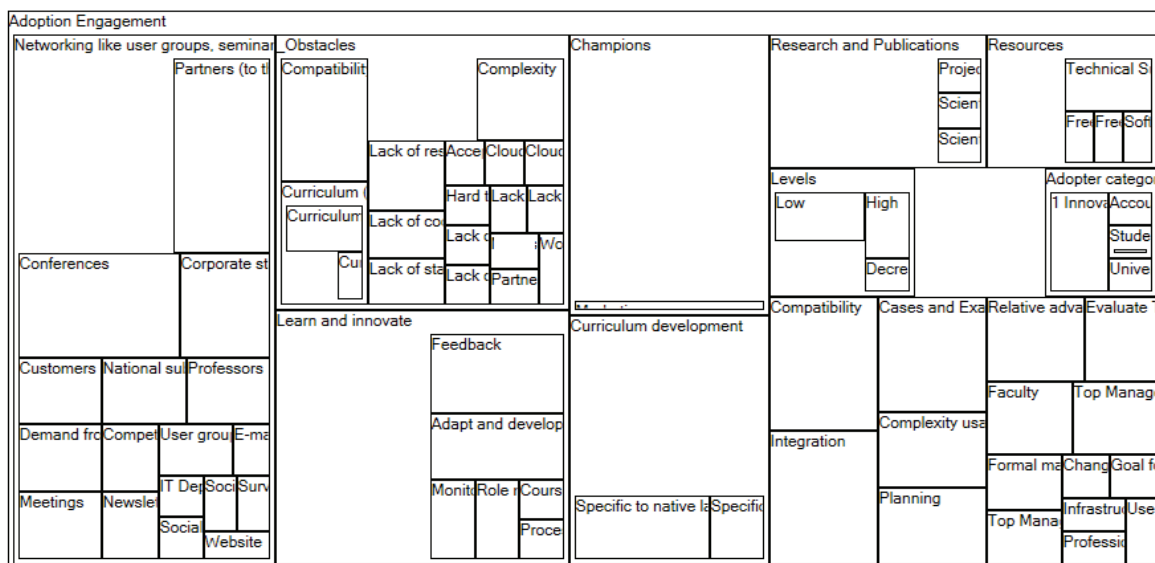


Figure 1: Tree map of nodes, case study of implementing ERP in university business courses

Here are now the *top success factors*, regarding implementation in university and university college course curricula, based on the case study in the Software Corporation analysed in NVivo. *The success factors are presented with highest coding density in the beginning.* Note that not all relevant material has been analysed so the rankings are approximate. Some categories with low coding density are not discussed in this paper. Also the lack of a success factor in the data, as coded by the researcher, can be reformulated into *failure factors* or *obstacles*.

The top factor is the influence of *champions* (I). Professors and other innovative staff in the universities and their networks make or break an implementation initiative. *Champions* are important in business too as noted by Finney and Corbett (2007), but it is not the top factor for business (rank 10). In the case study one professor (2013 conference) says “you will not be rewarded for the hours.” (PJ) Another professor says (2013) that “to get something new done requires individuals with energetic, determined minds to make it all happen.” (AT) Idealism seems to be at play more than in business, which might hamper implementation. Without resources, change is difficult.

Another top factor is *networking* (II) like user groups, seminars and conferences. This can be related to several business CSF primarily *project team* (rank 5) as well as *training and job redesign* (rank 4; Finney and Corbett, 2007). Professors and other learned people have had extensive knowledge networks since antiquity, regardless of culture or religion. In 2010, a professor from Mexico wrote about possible contributions to the university network “We are trying to work with other faculty members in Latin America. Currently, we are working in

the data collection initiative, to gather information about all faculty members in our countries. We can increase faculty member participation in XXX through YYY and CONACYT networks”.

The top networking channels coded are partners (to the software corporation) followed by customers, corporate staff, conferences and user groups. Then comes categories that have not been coded extensively but are of relevance, namely, demand from market, national subsidiaries of the Software Corporation, competitions, newsletters, websites, social media, meetings, IT Department of universities as well as e-mail.

Related to networking, an indication of the different situations in business and university curricula can be found in the attendance at the Software Corporation’s conferences for business partners, customers and the academic network. The number of participants at the annual global conference for business which takes place in the USA was around 12.000 in the Spring of 2014. 75 professors were registered for the academic conference that immediately preceded the mentioned business conference. That might be an indication of the implementation in business and government vs. university classes. The interest from business for the academic network during the business conference has been reported as significant. The Software Corporation had a booth with many visitors from business. The author participated in a competitors’ user group conference in the fall of 2013 in Stockholm, Sweden, with hundreds of business people. The author was the only academic researcher present.

Curriculum development (III) can be either a stimulating factor or an obstacle. Available commercial material might not be compatible for a university course, thus demanding effort to adapt material or develop new material. This has been noted above regarding accounting classes in Canada. Course material in English in the area of accounting can be a challenge to use in the Netherlands and France. To translate material and test is time consuming. A professor from Sweden (PA) said in 2012 that teaching material has been created by him based on material from Software Corporation. There are errors in the material from Software Corporation that need to be checked. The author has similar experience. The Software Corporation invites professors to share material, but some might not want to share. *Training and job redesign* in business can be related (rank 4; Finney and Corbett, 2007).

Learn and innovate (IV) is frequently discussed. You have to have a process perspective over time. Implementation can take several years, starting to a limited extent, evaluating and improving over time. Learn and innovate has a number of sub-nodes. You need to have a process perspective on learning. Monitoring and evaluation are essential. Role models can motivate others. A manager from the Software Corporation (JBT) in the Spring of 2013 regarding certification said “we have to start somewhere, evaluate after that ... we will check how big is the interest among students”. This topic can be related to *BPR* (rank 3) and *change management* (rank 2; Finney and Corbett, 2007).

Some professors emphasize *Research and Publications*, especially in North America. Some university professors in Europe active with the Software Corporation ERP for education are from applied universities, which might indicate less interest in publishing scientific work. This topic is not early possible to related to Finney and Corbett (2007).

Obstacles are not extensively discussed in the data if you compare to positive information. Still obstacles are important to analyse. Obstacles can often be when implementation promoting factors do not work. In many sources regarding business, top management support is at the apex of priority lists. This is also the case for Finney and Corbett (rank 1; 2007). However, for universities, top management support is almost not mentioned in the analysed data.

Acceptance among students can be challenging. Complexity is noted to hinder. It can be hard to find information and material. *Lack of communication, cooperation* between university departments, *interest, resources, staff with ERP knowledge* and *time* are mentioned. The Software Corporation’s *national subsidiaries* might not see ERP in higher education a priority. Professors in the advisory committees might meet face to face or online but work between formal meetings is needed. Professors are busy teaching and researching so new development can suffer. Here *visioning and planning* (factor 8; Finney and Corbett, 2007) might lack.

Complexity and *usability* issues are noted a little, which can be related to Finney and Corbett (factor 3; 2007). *Integration* is also discussed, but not as much as in business. Universities are sometimes called diversities since integration is not required as in business and government.

5. Conclusions

This paper shows Critical Success Factors for implementing ERP in business apply partially to university education curricula in ERP according to the performed case study. The top four factors found in the case study are champions, networking, curriculum development as well as learn and innovate. Champions in the university context can be related to the business CSF (10) project champion. Networking in the university context can be related to (5) project team: the best and brightest as well (4) training and job redesign. Curriculum development could be related to (4) training and job redesign. Learn and innovate in universities can be related to the business CSFs (2) change management and (3) Business Process Re-engineering (BPR).

Five out of ten business CSFs can be clearly related to the case study regarding successful implementation.

The missing business CSFs in the case study are (1) top management commitment and support, (6) implementation strategy and timeframe, (7) consultant selection and relationship, (8) visioning and planning as well as (9) balanced team.

One explanation could be that university organisations are radically different from business organisations. On the other hand, that many of the top business CSFs are not discussed extensively by the professors and the Software Corporation might indicate that implementation has not started extensively.

Some noted obstacles in the university context can clearly be related to business CSFs.

Future investigations could perform case studies in individual universities, including using multiple sources of evidence to trace implementation over time. Also a web survey could be executed to investigate the topics in this paper statistically.

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An Expert View on Business Case Usage: A Delphi Study

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Abstract: Information technology (IT) spending is still on the rise while enterprises are confronted with the dilemma of how to ensure value realisation from business investments enabled by IT. It is recognised that a detailed business case is crucial to realise this value potential, yet its usage is not as anchored in day-to-day practice as might be assumed. Some organisations develop weak business cases while other business cases gather dust after investment approval. In addition, most impact can only be achieved from a business if it is used continuously throughout the investment life cycle. Appropriate and continuous usage can support benefit realisation and increase the investment success. The present study therefore wants to investigate how such a continuous business case approach can be reached. We start from a conceptual model that takes a process perspective on business cases, which is operationalised by way of multiple individual business case practices. While in prior exploratory research several of these practices have been identified, the aim of this study is threefold: (1) to obtain a validated list of business case practices and definitions, (2) to understand the practices' perceived effectiveness / ease of implementation, and (3) to identify a minimum set of key business case practices. In order to achieve these objectives, a group of academic and practitioner experts participated in a Delphi study and validated in total 31 business case practices, of which the majority was perceived as highly effective.

Keywords: business case, process perspective, conceptual model, IT enabled investment, Delphi study

1. Introduction

Business investments enabled by Information technology are consistently recognised as investments that hold the highest potential for value creation (Weill and Ross, 2009). The research group Gartner forecasts a stable growth of four per cent per year on IT spending (Gartner, 2013). However, De Haes and Van Grembergen (2013:60) state that "a common and critical dilemma confronting enterprises today is how to ensure that they realise value from their large-scale investments in IT and IT-enabled change." According to a study by Swanton and Draper (2010), organisations perceive a business case as critical in order to realise the potential value from these investments. Developing and continuously using a well-founded business case can support benefit realisation and increase the investment success (Altinkemer et al., 2011; Al-Mudimigh et al., 2001). In order to realise these advantages, Franken et al. (2009) emphasise that a business case should become a living document that is frequently updated and matures along the investment. This requires a rational transformation in which people approach a business case more as a process instead of as a static document.

Unfortunately, few organisations employ a business case continuously. Many develop business cases to support the investment approval, after which they are disregarded (Franken et al., 2009). A review of the business case after investment launch is rarely executed, even if serious issues cause an escalation and threaten its potential success (Luftman and McLean, 2004; Ward et al., 2008). The present study therefore wants to investigate how a business case can be used appropriately throughout an investment life cycle. We present a conceptual model taking a process perspective on business cases, which is operationalised by way of multiple individual business case practices. Building on prior exploratory research findings, this study performs a Delphi study with the aim to achieve three research objectives:

- to obtain a validated list of business case practices and definitions,
- to understand the practices' perceived effectiveness / ease of implementation
- to identify a minimum set of key business case practices.

2. Conceptual model

In academic literature on IT and management, a business case is generally defined as a formal document that provides a structured overview of information about a potential investment. The information enclosed in the business case can be limited to the basic costs, benefits and risks (Hsiao, 2008), or an enriched version may include the identified actions necessary to implement changes and realise benefits along with a benefit realisation plan (Krell and Matook, 2009; Ward and Daniel, 2006). The overall goal of a business case is

consistently described as to enable well-founded business decisions to make, let proceed or stop the investment (ITGI, 2008; Post, 1992). Various advantages attributed to business cases result from its continuous usage. Business cases can help to monitor the investment progress, budget and risks, while regularly updating a business case increases the likelihood of responding adequately to changes in the investment context (Brown and Lockett, 2004; Smith et al., 2010). After the investment has been delivered, it can help to evaluate its contribution and success (Jeffrey and Leliveld, 2004; Luftman and McLean, 2004). Such a disciplined approach increases the use and adoption of the information system (IS) and is fundamental to benefit realisation (Law and Ngai, 2007; Al-Mudimigh et al., 2001). Moreover, frequently developing and continuously using a business case is one of the major success factors for an investment and a source of a competitive advantage (Altinkemer et al., 2011; Krell and Matook, 2009). Reaping these business case contributions requires a rational transformation in which people approach a business case more as a process instead of as a static document.

Taking a process perspective on business case usage, we argue that such a process transforms the static business case document into a dynamic, living document, as suggested by Franken et al. (2009). A common definition of a business process is provided by Davenport and Short (1990:14): “a business process is a set of logically related tasks performed to achieve a defined business outcome.” Building on this definition, we define a business case process as a set of logically related practices that affect a business case and supports continuous business case usage with the intent to enable well-founded investment decision-making and to ultimately increase investment success. A business case process runs in parallel with an investment life cycle, presented through a simplified three phase-perspective by Hitt et al. (2002): before, during and after implementation. The conceptual model, displayed in Figure 1, presents a business case process consisting of three distinct but consecutive phases supported by an accommodating layer. These four components constitute together the business case process model and each component is defined in Table 1.

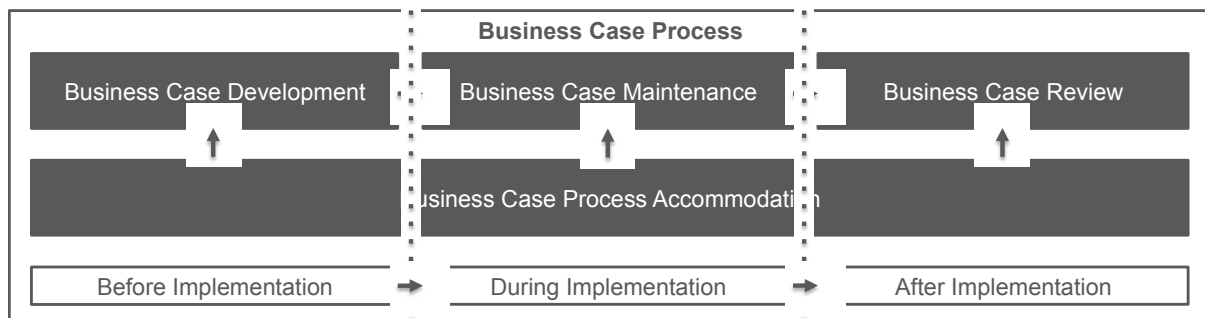


Figure 1: The business case process aligned with an investment life cycle

Table 1: Definition of the business case process model components

Component	Definition: A set of logically related practices to...
Business Case Development	identify relevant investment information that is integrated in a structured way with adequate and objective argumentation, in order to provide a rationale and justification of the initial investment idea.
Business Case Maintenance	monitor whether the investment is implemented in accordance with the business case (e.g. objectives, changes, costs), and to update the business case with the prevailing reality (e.g. assumptions, risks).
Business Case Review	monitor benefit realisation resulting from the utilisation of products and services, and to facilitate the evaluation of the overall investment success.
Business Case Process Accommodation	facilitate an adequate execution of the business case process adjusted to the investment and organisational context.

3. Research methodology

Building on prior exploratory research that helped to identify various individual business case practices, this study employs a Delphi study in order to achieve the above mentioned research objectives. A Delphi study lends itself well to validate the exploratory findings through the experience of international academic and practitioner experts (Nakatsu and Iacovou, 2009). It structures a group communication process in which experts can individually give their opinion on complex phenomena without needing a face-to-face meeting (Linstone et al., 1975; Taylor-Powell, 2002). In line with (Dalkey, 1969; Nakatsu and Iacovou, 2009; Okoli and Pawlowski, 2004), the Delphi study was performed through a multi-round procedure as presented in **Figure 2**.

After a preliminary phase in which quality experts were selected, objective 1 would be achieved through individual interviews with a small expert group. Two consecutive survey rounds dealt with objective 2 and 3. Each step was executed through an online survey platform.

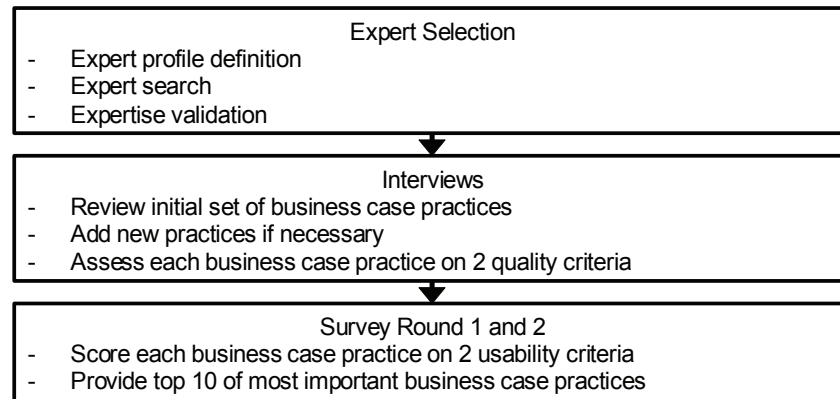


Figure 2: Multi-round Delphi study procedure

3.1 Expert selection

The Delphi study preparation starts with the development of expert profiles for academics and practitioners, and a search for them through multiple networks. The validity of a Delphi study is largely determined by the selection of quality experts (Taylor-Powell, 2002) and we therefore identified qualified experts based on a set of minimum qualifications (Nakatsu and Iacovou, 2009; Schmidt et al., 2001). For instance, among other criteria the working experience and expertise level in business case related topics had to be at least 10 years and good knowledge respectively. In total, 8 experts were individually interviewed and 24 experts participated in the two survey rounds.

3.2 Interviews

As a second step in the Delphi study procedure, interviews were organised to review the quality of the initial set of 54 business case practices in order to obtain a validated list of business case practices and definitions (objective 1). In line with the Delphi study philosophy, the interviews were performed individually without participant interaction. The interviews started with a structured questionnaire, which was pre-tested by academic researchers and practitioners, including closed and open-ended questions (Bryman, 2012). The closed questions assessed the practices and definitions through a 5-point Likert-scale (very low to very high) on 2 quality criteria: clarity (robustness and comprehend-sibility) and relevance (appropriateness to business case usage). The open-ended questions gave the experts the opportunity to provide feedback on individual practices, and to make suggestions to add new practices or to delete others. We followed up on the questionnaire by email to discuss their answers in order to get a deeper understanding of their opinion. We systematically analysed and discussed the quantitative and qualitative responses and updated the list with business case practices.

3.3 Survey round 1 and 2

In survey round 1 and 2, we aimed to understand the usability of the business case practices (objective 2), and to identify a minimum set of key business case practices (objective 3). Both questionnaires included a clear description of the business case process model and its components to structure the list with business case practices. The experts needed to score each practice on 2 usability criteria, similarly on a 5-point Likert-scale (very low to very high): perceived effectiveness (contribution to the overall objective of the business case process) and perceived ease of implementation (e.g. based on impact, cost, effort). Furthermore, we asked them to provide the top 10 most important business case practices, taking into account their personal experience and their previous scores assigned to perceived effectiveness and perceived ease of implementation. Round 2 was organised to let the experts re-evaluate their own scores attributed in round 1 and to reconsider their top 10 ranking of most important business case practices. We presented the expert's previous individual score/rank, the group average score/rank and the delta between both ranks. The objective of such a reiteration is to achieve a higher level of consensus among the experts. The consensus was measured

by the Kendall’s W coefficient of concordance for the top 10 ranking (Schmidt, 1997) and we adhered to Van den Heede et al. (2007) for the effectiveness and ease of implementation questions. The reiteration process of scoring and ranking was performed until we reached one of the following stopping criteria (Okoli and Pawlowski, 2004): (1) a high level of concordance is achieved (Kendall W above 0,7 or average Likert-scale consensus above 0,7 on ‘perceived effectiveness’), (2) a third survey round is finished according to our initial promise, (3) the mean rankings for two successive rounds does not show great difference. Eventually, we reached two stopping criteria in round 2.

The first criterion was reached because the average consensus level on perceived effectiveness scored 0,76 in round 2. The Kendall W coefficient on the other hand did not reach the stopping level. Although the coefficient increased between round 1 and 2 from 0,10 to 0,26, this score is low indicating that a weak consensus has been achieved on which practices are most important. This low consensus can be explained by two reasons. First, determining which practice will be most important is different for dependent and independent practices. Some Delphi studies are performed for independent practices or factors where an expert must determine which practice or factor will be most important or risky (De Haes and Van Grembergen, 2008; Schmidt et al., 2001). In this study however, experts needed to rank practices that can be employed in a sequential manner, i.e. they are dependent upon each other. We assume that some experts have reasoned that therefore the starting practices will be more important, because if one starts from a questionable basis then the next practices are of lesser importance. While other experts might have focused on which practices are indeed the most important if all will be executed anyways. Second, we consider that the investment context could have a substantial impact on which business case practice is perceived to be the most important. Some experts might have reasoned from a different perspective. As we stopped based on criterion 1, the second criterion was not reached. The third criterion was also realised because the top 10 most important business case practices included no new practices in round 2. Due to a tied 10th and 11th rank, the final top 10 includes 11 practices. As can be derived from **Table 2**, no substantial shifts can be ascertained in the top 10 ranking of round 1 and 2.

Table 2: Comparison of top10 ranking in round 1 and 2 with deltas

Top 10 Business case practices	Round 1 ranking	Round 2 ranking	Delta
BCD02 Capturing business drivers	2	1	1
BCD09 Identifying investment benefits	1	2	-1
BCD07 Identifying investment objectives	3	3	-
BCD03 Identifying stakeholder expectations	4	4	-
BCD01 Capturing investment vision	6	5	1
BCD10 Identifying investment costs	5	6	-1
BCD14 Evaluating cost/benefit analysis	8	7	1
BCD11 Identifying investment risks	9	8	1
BCPA07 Ensuring communication and involvement with stakeholders	7	9	-2
BCD05 Identifying investment scope	10	10	-
BCD12 Developing benefits realisation plan	11	10	-

4. Findings and interpretations

4.1 Interviews: Validation of initial set business case practices

The interviews provided much quantitative and qualitative data, which we systematically analysed and discussed. The list with business case practices was eventually reduced from 54 initially identified practices to 31 validated practices based on two principles. First, practices had to be focused and easy to comprehend so we merged several practices while others were split, and all definitions were drastically shortened to increase the comprehensibility. Second, practices had to focus on business case usage so we removed practices that were more closely related to project management and other operational issues. We also structured the business case practices through the process model. **Table 3:** Validated list of business case practices and their respective definitions **Table 3** shows the validated list of practices with their respective definitions, and an individual code that links them to a specific process model component (as explained before).

Table 3: Validated list of business case practices and their respective definitions

Code	A business case is developed by...	Definition
BCD01	Capturing investment vision	Capture the investment vision and establish the appropriate investment context.
BCD02	Capturing business drivers	Capture the business challenges and opportunities that drive the investment and how they contribute to the achievement of the organisational strategy.
BCD03	Identifying stakeholder expectations	Identify the stakeholders' expectations, needs and requirements in terms of delivered benefits.
BCD04	Identifying technology opportunities	Identify proven and emerging technologies that support the business drivers and may realise the investment objectives.
BCD05	Identifying investment scope	Identify what will be done in the investment and what not, and explain why.
BCD06	Identifying investment assumptions	Identify realistic assumptions and their logic for business drivers, investment objectives, investment solution(s), benefits, and costs.
BCD07	Identifying investment objectives	Identify and categorise what objectives the investment should achieve.
BCD08	Identifying investment solution(s)	Identify what organisational and technological changes are required, design one or more alternative investment solutions and implementation scenarios, and assign change owners.
BCD09	Identifying investment benefits	Identify and categorise what benefits will be created by the investment based on relevant evidence, define their explicit measures and assign benefit owners.
BCD10	Identifying investment costs	Identify and categorise what costs will be created by the investment based on relevant evidence, and define their explicit measures.
BCD11	Identifying investment risks	Identify and evaluate the impact and probability of investment risks and critical success factors, and determine preferred solutions to take a proactive approach.
BCD12	Developing benefits realisation plan	Develop a structured plan on when each benefit will be realised, in relevant phases and with appropriate consideration of organisational factors.
BCD13	Evaluating investment feasibility and viability	Evaluate the feasibility and viability of each alternative investment solution.
BCD14	Evaluating cost/benefit analysis	Capture identified investment costs and benefits with measures and values, and evaluate cost/benefit analysis to support the financial argumentation.
Code	maintained by...	Definition
BCM01	Monitoring business case relevance	Monitor the business drivers, objectives and assumptions, and control whether they are still relevant and realistic.
BCM02	Monitoring investment scope	Monitor the investment scope and realisation of changes, and control whether it is still in line with the business case relevance.
BCM03	Monitoring investment costs	Monitor whether the investment costs are consumed according to the scope and identified changes.
BCM04	Monitoring investment risks	Monitor the investment risks and evaluate their impact on the business case.
BCM05	Updating business case to react adequately	Update the business case frequently based on business case monitoring and identify adequate actions.
Code	reviewed by...	Definition
BCR01	Identifying objective evaluation criteria	Identify and communicate objective criteria with predefined weighting that help to evaluate the investment effectiveness and efficiency.
BCR02	Evaluating investment effectiveness	Monitor benefits realisation, and evaluate the contribution of investment objectives and changes.
BCR03	Evaluating investment efficiency	Evaluate the effort and costs that were consumed to realise the investment.
Code	A business case process accommodated by...	Definition
BCPA01	Establishing adaptable business case approach	Establish an adaptable business case approach according to investment and accept a growing maturation and granularity through its development and usage.
BCPA02	Establishing business case templates, training and guidance	Establish standard business case templates and tools, and accommodate training and guidance on what constitute business case practices and how to employ them adequately.
BCPA03	Establishing maximum objectivity in business	Maximise objectivity to support well-founded and comparable decision-making without influence from politics, lobbying or institutional powers.

Code	A business case is developed by...	Definition
	case usage	
BCPA04	Establishing simple and dynamic business case usage	Describe and employ business case practices and its content in a simple, straightforward and dynamic manner to encourage their usage.
BCPA05	Establishing business case practices as standard approach	Establish and evangelise business case practices as a standard way of working.
BCPA06	Ensuring business case practice improvements	Ensure business case practice improvements further through experience and continuous learning.
BCPA07	Ensuring communication and involvement with stakeholders	Ensure clear communication and active involvement with all stakeholders in order to gain insight, commitment and ownership.
BCPA08	Ensuring stakeholder confirmation	Ensure formal confirmation from relevant stakeholders on the (updated) business case to increase their commitment.
BCPA09	Evaluating business case regularly	Evaluate all business case documents in order to make well-founded decisions to approve, let proceed or stop the investment.

4.2 Survey round 1 and 2: Score and rank business case practices

Figure 3 shows the consensus level between experts regarding effectiveness and ease of implementation by providing the percentage of experts that rated 4 or 5 (on a scale of 5) for these questions. In total, we see that above 90 per cent of the experts perceive BCD03, BCD07 and BCPA07 as highly effective, reaching the cut-off level of very high consensus (Schmidt, 1997). More than 80 per cent of the experts perceive 12 practices as highly effective, and 23 practices are within the cut-off consensus level that more than 70 per cent of the experts perceive them as highly effective (grey rectangle in **Figure 3**). Eight practices do not reach the 70 per cent consensus level. In general, we observe that stakeholder attention is found to be highly effective: identifying their expectations (BCD03) and ensuring their active involvement (BCPA07) is positioned within the top 3 of highly effective practices, and reach a very high level of consensus among experts. This does not come as a surprise as various academics have stressed on the importance of stakeholder involvement and commitment (Davenport et al., 2010; Sherif and Vinze, 2002; Smith et al., 2010). Another set of practices that are perceived to be highly effective deals with what the investment wants to realise. One expert clarifies: “It is of utmost importance to (1) know exactly what problem you want to solve, (2) understand how this will be solved, and (3) obtain and maintain the desire to achieve this.” Although the latter refers mostly to the importance of stakeholder attention and involvement, the other two can directly be linked to BCD01, BCD02, BCD05, and BCD07. Indeed, the development of a business case should start from these fundamental practices (Ward et al., 2008).

The consensus levels on perceived ease of implementation are much lower and many experts attributed a score of 3 to several practices (moderate easiness). This demonstrates that experts have great difficulty to agree on their ease of implementation. Very low consensus levels on ease of implementation were achieved for 25 practices. In **Figure 3**, the light grey bars for these practices do not reach the 30 per cent consensus level indicated by the vertical black line. In other words, experts reached a high consensus level (>70%) that these 25 practices are difficult or moderately easy to implement. This finding should not come as a surprise as many organisations still struggle with business case usage (Jeffrey and Leliveld, 2004; Taudes et al., 2000). We conclude that a great discrepancy can be found between how effective most business case practices are perceived to be and the perception of their ease of implementation. This contrast signals to us an important urge to investigate how these practices can be better implemented in the future.

The second objective of this study was to identify a minimum set of key business case practices. Experts were therefore asked to rank the ten most important practices from 1 to 10, taking into account their personal experience and their previous scores assigned to perceived effectiveness and ease of implementation. Although the ranking exercise is limited by a weak agreement among experts (low Kendall W score of 0,26) on the top 10, as we explained before, this might be affected by the chronological dependence among individual practices. We are thus not able to deduce strong conclusions on what are the most important practices. Yet, if we compare the results of the top 10 ranking with the set of practices that received a high consensus on

perceived effectiveness, we observe that 10 out of 11 top 10 ranked practices achieved consensus by 79 per cent of the experts or more.

Table 4 presents the 11 practices ranked in the top 10 (11 practices were included due to a tied 10th and 11th rank), where practices that reached a high consensus level on perceived effectiveness are indicated in grey. The table also shows the number of times a practice was mentioned in the top 10 (total times mentioned) and the total ranking score (e.g. if a practice is ranked 1st, it receives 10 points).

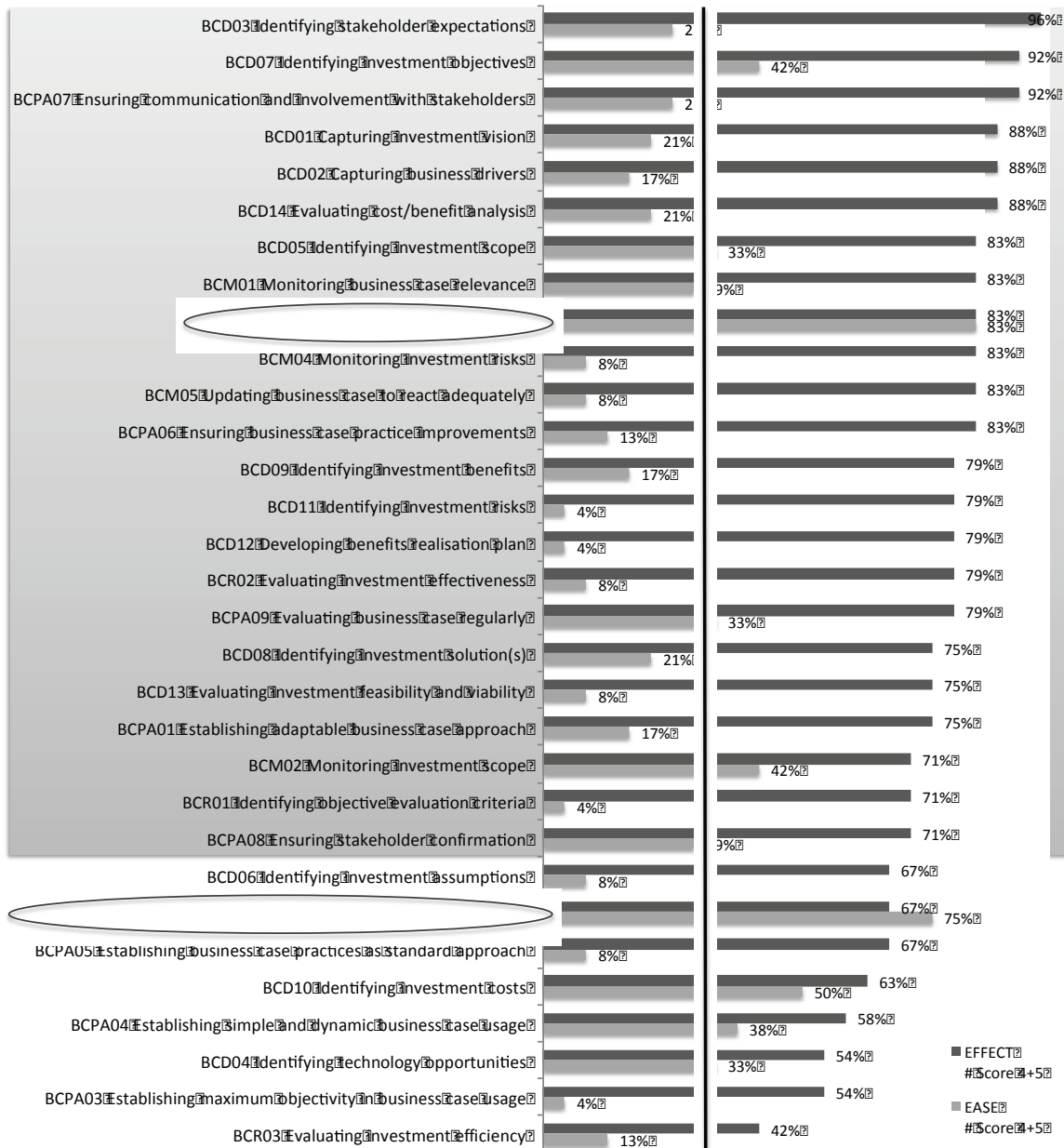


Figure 3: Consensus levels on perceived effectiveness and perceived ease of implementation of business case practices (based on score 4 and 5 on Likert-scale)

Only identify investment costs (BCD10) did not reach the 70 per cent cut-off level of high consensus on perceived effectiveness (scoring 63 per cent). This finding surprises us as many scholars in literature emphasise the importance of identifying the investment costs in detail (Franken et al., 2009). According to Ward et al. (2008:9), “a complete business case must obviously include all costs.” The authors say that it should be relatively easy to calculate the direct IT costs, but people have much more difficulty with estimating the costs associated with business and organisational changes. The underestimation of costs can have a dramatic impact on budget overruns and on ultimate value contribution. Combining these claims from literature with its 6th rank in the top 10 ranking, we might argue that this practice can be perceived as necessary in the business

case process. Especially, since monitoring investment costs (BCM03) is perceived as effective by 83 per cent of the experts, we consider the identification of investment costs as necessary to effectively execute BCM03.

Table 4: Minimum set of key business case practices

Top 10 Business case practices	Total times mentioned	Total score	Total rank
BCD02 Capturing business drivers	18	136	1
BCD09 Identifying investment benefits	18	135	2
BCD07 Identifying investment objectives	16	127	3
BCD03 Identifying stakeholder expectations	16	119	4
BCD01 Capturing investment vision	12	79	5
BCD10 Identifying investment costs	12	74	6
BCD14 Evaluating cost/benefit analysis	11	66	7
BCD11 Identifying investment risks	14	65	8
BCPA07 Ensuring communication and involvement with stakeholders	11	48	9
BCD05 Identifying investment scope	10	38	10
BCD12 Developing benefits realisation plan	7	38	10

5. Conclusion and future research

The present study focused on how a business case can be used continuously throughout an investment life cycle. It builds on a newly developed business case process model and investigates through which practices this process can be operationalised. Building on prior exploratory research and by way of a Delphi study, we were able to obtain a validated set of 31 business case practices and definitions (objective 1). The Delphi study additionally provided us with a better understanding of the perceived effectiveness and perceived ease of implementation of these business case practices (objective 2), and with the identification of a minimum set of key business case practices (objective 3).

Some practices achieve a higher consensus level on perceived effectiveness and ease of implementation than others. In total, 23 out of 31 practices are perceived as highly effective by more than 70 per cent of the experts, generating a high consensus level. Especially those practices that focus on stakeholder inclusion and the specification of ‘what the investment wants to achieve’ are considered to be of utmost importance. In many study fields, stakeholder management and stakeholder involvement is seen as critical for the success of an investment, whether this includes an IT enabled project, a business change program, or a large organisational transformation. For instance, according to Matthews (2004) an important step in an investment project “is to start contacting internal and external stakeholders to discuss the business implications of such a system. By lining up internal support behind the program (hopefully on both economic and environmental grounds), a stronger and broader business case can be developed and presented to management.” A clear definition of what the investment wants to achieve is an equally essential part of the business case process. Beatty and Gordon (1991) argue that “without a business case containing clear targets, progress is difficult to monitor and evaluate, and evangelists set their own targets.”

With regard to ease of implementation, only 2 practices are perceived as easy to implement whereas 25 practices are perceived as difficult or moderately easy to implement. Hence, a noticeable gap may be observed between the effectiveness and ease of implementation of business case practices. This finding is quite problematic since experts are convinced that organisations will have enormous difficulties with the implementation of the business case practices. This calls for future research that focuses on how these practices could be implemented. If we would be able to gain a better understanding on the applicability of business case practices, organisations can directly benefit from the dispersion of this knowledge. Organisations should be closely involved in the next steps of this research, so it can be investigated why the practices are difficult to implement. In this study experts have reasoned that it would be difficult, yet the observation and reasoning of organisations may differ. If organisations have the knowledge and skills to continuously employ a business case, they will appreciate the advantages it can bring to their investment success.

The experts were also asked to rank the top 10 most important business case practices. We conclude that all but one of the practices included in the top 10 receive high consensus on perceived effectiveness. This could indicate that experts might agree that the set of practices perceived as highly effective should also be

perceived as most important, despite of the chronological dependence. Moreover, our experience from the literature review and exploratory case studies indicate that the practice 'Identifying investment costs' might be perceived as highly effective, although this is contradictory to the experts' perception. The identification of costs is essential to perform the practice of 'evaluating the cost/benefit analysis' and the practice 'Monitoring investment costs', because these cannot be executed effectively if no costs were investigated. The next and final phase of our research, in which we will validate the business case process model and individual practices, will therefore include the identification of costs on top of the 23 practices that were perceived as highly effective.

Based on this study, we understand which business case practices are required in order to support the main objective of the business case process, i.e. to enable well-founded investment decision-making and to ultimately increase investment success. Future research can now investigate how well these practices support the business case process objectives by measuring the impact on both decision-making effectiveness and investment success. Such a research project can be executed based on Dean and Sharfman (1996), who employed a process perspective on strategic decision-making and investigated the impact on the decision effectiveness. Setting up this future research project can contribute to literature by applying their research effort in the context of a business case process. Second, as business cases are applicable in a wide range of technology and organisational investment contexts, a future research project could explore whether these business case practices should be adapted or complemented by additional practices when used in different contexts. For instance, some practices might be more useful in a multinational organisation while perhaps a more focused approach is desirable in small and medium sized companies or governments. This can also be related to the investigation of the perceived ease of implementation of business case practices. It would be very interesting to explore how this perception and experience may vary between different types of investments and organisational contexts.

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The Value of Using a Validated Information Security Culture Assessment Instrument

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Abstract: It is crucial to understand the perceptions, attitudes and behaviour of an organisation's employees in order to shape the information security culture into one in which the confidentiality and sensitivity of information are understood and handled accordingly. This can be done by conducting an Information Security Culture Assessment (ISCA). The key objective of ISCA is to reduce the risk that employee behaviour poses to the protection of information and to ultimately inculcate a compliance culture with fewer incidents. This paper reports on a case study in which the ISCA measurement instrument was deployed successfully in four assessments over a period of eight years. ISCA was expanded for the last two assessments to incorporate the measurement of the perception towards the protection of personal information and privacy, thereby introducing the definition of an information protection culture. A factor and reliability analysis is also reported on as part of the research to revalidate the ISCA measurement instrument. The analysis indicated that the ISCA is valid and reliable when grouping the items into the newly identified factors. The statistical analysis of the four assessments indicated significant improvements based on the corrective actions implemented by the Information Security Officer. The means of each of the dimensions in the 2006 assessment improved compared to the 2013 assessment following the implementation of specific training initiatives over a period of time. It was found that employees who attended training were more positive compared to employees who did not receive training and that the overall Information Security Culture means improved from one assessment to the next.

Keywords: information security culture, assessment, behaviour, validity, reliability, privacy

1. Introduction

The prevention of loss, damage, unauthorised destruction or access to information processed by organisations is an ongoing evolution. Internal and external risks continuously evolve and often result in breaches. In many instances, employee behaviour is the cause of several information security incidents and privacy breaches (Herold 2011).

Employees in organisations often have access to sensitive information such as the social security numbers, credit card numbers or health information of customers or employees. The manner in which employees process and use the information is critical to prevent mistakes, misuse or incorrect disclosure, which could stem from ignorance, fraud or wilful damage. The culture in an organisation should be conducive to the protection of information. A culture is required in which employees comply with the information security policy and handling requirements. This will help to minimise risks from an employee perspective such as wrongful disclosure of sensitive information; unlawful usage of information; unauthorised transfer of information to third parties or outside of legal jurisdictions without the required controls; saving sensitive and/or confidential information in unencrypted format on mobile devices; using internet e-mail accounts to e-mail sensitive and/or confidential information; and infrequent back-ups resulting in inaccurate or lost information.

It is crucial to understand the perceptions, attitudes and behaviour of the organisation's employees in order to shape the information security culture into one in which the nature, confidentiality and sensitivity of information is understood and handled accordingly. This can be done by conducting an ISCA, developed in previous research by the authors (Da Veiga and Eloff 2007, Da Veiga and Eloff 2010, Da Veiga, Martins and Eloff 2007). The first objective of ISCA is to reduce the risk that employee behaviour poses to the protection of information and to ultimately inculcate an information protection culture with fewer breaches resulting from an internal perspective. The second objective of ISCA is to help foster a compliance culture in which the processing of information complies with organisational policy and regulatory requirements.

The regulatory and legal requirements for the processing of information are of critical importance when employees handle information, specifically personal information. The terms "privacy" and "data protection" are often used to refer to the appropriate management of personal information (Swire and Bermann 2007). It

is essential that privacy principles are embedded in the information security culture to aid in meeting compliance and customer expectations when processing information. The ISCA can be utilised to also assess the privacy perceptions of employees to help management protect personal information in line with legal requirements, which in many cases also includes the information security requirements that organisations are required to comply with.

2. Aim of this paper

The aim of this paper is to validate the ISCA measurement instrument (questionnaire) and test its reliability. This paper provides an overview of information security culture and introduces the concept of privacy. It discusses a case study in which ISCA was deployed and customised to include privacy concepts.

This allowed the researchers to answer the following research questions:

- Is the ISCA measurement instrument valid and reliable in assessing an organisation's information security culture?
- Does the ISCA produce valid results that can be used for management decisions to improve the protection of information in the organisation?

3. What is information security culture?

Schein (1985) defines culture as "a pattern of basic assumptions – invented, discovered, or developed by a given group as it learns to cope with its problems of external adaptation and internal integration – that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems". According to Schein (1985), the core substances of corporate culture are the basic assumptions, attitudes and beliefs of employees, which relate to the nature of people and their behaviour and beliefs. Assumptions are values that become embedded and as such are almost taken for granted. These basic assumptions are non-debatable and non-confrontable (Schein 1985).

Organisational or corporate culture is expressed in collective values, norms and knowledge of organisations. Values relate to the sense that people have of what ought to be. Many values are adopted consciously and guide the actions of employees (Schein 1985). Such norms and values affect the behaviour of employees and are expressed in the form of artefacts and creations. Artefacts are the visible output of a culture, for example, the written or spoken language or the way status is demonstrated (Schein 1985).

In terms of the above, Da Veiga and Eloff (2010) define Information Security Culture as the "attitudes, assumptions, beliefs, values and knowledge that employees/stakeholders use to interact with the organisation's systems and procedures at any point in time. The interaction results in acceptable or unacceptable behaviour evident in artefacts and creations that become part of the way things are done in the organisation to protect its information assets."

4. Privacy

The concept of privacy goes back as far as 1948 where human rights were defined in the UN Universal Declaration of Human Rights (UN 1948). In 1970, the US Department of Health, Education and Welfare (today referred to as Department of Health and Human Services) developed the Code of Fair Information Practices (Swire and Berman 2007). The Organisation of Economic Cooperation and Development (OECD) published guidelines on the protection of personal information and trans-border flows of personal data in 1980 (OECD 1980) which the US Federal Trade Commission (FTC) endorsed. The USA adopts a sectoral approach to privacy with privacy regulations per industry, for example, the financial or medical sector (Swire and Berman 2007). In Europe, the EU Data Directive 95/46/EC came into effect in 1998, and outlined privacy principles to protect the privacy of individuals and to facilitate the free flow of personal data within the European Union (EU Data Directive 95/46/EC 1995). The EU Privacy Directive is currently being revised to formulate a regulation that will apply to all European member states (APEC 2005). The Asia Pacific Economic Cooperation (APEC) Privacy Framework was established in 2005 (APEC 2005). In Africa alone, there are 15 countries with privacy related laws and five countries in which privacy efforts are under way.

According to Greenleaf (2013), in June 2013, there were 99 countries with privacy laws and about 20 governments in the process of considering such a law. In November 2013, South Africa's Protection of Personal Information Act 2013 (PoPI) was signed into law.

The OECD (1995) privacy principles are enshrined in most of the privacy laws, and focus on the following: collection limitation; data quality; purpose specification; use limitation; security safeguards; openness; individual participation; and accountability. Jurisdictions with privacy laws have to comply with regulatory requirements when processing personal information. The security safeguard requirements must be considered throughout the information processing life cycle to preserve the integrity and confidentiality of the information. Organisations need to ensure that their employees are aware of information security and privacy policy requirements which encapsulate regulatory requirements. Employees need to understand the risk to the information they process, implement the required controls to protect it and take accountability for their actions.

An information security culture should be inculcated in which compliance behaviour for all sensitive and confidential information, including personal information, is evident. A culture must be established in which information is protected from risk and the privacy of the information is maintained. As such, ISCA should also incorporate the assessment of employee perceptions towards privacy principles.

5. The ISCA methodology

The ISCA methodology comprises an information security culture measuring instrument (questionnaire) and approach developed by the researchers (Da Veiga et al. 2007; Da Veiga and Eloff 2010).

ISCA is used to identify whether there is an acceptable level of information security culture. This means that the level of information security culture provides adequate protection to information assets and thus succeeds in minimising the threat to the confidentiality, integrity and availability of the information asset. The results could indicate that the overall results are positive or that only certain dimensions, statements or biographical groups are positive. If the overall results are positive for certain biographical areas, this means that those employees have a positive perception towards the protection of information, which could mean that there is a good level of awareness, policies are understandable, change is implemented effectively, there is management commitment and training is effective. Having a positive or strong information security culture enables employees to interact with information in a more secure manner, thus creating an environment in which compliance behaviour is the accepted norm and ultimately reduces incidents.

The ISCA methodology (Da Veiga et al 2007) was deployed in the organisation chosen for the case study, to conduct four assessments over a period of eight years. The phases of the methodology include planning, design, survey administration, statistical analysis and reporting. A high-level discussion of the application of ISCA in the case study organisation is provided below.

5.1 Planning

The planning phase was used to identify potential stakeholders. A kick-off meeting was held with the project sponsor who, in this case, was the Global Information Security Officer (ISO). During this meeting, a high-level discussion of the information security policy and projects in the organisation took place. Information about training and awareness initiatives in the previous year was also obtained. Relevant information security policies were obtained for background purposes, to customise the ISCA questionnaire. A list of information security awareness topics and training was also obtained in order to incorporate questions about these initiatives. The planning activities were repeated for each of the four assessments. The sample sizes were calculated for each assessment to allow for changes in staff numbers.

5.2 Design

The objective of the design phase was to customise the ISCA measurement instrument with the input of the organisation. Eighteen knowledge questions were defined for inclusion in the questionnaire. The purpose of the knowledge questions was to gain an understanding of the employees' awareness of certain information security policy concepts and factors they are expected to know about.

Biographical questions were included to segment the data into 27 regions (including provinces in the breakdown for a total of 12 countries), 13 business units and 3 job levels. An additional question was added to segment the data between employees who had attended information security awareness training, versus those who had not. Another question was added to segment the data between employees working in IT versus other business areas. The objective of the biographical segmentation was to identify any developmental areas across the organisation on which to focus efforts and interventions in order to improve the information security culture.

Forty-four culture questions were included in the questionnaire in line with the previous research (Da Veiga and Eloff 2007; Da Veiga and Eloff 2010). The questions were grouped into 8 dimensions to gauge the perception of employees on the protection of information. The key objective was to identify what perceptions of employees need to change in order to create a culture in which information security is accepted as everyone’s responsibility and compliance behaviour becomes evident across the organisation.

Two additional dimensions were added for inclusion in the last two assessments. A dimension focusing on the protection of personal information was added and named, “Privacy Perception”. This dimension comprised 9 statements and gauged the perception of certain privacy requirements of employee and customer data in line with the privacy principles of the organisation’s privacy policy. A second dimension was added, namely, “Training and Awareness”, with two statements to assess specific requirements regarding information security training and to establish the future training needs of employees. Eight additional knowledge questions were added to assess employee perception of the usage and risks relating to personal information. Table 1 outlines the dimensions of the ISCA questionnaire used.

Table 1: ISCA questionnaire dimensions

ISCA dimensions	Description
Information Asset Management	Assesses users’ perceptions of the protection of information assets
Information Security Management	Assesses management’s perceptions of information security management
Change Management	Assesses the perceptions about change and the willingness of users to change in order to protect information
User Management	Assesses user awareness and training with regard to the requirements to protect information
Information Security Policies	Assesses whether users understand the information security policy and whether communication thereof was successful
Information Security Programme	Assesses the effectiveness of investing in information security resources
Trust	Assesses the perceptions of users regarding the safekeeping of private information and their trust in the communications of the organisation
Information Security Leadership	Assesses users’ perceptions of information security governance (e.g. monitoring) to minimise risks to information
Training and Awareness (new)	Assesses employees’ perception of additional needs for information security training
Privacy Perception (new)	Assesses employees’ perception of privacy principles

Once the Group ISO had approved the ISCA questionnaire, the HTML version was designed and tested. As part of this phase, the communication e-mails and intranet messages that would be used to launch the survey and remind employees to complete the survey by the due date were designed.

5.3 Survey administration

This phase includes the survey completion, monitoring and closing out of the survey. The Global ISO sent out the launch e-mail with the survey link as well as the reminder e-mails. A four- to six-week period was provided for employees to complete the survey. The responses received were tracked on a weekly basis to monitor whether enough responses had been obtained in line with the required sample sizes for each biographical area and to motivate employees to respond accordingly.

5.4 Statistical analysis

The statistical analysis focused on an overall analysis of the data and comparative analysis for the biographical areas. The data was analysed in means, frequencies and frequency distribution. The SPSS software package (IBM SPSS Statistics 2012) was used for the statistical analysis. Correlation and regression analyses were conducted to determine the most important focuses. Anova and t-tests were used to determine significant differences between the results of the statements for the biographical groupings.

5.5 Reporting

During the reporting phase, the statistical analyses were interpreted and developmental areas identified. Once the report had been compiled, a formal feedback session with the Group ISO and relevant stakeholders was conducted.

6. Overview of the case study

The case study organisation embarked on a journey to foster a strong Information Security Culture across the organisation. Its objective was to instil a culture in which information security practices would become part of the “way things are done” in the organisation. Under the direction of the Group ISO, four ISCA’s were conducted over a period of eight years, with the first assessment having being done in 2006, followed by another in 2007. In 2010 and 2013 the ISCA was conducted again.

The organisation employed 3 927 employees in 2006, which increased to 8 220 in 2013. The organisation processes financial data on a global basis which is of a sensitive nature and which must be kept confidential from unauthorised parties. In addition, the organisation has to comply with a number of legislative and industry requirements when processing the financial data of organisations and individuals. From a privacy perspective, the data privacy laws in the Australia, Hong Kong, Ireland, Jersey, Mauritius, the UK, the USA and South Africa apply to the organisation. The organisation has established information security policies from an information technology (IT), end user and privacy perspective. The governance of information security across the organisation is affected through country’s ISOs who report to the Group ISO. Generic information security awareness was conducted across the organisation prior to the 2006 ISCA.

6.1 Biographical data

In all four assessments, an adequate number of responses were obtained for the overall data analysis:

- 2013 survey: 367 responses were required and 2159 responses were obtained
- 2010 survey: 364 responses were required and 2 320 responses were obtained
- 2007 survey: 351 responses were required and 1571 responses were obtained
- 2006 survey: 351 responses were required and 1941 responses were obtained

This means that the findings could be generalised across the group. The sample size calculation used was based on a marginal error of 5% and confidence level of 95%, to ascertain the findings across the organisation (Krejcie and Morgan, 1970). In 2013, a 38.7% response rate was obtained, 28% in 2010, 29% in 2007 and 40% in 2006. Non-managerial employees represented almost two thirds of the responses in 2013, with the rest being managers. Less than 3% of the respondents were made up of executives.

6.2 Overall findings

Table 2 outlines the ISCA dimensions with the corresponding mean and percentage agreement for each dimension for the four assessments. The mean represents the overall mean for a respective dimension comprising a number of statements. The arrows indicate whether the results for a dimension improved (arrow

pointing upwards), remained the same (arrow being horizontal) or declined (arrow pointing down wards) from the previous year’s assessment. from the previous year’s assessment. The results from the 2013 ISCA improved for all dimensions, compared with the 2007 and 2006 data. A cut-off point of the mean of 4.00 was deemed acceptable for the information security assessment, given the importance of information security. This is higher than the 3.37 mean for *The Best Company to Work for* survey.

Table 2: ISCA dimension means for 2013, 2010, 2007 and 2006

ISCA Dimensions	Mean/% Agreement 2013 N = 2 159	Mean/% Agreement 2010 N = 2 320	Mean/% Agreement 2007 N = 1 571	Mean/% Agreement 2006 N = 1 941
Information Asset Management	4.30, 91.2% ↑	4.22, 88.9% ↑	4.17, 88.3% ↑	4.10, 86.1%
Information Security Policies	4.15, 82.5% ↑	4.08, 80.5% ↑	4.07, 81.0% ↑	3.93, 72.6%
Change Management	4.14, 86.1% ↑	4.09, 84.7% ↑	4.08, 85.4% ↑	3.97, 79.9%
User Management	4.14, 85.8% ↑	4.08, 83.4% ←	4.08, 84.9% ↑	3.94, 78.8%
Information Security Programme	4.05, 80.55% ↑	3.96, 76.8% ↑	3.98, 79.9% ↑	3.85, 71.0%
Information Security Leadership	4.03, 82.1% ↑	3.88, 76.1% ↓	3.89, 77.8% ↑	3.79, 70.9%
Information Security Management	3.96, 80.1% ↓	4.14 90.6% ↑	3.88, 79.4% ↑	3.84, 76.7%
Trust	3.95, 76.8% ↑	3.88, 74.8% ↑	3.87, 76.3% ↑	3.73, 68.6%
Training and Awareness	3.08, 43.0% ↑	3.02, 39.9% ↑	-	-
Privacy Perception	3.67, 65.4% ↑	3.56, 61.5% ↑	-	-

It is critical to note in Table 3 that employees who had attended prior information security training were more positive compared to employees who had not attended prior training. The percentage of employees who had received training improved from 2006 by 23.75% to 72.8% in 2013. However, 61.0% of employees indicated in the 2013 survey that they believed there is a need for additional information security training to use information security controls in order to protect information. The awareness initiatives seemed to be effective with 69.4% of employees agreeing with the statements.

Table 3: Information security (IS) training means for 2013, 2010, 2007 and 2006

Mean for training versus no training	2013	2010	2007	2006
Prior IS training	4.15	3.79	4.07	4.09
No IS training	3.96	3.65	3.92	3.83

Less than half of the respondents indicated that the organisation’s client data was complete and accurate, with only half of the respondents who believed their colleagues ensure that client information is protected when taken off site. Both these views improved significantly from the 2010 to the 2013 surveys. From a privacy perspective, most employees indicated that the organisation has clear directives on how to protect sensitive/confidential client and employee information. Employees also perceived the limitation of the collection and sharing of sensitive, personal information as important.

In summary, it was found that employees believe that they have a responsibility to protect the organisation’s information and that information security is necessary in their divisions. It was found that employees are aware of the information security policy and believe that it is applicable to them in their daily duties.

Most respondents indicated that they are willing to accept some inconvenience to secure important information and that they are prepared to change their working practices in order to ensure the security of information assets. There was also a positive perception among respondents that executive and senior management demonstrate commitment to information security. Interestingly, the most preferred method to

receive information security communication was through face-to-face presentations, followed by web-based training and e-mail. Another interesting finding was that IT workers were significantly more positive compared to non-IT workers about the culture dimensions, but there were no significant differences for the Privacy Perception and Training and Awareness dimensions.

6.3 Validity analysis

To determine the factorability and the sampling adequacy, the Kaiser-Meyer-Olkin measure of sampling adequacy and Bartlett’s test of sphericity were first conducted. Both the indicators provided adequate scores. Principal axis factoring (PCA) was postulated and the factor matrix obtained was rotated to a simple structure by means of a varimax rotation (Brewerton and Millward 2001, Howell 1995). The scree plot was used to determine the number of factors that should be included in the measurement. From the use of the Kaiser criterion, it emerged that nine factors could be extracted, explaining 54.3% of the total variance based on the cumulative percentage of eigen values. Statements with a value greater than 0.3 were retained and could be regarded as meaningful to be included in a dimension (Hintze 1995). Table 4 indicates the factors with the number of statements grouped into the newly identified factors (dimensions) as well as the statement numbers.

Table 4 Results of the first factor analysis

Factors	Number of statements/items	Statements
Factor 1	20	49, 55, 50, 54, 62, 35, 61, 58, 57, 28, 60, 22, 56, 24, 66, 64, 42, 21, 47, 32
Factor 2	13	44, 43, 30, 36, 45, 29, 34, 38, 46, 53, 19, 27, 52
Factor 3	5	26, 23, 39, 31, 33
Factor 4	6	48, 63, 40, 20, 59, 41,
Factor 5	5	69, 65, 70, 67, 68
Factor 6	2	71, 72
Factor 7	3	25, 37, 51

A second-phase factor analysis was conducted to establish whether the items in factor 1 could be further grouped into subdimensions. The analysis indicated that the items could be grouped into two new dimensions as outlined in Table 5.

Table 5: Second phase factor analysis – Factor 1

Factors	Number of statements/ items	Statements
Factor 1	12	54, 60, 64, 57, 49, 62, 61, 66, 50, 56, 42, 47
Factor 2	8	21, 28, 24, 22, 55, 35, 32, 58

6.4 Reliability analysis

The Cronbach alpha was calculated to determine the reliability of each factor (Church and Waclawski 1998). Table 6 indicates the final six factors (dimensions) of ISCA with the corresponding Cronbach alpa and dimension description. The results indicate that the Cronbach alpa for factor 4 can be improved to 0.930 if statements 23 and 39 are omitted. These statements, however, relate to the measurement of the effectiveness of information security communication efforts. Owing to the importance of assessing the communication efforts, the statements were included. The Cronbach alpha for all six factors was above 0.7, which was deemed acceptable as a minimum value (Brewerton and Millward 2001).

Table 6: New ISCA dimensions

Factor – ISCA dimension	Cronbach alpha	Name	Description
Factor 1	0.887	Information Security Commitment	The perception on the commitment from an organisational, divisional and employee perspective regarding the protection of information and implementation of information security controls.

Factor – ISCA dimension	Cronbach alpha	Name	Description
Factor 2	0.766	Management Buy-in	The perception on management buy-in towards information security and the importance attached to the concept by senior managers and executives. The concept of management adherence to the information security policy is also established.
Factor 3	0.878	Information Security Necessity and Importance	Information security necessity is established by focusing on specific concepts such as people, time, money and the impact of changes.
Factor 4	0.798	Information Security Policy Effectiveness	The effectiveness of the information security policy and the communication thereof is established.
Factor 5	0.803	Information Security Accountability	Individual accountability to compliance and the requirements for information security training.
Factor 6	0.764	Information Usage Perception	The perception on information security and privacy usage requirements.

7. Conclusion and recommendations

The aim of this research was to conduct an information security culture assessment and to revalidate the ISCA. The results of the statistical analysis, and improvements in the survey instrument and, subsequent interventions after each assessment, illustrated the benefit of utilising the ISCA. The means of each of the dimensions in the 2006 assessment improved compared to the 2013 assessment, following the implementation of specific training initiatives over a period of time. It was found that employees who had attended training were more positive compared to employees who had not received training.

The results also indicated that the ISCA is a valid measurement instrument. The Cronbach alpha showed that the internal consistency of each factor was above the minimum required values, thus contributing to the reliability of the ISCA.

Through this research study, the ISCA was expanded to include privacy concepts. This allows organisations to measure the concept of information security culture in relation to the protection and usage of personal information to effect compliance behaviour. By introducing the concept of privacy it becomes necessary to extend the definition of information security culture and to formulate a definition for this concept. Considering the definition of information security culture and the concept of privacy, an “Information Protection Culture” can be defined by the researchers as *“a culture in which the protection of information and upholding of privacy are part of the way things are done in an organisation. It is a culture in which employees illustrate attitudes, assumptions, beliefs, values and knowledge that contribute to the protection and privacy of information when processing it at any point in time in the information life cycle, resulting in ethical and compliant behaviour.”*

In reviewing the adapted ISCA measurement instrument it was found that it could be further improved in the future by considering more statements relating to the appropriate and secure processing of information in line with privacy regulatory requirements. This would entail that the Information Security Culture Framework (Da Veiga and Eloff 2010) which the ISCA is based would need to be amended to support the Information Protection Culture definition and newly defined ISCA dimensions.

The findings of this research are of particular importance to Information Security, Privacy, Risk, Training and Compliance Officers. The findings provide insight into the survey methodology and assessment instrument that

organisations can apply to determine current and potential risks from an employee perspective to the protection of information.

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ERP Systems and Organizational Learning: Where do we Stand? A Literature Review

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Abstract: ERP systems are today implemented in a great number of organizations. Research has invested much energy and time to make descriptions and recommendations regarding how the implementation should best be managed. The next step in practice as well as in research is how to continue to develop the business processes and ERP systems in order to take advantage of all their promises, and to refine how ERP systems are used in day-to-day activities. A starting point for the present study is that organizations today are characterized by strong external and internal pressure. In order to respond to and deal with these, organizations strive to balance demands regarding stability and change. This implies that organizations put effort into designing and maintaining or changing practices, rules and routines. Within the general fields of organization theory and management accounting/control the ambition to create deliberate change is often conceptualized as processes of organizational learning (OL). This concept has also been used in the context of ERP systems. The research field is however heterogeneous and findings are scattered and inconsistent. There is a need for further development of our knowledge about the role of ERP systems in processes of organizational learning after the implementation phase. The present paper strives to consolidate and synthesize the current knowledge. The research question is to what extent and how do research conceptualize organizational learning and its interactions and involvement with the ERP system? The paper is a literature review of research on OL in the context of ERP systems. The aim is to analyze and classify previous research, and also to give suggestions for avenues suitable and fruitful for future research. The review compares and contrasts approaches in order to analyze similarities and dissimilarities and to investigate what topics or issues have been addressed by previous research. The analysis shows that overall there is a lack of definitions and stringency in research on OL in an ERP systems context in the post-implementation phase. The final section also forwards some suggestions for future research.

Keywords: ERP systems, organizational learning, stability, change, literature review

1. Introduction

Research on ERP systems has grown over the years. Already several years ago research pointed the direction for also focusing the post-implementation phase of the projects (for example, Botta-Genoulaz et al. 2005; Gattiker & Goodhue 2005; Shang & Seddon 2002) which is still a current research topic (Law et al. 2010). The phases of an ERP project can be described in different manners, for example as the five phases of design, implementation, stabilization (also called the shake-down phase), continuous improvement, and transformation (Ross & Vitale 2000), where in this paper the three last phases are regarded as post-implementation. The growing numbers of research articles however make our knowledge limited as to how far our knowledge has evolved. There is need of a synthesis of post-implementation research. A starting point for the present article is that the use of an ERP system implies a continuous change process, where people interact with the technology in every day practice. At the same time the organization is exposed to strong external and internal pressure in a globalized world, which can be characterized as competitive and institutional pressures (cf Benders et al. 2006). Due to the complexity in these pressures the deployment of an ERP system also may lead to standardization within and between organizations (ibid.). There is thus a need for organizations to balance demands regarding stability and change.

The deployment of ERP systems increases the need for organizations to adjust, to learn to do things in new ways, and even to think in a new manner (Myreteg 2007). The expected benefits of ERP systems can be located in several dimensions: operational, managerial, strategic, IT infrastructure, and organizational, where organizational learning is included as a benefit (Shang & Seddon 2002). The concept of organizational learning (OL) is based on the works of Bateson (1972) and furthered by Hedberg (1981), Argyris and Schön (1978) and Argyris (1977). OL comes about when individuals that acts as agents for the organization are involved in learning activities (Argyris 1977). The use of an ERP system need to be regarded as part of a total organizational development program in order to facilitate learning (ibid., p. 121) which corresponds to a holistic view of the relationship between IT and the social organizational life (ensemble view; embedded technology; Orlikowski & Iacono 2001).

The dynamic concept of OL is a possible and fruitful starting point for evaluating and synthesizing research regarding the post-implementation phase with a broad analytical value and used in several academic disciplines, such as organization theory and management. We need to further its application in the area of ERP systems. The question in this article is to what extent and how does research conceptualize organizational learning and its interactions and involvement with the ERP system?

The following method was adopted: The review was restricted to the period from years 2005 unto 2013. Articles published in academic journals were searched using web search facilities on the keywords enterprise resource planning and organizational learning, in IS and management research. Based on the abstracts, a further selection eliminated articles about the early phases of ERP projects. A total of 15 articles were selected and analyzed.

It is difficult to find agreement on OL and its definitions. Different classifications are complementary, rather than exclusive. The article starts with the ambition to model OL, followed by an analysis and classification on previous research on OL and ERP systems in the post-implementation phase. The review compares and contrasts approaches, striving to identify similarities and dissimilarities, and to investigate what topics or issues have been addressed. Based on this analysis an assessment is made on the standings of research in the field. Finally, some suggestions are made for future research.

2. The concept of organizational learning

The idea of organizations as learning systems is developed from an interest of how information processing is carried out within the organization. A distinction was made between single-loop and double-loop learning. In a single loop, the learning is restricted to an ability to detect and correct errors in accordance to the operating norms that were previously set up (using budgets, performance reports, and deviation analyses). In double-loop learning the set objectives and basic norms need to be repeatedly challenged over time. Instead of being occupied with “keeping the course”, goals and norms are reviewed and changed as needed (Argyris 1977). Another approach to organizational learning can be found in organizational research and the concept of organizational memory (e.g. Stein 1995, Walsh & Ungson 1991). Here, what people learn is collected and saved within a storage device (i.e. the ERP system) in the organization; the organizational memory.

Robey et al. (2000) carried out an early review of OL in IS research. They found research either be occupied with OL *about* IT, or with IT designed to *support* OL. It is thus of interest to separate research into two tracks: one who considers how actors get to learn how to use ERP systems, and another who investigates how ERP systems may be used to support learning. Shang and Seddon (2002) distinguish between five groups of expected benefits of ERP systems: operational (tangible benefits linked to business value chain processes and end-results, such as quality), managerial (intangible benefits regarding resource management, planning and decision-making), strategic (mostly intangible issues related to business expansion, product and marketing competition), IT infrastructure (tangible as IT costs, indirect support for business changes), and organizational (mostly intangible benefits linked to work patterns, individual attitudes, interpersonal relations, facilitating OL, empowerment, and common vision). The present article makes use of these to identify what topics the reviewed articles are concerned with. The analysis spurred the need for a sixth group to be added: fit.

3. Organizational learning in OT and management studies

One method of classifying OL research is to separate it by its conclusions into three groups (Dodgson 1993): i) the goals of learning (outcomes), ii) learning as a process or iii) the ways in which learning may be facilitated and impeded. According to a similar classification by Bapuji and Crossan the difference between studying the process of learning (ii) and studying the facilitators of learning (iii) is a difference in perspective. In the present study articles have been classified as a study of OL as a process if the learning was regarded as carried out over time, for example through interaction between different actors, or if the researcher investigated different learning strategies. If the reviewed article tested different types of factor models to investigate what factors were important or not for learning to occur it was classified to the group where facilitators and impediments are regarded as critical (OL as CSF).

Another classification was made by Lähteenmäki et al (2001). They are very critical: OL conceptualizations were vague, and little empirical research had been done. Bapuji and Crossan (2004) however note that empirical OL research has increased, and also that the field is maturing. Shipton (2006) confirms Lähteenmäki

et al.'s estimation that there is a lack of empirical testing within the field. The present article will investigate whether the reviewed articles use empirical material.

A model developed by Shipton (2006) introduces research approach as a continuum from prescriptive/normative to explanatory/descriptive. Combined with the dimension individual or organizational learning, Shipton creates four areas of research with different key features (figure 1). Quadrant 1 represents an idealized view of learning. The other quadrants includes research that is, more or less, critical to the idealized vision. In quadrants 1 and 2 research deals with the anticipated outcomes by learning and with how to transfer learning from individuals to the organization. In quadrant 3 research focuses on identifying changes rather than the outcomes of learning. According to Shipton this perspective is especially concerned with dysfunctional aspects and less than optimum results by learning; these researchers regard learning as an imperfect process (Shipton 2006). In quadrant 4 research is descriptive, which difficulties to draw general conclusions and few practical implications (Shipton 2006). The present article uses this framework, even if what she calls a "continuum" is nonexistent: the model display four different positions (figure 1).

<p>Quadrant 1</p> <p>The prescriptive perspective</p> <p>Individual learning</p>	<p>Quadrant 2</p> <p>The normative perspective</p> <p>Organizational learning</p>
<p>Quadrant 4</p> <p>The descriptive perspective</p> <p>Individual learning</p>	<p>Quadrant 3</p> <p>The explanatory perspective</p> <p>Organizational learning</p>

Figure 1: OL research as four different areas (based on Shipton 2006)

The present study includes the following aspects in the review process: **topic** (six dimensions of benefits with ERP systems), **method** (theoretical, survey, field or case study), **research approach** (prescriptive, normative, explanatory or descriptive), **view of ERP** (simple or complex view), **relationship between ERP and OL** (how users learn about the ERP system, or how ERP can support learning), **level of learning** (individual or organizational learning), and **view of learning** (OL as a process, as related to critical success factors (CSF), or OL as an effect of using ERP).

4. Advances so far: Organizational learning and ERP systems

Research on IT and OL is a growing field, which only some years ago was described as being in its early history (Robey et al 2000). Since ERP systems today are very commonly used in organizations of all sizes, it is important that we increase our knowledge on every aspect of how these systems are used within organizations. OL as a theoretical concept was found to be little used in a previous review of articles treating the selection, implementation and use of ERP systems (Myreteg 2009).

4.1 Classification of research on OL and ERP systems in the post-implementation phase

The literature about ERP and OL in the post-implementation phase is heterogeneous (table 1). All 15 identified articles assumed ERP systems to be complex IT systems (explicitly or implicitly). 12 treated the relationship between OL and ERP as an issue of how actors learn how to use ERP (9 lifted the discussion to a group or organizational level). Only three studied how ERP systems can be used to support OL. Two of these were empirical, one was theoretical. This is an unbalanced state; research neglects issues concerning how technology may support OL.

Six articles defined learning as a process, and six viewed learning as a CSF. Only three studied the implication the ERP system had on OL. Of these, only one took an interest in how ERP, by supporting learning, gave benefits to business operations. The other two studied organizational benefits.

Almost the complete set of identified articles was empirical studies: only two were theoretical. Of the rest, six were case studies (one or several cases), two were field studies, and five surveys. The articles were analyzed to reveal patterns or trends that could be evolving over time (change of interest regarding topic, definition of OL, choice of method, *et cetera*). No such patterns were however found.

Table 1: Analysis of ERP and OL research in the post-implementation phase during 2005 - 2013

Author/-s	Year	Topic (benefit of ERP)	Method	Research approach	View of ERP		Relationship ERP-OL and level of learning		View of OL		
					simple	complex	learning about ERP	ERP design to support learning	OL as a process	OL as CS F	OL as an effect of ERP
Boudreau & Robey	2005	ORGANIZ.	CASE	EXPLANATORY		X	INDIVID.		X		
van Fenema et al	2007	ORGANIZ.	CASE	DESCRIPTIVE		X	ORG.		X		
Graville & Compeau	2008	ORGANIZ.	FIELD	NORMATIVE		X	ORG.		X		
Wagner & Newell	2007	ORGANIZ.	CASE	EXPLANATORY		X	ORG.		X		
Boudreau & Seligman	2005	ORGANIZ.	CASE	EXPLANATORY		X	ORG.		X		
Ettlie et al	2005	ORGANIZ.	SURVEY	EXPLANATORY		X	ORG.		X		
Wang et al	2007	FIT	SURVEY	NORMATIVE		X	ORG.			X	
Saraf et al	2013	FIT	SURVEY	EXPLANATORY		X	INDIVID.			X	
Chang & Chou	2011	ORGANIZ.	SURVEY	NORMATIVE		X	INDIVID.			X	
Wang et al	2006	ORGANIZ.	SURVEY	EXPLANATORY		X	ORG.			X	
Chen et al	2009	MAN.	CASE	EXPLANATORY		X	ORG.			X	
Wang & Ramiller	2009	IT-infrastr.	FIELD	EXPLANATORY		X	ORG.			X	
Ryu et al	2005	ORGANIZ.	THEORETIC	NORMATIVE		X		INDIVID.			X
Cotteleer & Bendoly	2006	OPERAT.	CASE	EXPLANATORY		X		ORG.			X
Tomblin	2010	ORGANIZ.	THEORETIC	EXPLANATORY		X		ORG.			X

4.2 Illustration of the reviewed research by research approach

In the present review, no article was prescriptive research but as many as four were normative (figure 2). Within quadrants 3 and 4 there is a great variety of research approaches. Case studies are found in both. Only one article was considered more of a descriptive kind. The biggest share of articles is found in quadrant 3, where researchers explain OL as a problematic process or explain the importance of factors involved in learning. Researchers seem to have listened to the previous calls for more explanatory research about OL as a process (i.e. Robey et al 2002). That this research would be especially concerned with dysfunctional aspects, which Shipton (2006) claims, is not supported by the present analysis.

5. Conclusion and issues for future research

The present article investigated research on OL in the context of ERP systems in the post-implementation phase. The aim was to analyze and classify previous research compare and contrast approaches in order to analyze similarities and dissimilarities and to investigate what topics or issues have been addressed by previous research. A framework for the analysis was constructed based on research on OL in the organization and management fields. 15 research articles were identified and reviewed. They were classified based on what topics were addressed, what methods were used, view of OL, how they constructed the relationship between

OL and ERP system, level of analysis, and research approach. The analysis shows great variety in research and the overall impression is a lack of definitions and stringency in the field.

Quadrant 1	Quadrant 2
The prescriptive perspective	The normative perspective
	Ryu et al 2005 T (three different learning processes)
	Wang et al 2007 S (learning as a knowledge transfer)
	Graville & Compeau 2008 F (software training, learning strategies)
	Chang & Chou 2011 S (learning is a critical factor)
Quadrant 4	Quadrant 3
The descriptive perspective	The explanatory perspective
van Fenema et al 2007 C (necessitates OL, learning increase)	Boudreau & Robey 2005 C (improvised learning)
	Boudreau & Seligman 2005 C (quality of use)
	Ettlie et al 2005 S (strategic predictors)
	Wang et al 2006 S (knowledge transfer, fit)
	Cotteleer & Bendoly 2006 C (order lead-time improvement)
	Wagner & Newell 2007 C (participation, post-implementation)
	Chen et al 2009 C (project management)
	Wang & Ramiller 2009 F (innovation, community)
	Tomblin 2010 T (theory development)
	Saraf et al 2013 S (absorptive capacity)

- C:** case study
- F:** field study
- S:** survey
- T:** theoretical study

Figure 2: Classification of ERP and OL research in full text during 2005 – 2013, based on research perspective

Topics varied from some focusing on management activity, IT-infrastructure, and operational effects, or the importance of fit between ERP and institutional pressures. Mostly they addressed organizational benefits of different kinds (i.e. individual attitudes, interpersonal relations, participation, general use, reinvention, avoidance, and resistance). The vast majority of the identified articles treated the relationship between OL and ERP as how users learn to use ERP, and disregarded how ERP can support OL. A conclusion is that it is truly problematic that we lack research concerning ERP as a support for OL. There is a heavy dominance of studies concerning how to use the ERP system itself, rather than investigating how IT can support learning processes that could have operational, managerial, strategic or organizational benefits. For the promised benefits of ERP

systems to be realized in practice we need to know more about how organizations can use them to support how to work and think in a new manner.

The current article suggests future research to better state the topic under investigation: to avoid treating organizational benefits as unspecified, intangible benefits related to attitudes and general usage, and to particularly focus on managerial issues (such as resource management, planning and decision-making) and operational benefits (tangible benefits linked to business value chain processes and end results; quality). This together with the study of how ERP can support OL will make a fruitful avenue for future research.

Bapuji and Crossan (2004) and Shipton (2006) concluded that empirical OL research has increased, which is supported by the present study: only two articles were theoretical and the rest used empirical material in some form for the analysis.

Previous research has suggested that research should regard OL as a process and disregard critical success factors (Robey et al 2002). Of the reviewed articles six regarded OL as a process, but an equal number still studied CSF. Few of the articles that saw OL as a process succeeded in illustrating explicitly the relationship between OL and the ERP system. Mostly they discussed learning as an increased understanding of ERP systems. There is still a general lack of precision in accounts of who, when, how and what was learnt, and the role of the ERP system in this. In line with previous calls for research, the present analysis revealed that the majority of research was explanatory. However, the question still remains whether these articles explain the phenomena that are most important for us to understand in order to make sure the promised benefits of ERP systems are realized. The complexity of the ERP system and how that can be understood, how the artifact functions or interplays with the organization and the organizing process, is seldom discussed in greater detail. If learning in organizations, at least partially, depends on the use of enabling technologies (Robey et al 2000), it would be a worthwhile effort to analyze more closely how, when and why an ERP system can be used in this respect

Further, few of the reviewed articles defined OL as an effect of the use of ERP systems, that is: focused on the role the ERP system played in the organization for its learning. A conclusion is that in order to investigate and reach a full understanding of ERP systems and their role in organizations, it is important that we set our mind at having them play an important role in processes of learning. It is not sufficient to state that ERP systems are complex artifacts (which all the identified articles did; explicit or implicit). If research assumes that ERP *contains* a structure that the user must apply, and that there is a “right” or “wrong” way to use the system (cf. Orlikowski & Robey 1991), this means it is sufficient that users learn to use ERP in a “proper way” to have desired results. If research however considers the ERP system to be an artefact that emanates in and is enacted by the actual usage – that is: the system does not contain structures, but users interact with the system and thus *invent and create* its possibilities and embed it into the socio-economic reality of the organization (Orlikowski & Iacono 2001) – it is important that research acknowledges that users and the organization hold the keys to how ERP systems should be designed and used in the specific situation in order to achieve and support OL. Then it is not enough to focus on getting users to learn “how to use the system”, the issue of achieving OL – and especially double-loop learning – runs deeper than that. The definition of the ERP system as an artifact is thus of great importance, just as Orlikowski and Iacono (2001) argues, and needs to receive more attention in future research.

To sort the articles on publishing year did not reveal any patterns or trends of any kind (for example regarding topic, definition of OL or choice of method), so the conclusion is that research in the current field is not developing in a certain or specific direction.

Finally, an observation should be made of the difficulty of carrying out the classification of the investigated articles. The borderlines between the four perspectives, for example, are not obvious. Shipton’s framework (Shipton 2006) is not unambiguous and could be improved. The interpretation of whether the level of analysis is at the individual or at a group or organizational level is also difficult to make; organizational learning deals with a situation when individuals acts as agents for the organization and are involved in learning activities (Argyris 1977). This is also one of the strongest critiques to the concept of OL that it is problematic to talk about an organization learning when it is *de facto* the individuals belonging to the organization that learn (see for example Huber 1991). If a broad definition of OL is selected this would imply that all articles that analyze individuals as members of an organization (as separated from individuals as private persons) are investigating

learning at an organizational level. Thus, the distinction in the present article between organizational and individual analysis should be regarded as suggestive.

To sum up, the review of research in the field of OL and ERP systems in the post-implementation phase shows a need for further research. It is of great importance that research defines what is meant by OL and how the ERP artifact is defined. Analyses should be more explicitly engaged with the relationship of how ERP systems may support OL, especially focusing on areas of ERP benefits such as operational, managerial, strategic, and organizational benefits. These benefits need to be well defined so that research may contribute with specific theoretical knowledge as well as practically relevant and realizable knowledge. Questions of what role or function ERP systems may or should have in the OL process has so far not been advanced in research. Future research need to be more specific regarding what OL involves. As long ago as 1991 Huber noted the lack of cumulative work and lack of synthesis of work from different research groups in the area of organizational learning. It seems much remains to be done in research in order to correct these deficiencies.

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Critical Organizational Challenges in Delivering Business Value From IT: The Perspective of Lebanese CIOs

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Abstract: The collective body of theoretical and empirical research in Information Systems (IS) comes mainly from the West. While there is emerging IS research in some developing countries and parts of the Middle East, the research agenda in Lebanon is so far non-existent. This study forms part of a larger research project to explore and analyze the perceived value of IS and the organizational competencies needed to deliver that value in Lebanon. Many of the challenges faced by Lebanese organizations are also dominant in the literature. These include resistance to change, which is often found in large and mature organizations and often exacerbated by enterprise IS projects. Other common challenge include how to enrich the IS literacy of Line Managers and users; how to improve CIO to CxO relations; and management of benefits to be derived from IT. There are, however, many challenges that are unique to Lebanon, which include the overabundance of family owned and controlled businesses, with consequent mixed impacts on the management of IS. Lack of political, economic and social stability in Lebanon poses further challenges, as does the heavily regulated telecom sector resulting in expensive, unreliable, and inconsistent access to networks and bandwidth. Further challenges arise from the often damaging effects of the local culture of individualism, procrastination, and entitlement. There are also many challenges associated with the growing pains of the IS discipline in Lebanon, including: lack of formal IS Governance; heterogeneous and unduly complex applications architectures; talent management; and how to improve the competence of partners. These challenges may best be mitigated by developing organization-wide IS competencies, and the development of these competencies is an organization-wide responsibility.

Keywords: IT value; IT competencies; IT challenges; IT capability; ERP CSFs; CIO

1. Introduction

While the predominant source of Information Systems (IS) research comes from the West, there is emerging IS research in developing countries and in the Middle East region. Although the IS literature coming out of Europe and the USA is relevant to the global community of academics and practitioners, valuable insights could be gained from the experiences of companies in other countries and continents. This paper reports the first part of a larger research project to explore and develop theories explaining how organizations derive business value from their investments in IS, and what competencies are critical to sustain that value, within the context of Lebanon. The aim of this paper is to develop a general baseline of the IS landscape in Lebanon, and to explore and assess the key challenges Lebanese organizations face in delivering business value from IT/IS and to suggest how these may be mitigated through the point of view of the CIOs in these organizations.

2. Literature review

2.1 The ever elusive value of IT

DeLone and McLean (1992), through a comprehensive literature review of IT success measures, observed that “in searching for an information systems (IS) success measure, rather than finding none, there are nearly as many measures as there are studies”. These authors developed an integrated view of IT success by defining six major dimensions: systems quality, information quality, use, user satisfaction, individual impact, and organizational impact. Later, DeLone and McLean (2003) added the concept of service quality and net benefits, reflecting the positive or negative impact of IS on customers, suppliers, employees, organizations, markets, industries, economies or even society.

The term IT business value has been commonly used to refer to the organizational performance impacts of IT, including productivity enhancement, profitability improvement, cost reduction, competitive advantage, inventory reduction, and other measures of performance (Devaraj and Kohli, 2003; Hitt and Brynjolfsson, 1996). General expectations are that IT provides services with better quality at a low cost and low business risk with increased agility (Govekar and Adams, 2010). Kohli and Grover (2008) have defined value as the ability to improve access to information, and the ability to generate value from information, and improving the quality and abundance of information.

There isn't a single agreed upon measure of the impact and value of IT, and there are many stakeholders involved in the IT value proposition each having different and often competing needs. The business executive's view of IT value may be different than the view of the corporate IT function, and this in turn, may be different than the view of the actual users of IT, and the view of the other organizational stakeholders, such as customers, partners, and suppliers. While there's general agreement on the overall expectations, benefits, and resulting business value from IT, there continues to be challenges in delivering that value.

2.2 ERP implementation challenges

Momoh et al., (2010) conducted a detailed review of the critical factors that cause enterprise resource planning (ERP) implementation failures, based on an in-depth literature review (1997-2009). Nine factors were found to be critical in the failure of ERP: excessive customization, dilemma of internal integration, poor understanding of business implications and requirements, lack of change management, poor data quality, misalignment of IT with business, hidden costs, limited training and lack of top management support.

2.3 How to get value from IT

In the quest to find the "silver bullet" for deriving business value from IT, scholars and researchers have prescribed a number of different cures. Some advocated the use of IT Governance (Marshall et al, 2007; Sambamurthy and Zmud, 1999; Peterson, 2004; Weill and Ross, 2004). Others have suggested the use of formal benefits management processes to manage value throughout the lifecycle of the IT value proposition (Peppard, 2007; Ward and Daniel, 2008).

There is also a large body of research evaluating individual competencies needed by the Corporate IT function and the CIO. Periasamy and Seow (1998) identified five critical success factors for the CIO to deploy IT to deliver optimal value to his organisation promptly and successfully. Lane and Koronios (2007) found that the role of the modern CIO has become increasingly business focused and strategic, and that soft skills dominate the critical competencies. For example, Polansky et al. (2004) presented a 10 Point Leadership Agenda for CIOs, which comprised IT strategy; IT governance; IT organisation and staffing; technology and architecture; technology awareness; corporate governance; business intelligence; business transformation; customer care; and Internet and e-business. CSC (1997) defined six leadership roles for the CIO (e.g. Chief Operating Strategist) and Remenyi et al. (2005) used the analogy of the Chameleon to describe the key characteristics of CIOs (e.g. the ability to change). Chun and Mooney (2009) found that much of CIO role has evolved to the executive-level management and is centered on working with other business executives inside and outside of the firm to change the firm's strategy and processes.

A stream of research has looked beyond the individual competencies needed by CIOs and the corporate IT function, and stressed the importance of user-related and other contextual attributes as contributing factors to IS success. Sabherwal et al. (2006) developed and tested a comprehensive theoretical model linking IS success with four user constructs (user experience with IS, user attitude towards IS, user training in IS, and user participation in the development of IS), and two constructs representing the context (top-management support for ISs and facilitating conditions for ISs). Several authors (Armstrong and Sambamurthy, 1999; Feeney and Willcocks 1998; Sharma and Yetton, 2003) emphasized the importance of non-CIO executives taking an active role in the planning of IS. Peppard and Ward (2004) argued that competence is an organizational concept that reflects a bundle of skills and technologies while capabilities are related to the strategic application of competencies in order to achieve business objectives.

2.4 The country-specific CIO experience

A number of other authors have explored the challenges faced and competencies needed by CIOs within the context of a particular country. For example, to understand the individual competencies required of CIOs in Brazil, Vreuls and Joai (2011) evaluated seven competency models found in literature and used a pure quantitative approach to identify CIO competencies from the perspective of Brazilian CIOs. They concluded that CIOs should possess/develop knowledge of the business; understanding of the organizational context; the ability to influence the organization; technical expertise; external networking; management of the information technology operation and the capacity to innovate using new information technologies.

Zuo and Maou (2005), carried out the first academic study in China with regard to CIO state and impact. The CEO's perspective in that study was that CIOs need to be more business-oriented, requiring soft skills and relationship management skills. Using a different approach, Gottschalk (2000) looked at CIO roles in Norway, which lead to the identification of required competencies. Oracle conducted a study in 2011 and included information from a number of regional CIOs/organizations (e.g. Saudi Arabia, Emirates, Jordan, Dubai, India and other emerging markets). They found that the IT knowledge and competency of non-IT people (general Management and the users) is weak and that CIOs are surrounded by executives who have an inadequate awareness of IT capacity.

3. Data collection

The data in this paper has been collected from interviews with the CIOs of the participating organisations. Two interviews with each of the participating CIOs were conducted, followed by an offline collaboration process, using email as the platform to confirm and to prioritize the challenges raised during the interviews. Next, a one day forum was organized allowing the CIOs to meet each other and to collaborate real-time on the key challenges. The forum was also used as an opportunity to plant the seeds for a more permanent platform for CIO collaboration and for future research, which ultimately resulted in the formation of the "CIO Lebanon Association" officially approved by the Lebanese Ministry of Interior.

Data from Kompas (2009) was initially used to identify the total population of industries and organizations. Subsequently, a sample was selected to include organizations that represented the four key industries in Lebanon: Banking, Healthcare, Higher Education, and Retail (77% of the sample included such companies). It was also important to choose organizations that had significant experience in IT/IS, and with no prior IS studies to reveal that population, organization size (no. of employees) was used as a substitute to select the participants (35% of large organizations and 8% of medium size organizations in Lebanon were included in the sample), (See Tables 1 & 2):

Table 1: Lebanese organizations and sample used

	Total for Lebanon	Sample
No of Organisations > 500 employees	78	26
No of Organisations 250 - 500 employees	122	10

Table 2: Participating organizations

Sector	Sample
Banking	11
Healthcare/Hospitals	6
Higher Education	6
Airline carrier	1
Post office	1
Retail	5
Telecomms	1
Printing	1
Logistics	1
Pharmaceuticals	1
Food & Beverage	1

4. Results

A total of 14 key challenges were identified as follows:

4.1 Change resistance

The majority of CIOs indicated that it was very difficult, costly and time consuming to implement business process changes and related behavioral changes in their organizations. This was by far one the most important challenge raised. The CIOs attributed this challenge to a number of factors, including: the ownership of IT projects resting upon the IT function; not having or not adopting a formal change management process which clearly identifies and communicates the required changes and responsibilities required to make such changes; the lack of IT literacy of the users and management; lack of a Benefits Management process; having powerful users with self-serving and hidden agendas; and lack of having change champions, and the lack of empowering the CIO to be change agents.

According to the majority of CIOs, the mitigation of this challenge requires organizational leadership that recognizes the strategic value of IS investments and empowers CIOs to partner with the users to resolve the above factors.

4.2 IT illiteracy of management and users

While this was generally less of an issue in some sectors (e.g Higher Education), this was a major issue preventing the majority of participating organizations in getting maximum value from IT. The CIOs of organizations that had this issue attributed it to a “*generational gap*” claiming IT illiteracy among their older employees who were still in charge of key management positions. Other CIOs blamed the Higher Education sector in Lebanon for not preparing future managers adequately in the use and exploitation of IT. While most of the participating organizations had developed employee training programs, the training was more oriented to developing general IT literary competencies, rather than developing IT planning, exploitation, and value extraction training.

4.3 Inadequate CIO to CxO relations

The title of CIO was only given to four of the participants, while others held a number of other titles, including Director of IT, Head of IT, and IT Manager. Three of the CIO positions were in the Banking sector, and one in Higher Education. More than half of the participants reported directly to the top executive. 80% of the CIOs in the Banking sector reported to the COO, and only one of the CIOs in the Higher Education industry reported directly to the President, the rest reporting to the VP of administration position. In other sectors, it was a mixed bag, with some CIOs having direct access and strong relationships with their CEOs, and others reporting to lower level executives and therefore lesser potential impact on their organizations. Where the relationship was direct, the CIOs enjoyed a strong and productive relationship, resulting in an equal seat at the executive table and a direct involvement and impact to their organization’s strategy. Many of the CIOs who did not hold that title, or did not report directly to their CEOs expressed a deep concern and attributed this issue to the lack of appreciation of the strategic value of IT within their organizations.

4.4 Lack of formal and comprehensive benefits management

None of the participants had implemented a comprehensive benefits management program. While some (25%) had developed formal processes at the early stage of planning IS investments (by using business cases), and others (50%) had formal project management practices during the implementation stage of IS projects, none had any meaningful management practices at the post implementation stage. It also seemed that the majority of companies and their management were not interested or capable of measuring the value of their IS investments. Of those companies that were measuring, the focus was either on project efficiency measures (in-flight, or during IT project implementation metrics) such as: delivery of projects on time, on budget, and according to customer scope and requirements; or the focus was more on IT operational measures (availability, throughput, and response time).

The majority of CIOs were also struggling to convince their users to own or at least co-own the responsibility of deploying information systems and more importantly the responsibility of reaping the benefits from such investments. In addition, the business value of IT was poorly defined and vaguely understood and not common

to all stakeholders within the organization. More than 40% of organizations viewed IT as a cost center, rather than as a partner in generating value.

4.5 Family business ownership

With the exception of organizations that were owned by religious entities (three Hospitals and three Universities), or public organizations (two were involved in this study), or organizations that weren't family owned (two Universities, and two other organizations), all remaining 26 organizations were family-owned, which constituted 72% of the participating organizations.

The predominance of family business ownership is one of the characteristics of the Lebanese economy. In family firms, property and control are so firmly entwined that family members are involved in both strategic and day-to-day decision making, and the firm is shaped by dynastic motive. As evidenced by this research, the family impact extends to large organizations, and many organizations in the thriving banking industry, for example, were closely held by extended families. Five of the family-owned organization felt that family-ownership was a positive situation because it involved leaders who were also owners that cared about the longevity and long-term viability of their firms, as opposed to leaders that were only in these positions to establish short term gains. All remaining family-owned organization CIOs indicated serious disadvantages arising from family ownership, such as unfair and inconsistent human resource policies in the recruitment, selection, and promotion of employees.

4.6 Lack of formal IT governance

While a number of organizations, especially the ones in the Banking sector have instituted structural forms of governance, in the forms of organization-wide IT steering committees to approve and manage enterprise IT projects, IT decision rights were, in the majority of organizations, owned and exercised by the Corporate IT function. Many of the CIOs attributed this to the lack of technology literacy of their Management and users. There was also an emergence of enterprise-wide Project Management Office (PMO) structures in a few organizations, but these were in their very early stages. The PMO function either did not exist (75% of cases), or was just being implemented.

4.7 Complex IT applications architectures

The applications architecture (AA) construct is a conceptual model representing departmental and enterprise information systems in support of operational business processes and analytical decision-making. The challenge as described by the CIOs was that their AA was very complex, difficult to support, did not fully support their business strategy, and was not flexible. The most significant issues include:

- *Legacy information systems* built with technologies that are no longer supported by technology vendors, and no longer taught at universities or technical schools.
- *ERP systems that have been heavily customized and which were no longer supported by ERP vendors.* Almost every CIO indicated at one time or another having difficulty and/or failing to implement enterprise applications. Two of the major retail organizations had customized their ERPs to the point where it was impossible for them to upgrade to a new version of the ERP.
- *Too many technology solutions which made it difficult and costly to support.* One major bank's AA included every conceivable database management platform
- *ERP deployment approach.* This involved organizations that were headquartered in Lebanon but also operated in multiple counties throughout the Middle East. Due to the exorbitant cost and unreliable and slow Internet service in Lebanon and in the region, they were forced to implement a de-centralized ERP architecture causing delays and inaccuracies.
- *ERP implementation failures.* One involved a major company that spent three years and millions of dollars failing to implement their ERP, and a few cases that implemented successfully only after several failed attempts.
- *The majority of CIOs did not have a clear AA roadmap or strategy,* and even if such a roadmap existed, it was not a formal planning process linked with their overall business planning process.

The CIOs attributed these challenges to a number of factors including: having weak change management processes and not being empowered enough to enforce changes; immaturity of local implementation partners; inadequate IT literacy of line managers and users; the lack of viable local ERP providers; and the lack of reliable and affordable country infrastructure. These factors also alluded to the significant interrelationship of the 14 challenges raised. Finally, given the fragmented and complex nature of their AA, the CIOs felt the need identify, develop and sell the role of a chief architect. The majority of organizations did not have a dedicated resource in support of their convoluted AA.

4.8 IT talent management issues

This was mentioned as a key issue by more than 70% of the participants, and it was a more acute issue when it came to finding senior level people. A number of the CIOs felt that this was a much bigger issue 5 years ago when talent was being lost to higher-paying markets outside of Lebanon. However, due to the economic problems in the Gulf, and the relative stability in Lebanon, CIOs felt that this issue was more under control.

4.9 Budgetary constraints

This was more of a challenge in the Healthcare sector, as most of the organizations in this sector had cash flow issues due to significant delays in receiving remittances from the Government. The CIOs in the Healthcare sector indicated that the biggest share of their revenues came from government-insured patients (75%), and only 25% of their patients had private insurance. This was also a challenge in smaller organizations.

4.10 Political, economic, and social instability

Lebanon has witnessed many devastating wars before and after its independence from France in 1943. The most devastating recent war lasted for over fifteen years beginning in 1975. Another recent war in 2006 resulted in the destruction of the country's majority of infrastructure. Since 2006, the country continued to experience many additional conflicts inside the country and throughout its surrounding neighboring countries. Many of the CIOs expressed total frustration and lack of control over these issues and found this to be the most serious challenge they faced.

4.11 Telecommunications issues

During the initial interviewing process, this challenge clearly emerged as the top challenge among most CIOs. Issues related to the reliability, availability, and cost of Internet bandwidth was a key concern. This even resulted in three of the organizations having to compromise the architecture of their core ERP system. The affected organizations had several branches in the region, and have deployed an ERP product in a totally decentralized architecture/approach. Had they had more reliable and affordable Internet access, they would have chosen to deploy these ERPs using a centralized architecture/approach.

4.12 Lack of Governmental IT laws

One of the key issues raised by the majority of CIOs is the lack of any governmental ICT legislation regulating and protecting the electronic rights of organizations and consumers.

4.13 Local culture issues

This was mentioned by the majority of CIOs as a key and possibly detrimental factor in not only getting business value from IT, but in getting any value from the business. Three of the CIOs that are currently engaged in re-engineering their entire organization spend the majority of their time (one CIO indicated that it is as high as 70% of their time) dealing with and managing cultural transformation. The issue of "entitlement" was dominant in larger organizations, and in organizations that were family-owned.

4.14 Immaturity of local suppliers, vendors, and partners

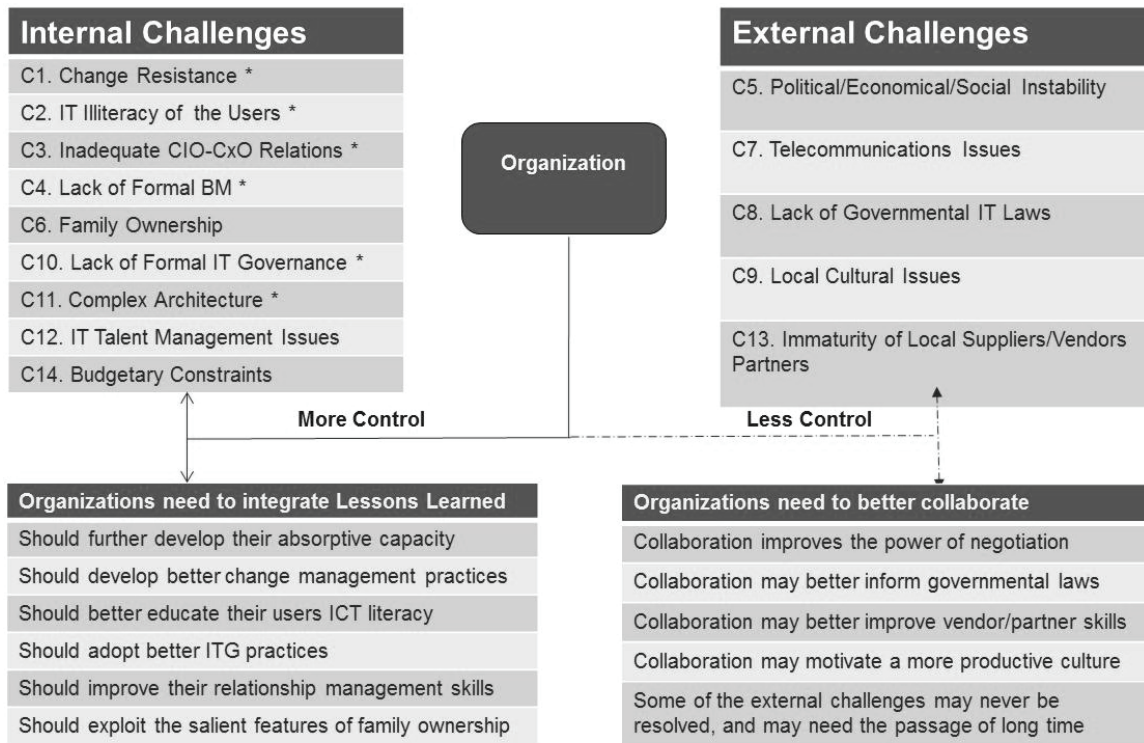
All CIOs indicated their extreme dissatisfaction with local software and professional services organizations, and expressed a need and commitment to help improve these vendors' service levels. Also of deep concern in the Hospital sector was the lack of ICT competence in doctors, which created a key challenge in rolling out IT applications and services. In the Higher Education sector, there were similar issues with Faculty members who

did not want to be involved in the planning, implementation or roll-out of applications, and when it came to using such applications, they abdicated that responsibility to their assistants.

5. Conclusions and future steps

Figure 1 shows the key challenges of delivering business value from IT in Lebanon and how these challenges may be mitigated. These challenges may be categorized as either “Internal” - contextual to an organization’s micro environment, or “External” - contextual to the larger macro environment an organization operates in. Nine of the challenges may be classified as internal, and therefore may be easier to mitigate, as compared to the remaining five challenges which are external and more difficult to mitigate. Given the right impetus, an organization may be able to mobilize resources and develop organization-wide competencies to mitigate such challenges. By empowering CIOs to be “change agents”, developing the proper organizational context, and motivating the appropriate organizational behavior, organizations in Lebanon may be much more effective in getting value from their IT/IS investments.

However the external challenges are more significant and may have a heavier impact on the organization, and their mitigation may require resources and strategies that may be more difficult to achieve and are beyond the control of the organization. Organizations may team up and collectively collaborate on finding solutions for these external challenges. Such collaboration platforms may have a better chance to improve governmental laws and regulations, and motivate local vendor and partners to improve their services, and to create the seeds for a more productive culture.



* Also dominant in the Literature

Figure 1: Key challenges and how to mitigate

The challenges faced may be classified as either “Internal” or “External”. Internal challenges may be easier to mitigate since they may be less dependent on external resources. Also, many of the internal challenges were also found in the literature (see * above, and literature section above). Given the abundance of the extant literature, Lebanese organizations should develop their “Absorptive Capacity”, which is a firm’s ability to identify valuable external knowledge, assimilate or transform this knowledge into the firm’s knowledge base, and apply this new knowledge through innovation and competitive actions (Cohen and Levinthal 1990). This would allow them to evaluate and integrate relevant lessons learned in “Change Management”, “IT Governance”, and other related practices.

External challenges appear to be more contextual and unique to Lebanon, and may require different mitigation strategies. For example, family-owned businesses, as some organizations in this study indicated, may have salient features and practices that should be shared and exploited, but the disadvantages of such organizational and management structures may require market corrections which may take a long time to materialize. The governmental constraints may also be eventually corrected, as was the case with some improvements in Internet bandwidth capacity that were observed as this study was unfolding. The issue with the local culture of procrastination and entitlement may also be improved with the passage of time, and with the constant flow and injection of "new blood" and new practices from other/Western countries, which was also observed as this study was unfolding. The CIO Lebanon Association platform which was launched as a direct outcome of this research provides organizations in Lebanon the opportunity to mitigate challenges by collaborating and sharing local and international best practices.

This paper reflected upon the Lebanese CIO's point of view and experience regarding the value of IT and how to attain it. Future research projects should also assess the point of view of other organizational stakeholders, which in turn would provide a more complete picture of how to best deliver business value from IT.

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Understanding the Roles of Enterprise Architects in a Proactive Enterprise Development Context

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Abstract: Understanding the significant roles of enterprise architects in enterprise development is becoming increasingly important in today's complex business world. The available related research addresses the various roles, professional and personal competencies of an enterprise architect. However, there are few studies that examine such roles within the context of proactive enterprise development. The purpose of this paper is to provide an improved understanding of the enterprise architect's roles within the various phases of proactive enterprise development. This knowledge contributes towards the improvement of our understanding of the enterprise architect's influence in theory and practice. The study is based on a model of Proactive Enterprise Development (PED) which consists of five essential phases namely: strategic situation analysis; formulation of vision, mission, strategy, core purpose, etc. of the enterprise; enterprise-based architectural design; change management; and lastly, architectural implementation. The empirical research was conducted through semi-structured interviews with enterprise architects from eight organizations. The empirical study identifies the following roles of an enterprise architect with respect to the various phases of the PED model: as *an agent of change* during the strategic situation analysis phase; as *a facilitator, consultant and conflict resolver* during the formation of the vision, mission and strategy of the enterprise; as *a design expert* of the future of the enterprise during the architectural design phase; as *a facilitator and conflict resolver* during the change management phase; and lastly, as *a coordinator* during the architectural implementation of the negotiated changes. The empirical findings support the notion that the enterprise architect's roles have a strong impact on proactive enterprise development through promoting the core purpose of the architected enterprise.

Keywords: enterprise architect roles, proactive enterprise development model, enterprise architecture

1. Introduction

Carrying out changes to foster enterprise development can prove to be a real challenge to many companies. For instance, astounding results from the Standish Group "CHAOS Summary 2009" (Standish Chaos Report, 2009) revealed significant decrease in project success rates where only 32% of the projects succeeded, hence a significant increase in the number of project failures. Thus, an explanation as to why some companies succeed while others fail to use information technology in enhancing enterprise development can be provided in terms of inflexibility and enormous complexity of their business and IT structures, processes, systems, and procedures often spread out over different regions, countries or even continents (Van der Raadt and Van Vliet, 2008).

The complexities related to enterprise development in a coherent and integral manner have led to the emergence of the enterprise architect profession within the field of Enterprise Architecture (referred to as EA). Accordingly, the enterprise architect has a significant role to play in an endeavor to deal with the challenge that faces a number of organizations. Therefore, understanding the significant roles of enterprise architects in facilitating enterprise development is becoming increasingly important in today's complex business world. Current research addresses the various roles of an enterprise architect such as a leader, communicator, manager, modeler, interpreter, facilitator, advisor, change agent, arbitrator, etcetera (Steghuis & Proper, 2008; Strano & Rehmani, 2007; Potts, 2013; Gøtze, 2013); professional and personal competencies including role-like competence areas such as credible expert, strategist and politician (Steghuis & Proper, 2008, Potts, 2013; Bredemeyer & Malan, 2004); and responsibilities of creating, applying, and maintaining the EA including organizing the processes involved in enterprise architecting (Steghuis & Proper, 2008). However, such research has been conducted in a more general fashion and there is no comparable study that examines such roles within the context of proactive enterprise development i.e. vision-driven enterprise development approach as opposed to the problem-driven approach, which is reactive in nature. Hence, according to our knowledge, there is a crucial need for research which addresses the roles of enterprise architects in relation to the various phases of a proactive enterprise development.

The purpose of this paper is to provide an improved understanding of the roles of the enterprise architect within the context of proactive enterprise development and this has been done by elucidating on the following question: *“What are the essential roles of an enterprise architect in the different phases of proactive enterprise development?”*

Research method

The study is framed by a model of Proactive Enterprise Development (PED), which has been derived from four well-known approaches in organizational development (Checkland, 1995; Hedberg, 1980; Mackenzie, 1984; Tichy, 1983). The PED model consists of five essential phases namely: strategic situation analysis; formulation of core purpose, vision, mission, strategy, etcetera, of the enterprise; enterprise architectural design; change management; and lastly, EA implementation. Our empirical research has been conducted through both structured and semi-structured interviews by using the qualitative and inductive approaches (Holme and Solvang, 1997; Bryman and Bell, 2005; Pierce, 1914). This has been instrumental in capturing the interpretations of the participants and their involvement as Enterprise Architects in proactive enterprise development. The interview questions have been derived from the different phases of the PED model. The ultimate aim of our research design is to inductively build a theory pertaining to the roles of an Enterprise Architect within the context of proactive enterprise development. Therefore, it is expected that such design should guide any effort related to the process of acquiring, analyzing and interpreting the received answers from the involved participants in the study.

Consequently, we have interviewed eight senior enterprise architects from eight successful organizations comprising of four international firms in the field of information technology and management consulting and four large enterprises within manufacturing, transport and logistics, pharmaceuticals, energy production and supply respectively. The empirical material has been analyzed by addressing the similarities and differences that exist in the responses provided by the respondents.

Following the analysis of the empirical results, we have been able to identify and describe the primary roles of an Enterprise Architect in the various domains of the PED model.

2. Literature review: Roles of enterprise architects

The emergence of enterprise architecture (referred to as EA) has resulted into an evolving profession of different architects as a mechanism for addressing increased complexity. As EA takes on an increasingly significant role in business management, new responsibilities are emerging within the organizational structure (Strano and Rehmani, 2007). The IT Management field comprises of three main categories of architects i.e. enterprise architects, domain architects and solutions architects. The enterprise architect encompasses the scope of business and IT in an organization, while domain architects center on one specific portion of the enterprise such as business, IT, and information. Solutions architects tend to focus on one small component of the implementation of the architecture such as applications, software, and business processes (Steghuis and Proper, 2008). Other categories of architects include agile enterprise architects, technical architects, chief architects, project architects, service architects, core enterprise architects, implicit enterprise architects, applied enterprise architects, and so forth (Mthupha, 2012; Gøtze, 2013).

An enterprise architect has to articulate and understand the capabilities that the organization has as well as those required to implement the business strategy. Architecting the enterprise requires establishing a strategy, formulating a conceptual approach to achieving the strategy, and directing the execution of the concept to fulfill the strategic plan. The role of the enterprise architect changes with each of these stages and the effort required for each stage varies depending on the organizational type and skill sets of the architects (Strano and Rehmani, 2007). Given the interdisciplinary nature of EA, the enterprise architect should have a general knowledge of various disciplines such as business strategy, financial management, organizational dynamics, business process design, and information technology. Besides possessing excellent technical skills, a good enterprise architect should have both business and behavioral competencies as well. Strano and Rehmani (2007) discuss three distinct roles of the enterprise architect, i.e. as that of advisor, agent, and arbitrator. The architect advises the owner on how best to address business opportunities, solve business problems and allocate budget or invest capital. The agent deals with others on behalf of the owner when selecting methods and tools. The arbitrator remains impartial while enforcing the needs and requirements of both the builder

and owner. The enterprise architect's most important function is balancing the disparate needs of people, management, and business requirements (Strano and Rehmani, 2007).

Besides the traditional role of being a creative problem solver, an enterprise architect plays a significant role as a facilitator of critical meetings during problem solving and assisting in the design and management of the entire planning process which will in turn encourage a win/win solution and minimize both the win/lose and lose/lose decisions. This can be done by bringing people of different ideologies into the same room in order to produce a wide range of results from chaos to synergy (Straus and Doyle, 1978).

According to Steghuis and Proper (2008), the responsibilities of an enterprise architect comprise of the creation, application, maintenance of an EA as well as organizing the various processes involved during the enterprise architecting exercise. During the design process of EA, the enterprise architect is expected to have a clear understanding of the purpose and context of the EA as well as stipulating the necessary requirements in the design process. He/ she should also examine the enterprise's current situation and create shared conceptualization among the stakeholders involved in the development of that enterprise. The enterprise architect is further responsible for designing the processes, examining the effect of alternative enterprise architectures and communicating the results of the design process. In addition, the enterprise architect is also responsible for the application of the EA in the organization. He/she is charged with the duty of informing the stakeholders about the selected EA and its motivations. The enterprise architect should support decision-making processes that are based on the EA. Furthermore, he/she should make sure that the development of the enterprise conforms to the architecture and that the EA results are made available to those concerned. EA and its impact should be re-communicated by the enterprise architect to the relevant stakeholders (Steghuis and Proper, 2008).

Enterprise architects should remain constantly vigilant to the external and internal environment of the enterprise, and how it may impact people's decisions and actions. Furthermore, enterprise architects are expected to visualize the architectural implications of environmental changes, design decisions, and people's actions. Architects are considered to be designers and as such, they create designs, agree on designs with people and ensure that the actual enterprise matches the agreed design. They model and articulate the as-is design of the enterprise, as well as the architectural impacts of ideas for change (Potts, 2013).

The enterprise architect is responsible for visualizing the business activities of the enterprise with the help of different scenarios and models by reflecting both the current and future descriptions of the enterprise. He or she should ensure that the relationship between information flow and business processes is organized from a business perspective. Moreover, the enterprise architect is responsible for ensuring that the need for using IT as an enabler is derived from the business requirements of the enterprise (IASA, 2012).

The task of evaluating the various drivers for change both from within and outside the enterprise and the effort of updating as well as re-communicating the EA are some of the roles played by the enterprise architect in his/her EA maintenance endeavors. Organizing the various processes that are carried out in enterprise architecting can be done by the enterprise architect in several ways such as organizing the EA team, selecting frameworks, tools and ensuring that EA is treated as a means to an end and not an end in itself. The enterprise architect is charged with the duty of administering the quality of the EA both as a product and a process in his/her organizing role. Furthermore, he/she has to set up the right leadership and to ensure that the architecture processes go through innovation with time (Steghuis and Proper, 2008).

Gøtze (2013) argues that the work of the enterprise architect evolves as the EA practice evolves; hence the changing role of the enterprise architect. According to the Center for Advancement of the Enterprise Architecture Profession (CAEAP), enterprise architects are expected to promote strategic and operational value of both the strategies and the operations of the enterprise. Furthermore, they make architectural assessments by translating the enterprise's strategies, visions, and goals into a holistic architecture thereby integrating the viewpoints of the various domains of interest in an enterprise. Enterprise architects also minimize inappropriate complexity and alleviate risk to enhance architectural value for the enterprise.

In summary, although the above literature review addresses the enterprise architect's roles in general, such roles have not been examined in relation to the different phases of proactive enterprise development. Hence,

it is upon this background that we have decided to discuss the enterprise architect' roles using the different phases of a proactive enterprise development approach.

3. Proactive enterprise development model

Proactive enterprise development is a vision-driven enterprise development approach as opposed to the problem-driven approach, which is reactive in nature. Successful enterprise development can neither be guided by intuition and praise alone nor by rigid planning and rigorous methodologies that cannot absorb the uncertainties of an ever changing and heterogeneous business environment. Proactive enterprise development is based on the capabilities of management (a) to consciously combine intuition and knowledge, (b) to secure the active participation and commitment of the stakeholders as well as (c) to find sound principles for improving the coordination of enterprise development, information systems development, and knowledge development. It seems that there are three essential principles for guiding the success of such development, namely: (i) the principle of comprehensibility (Langefors 1975; Simon, 1962), i.e. the requisite for a holistic architectural design of the enterprise, (ii) the principle of shared awareness and understanding of the participated stakeholders, i.e. the requisite for updating their mindset and by this way understand the consequences of the proposed changes, and lastly, (iii) the principle of meaningfulness, i.e. the requisite for equal and symmetric participation of the stakeholders in deciding on instrumental, structural or strategic changes.

The proactive enterprise development model (PED model) provides a meaningful foundational context upon which we have tried to clarify the essential roles of an enterprise architect. The PED model has been derived from three well-grounded models of organizational development, namely: Mackenzie's approach (1984), Checkland's approach (1985) and Hedberg's approach (1980). A fourth approach proposed by Tichy (1983) has been used to validate the integrative, holistic and proactive nature of PED.

As illustrated in Figure 1, the logical nature of our inquiry has been expressed by exhibiting the enterprise architect's roles in the context of PED.

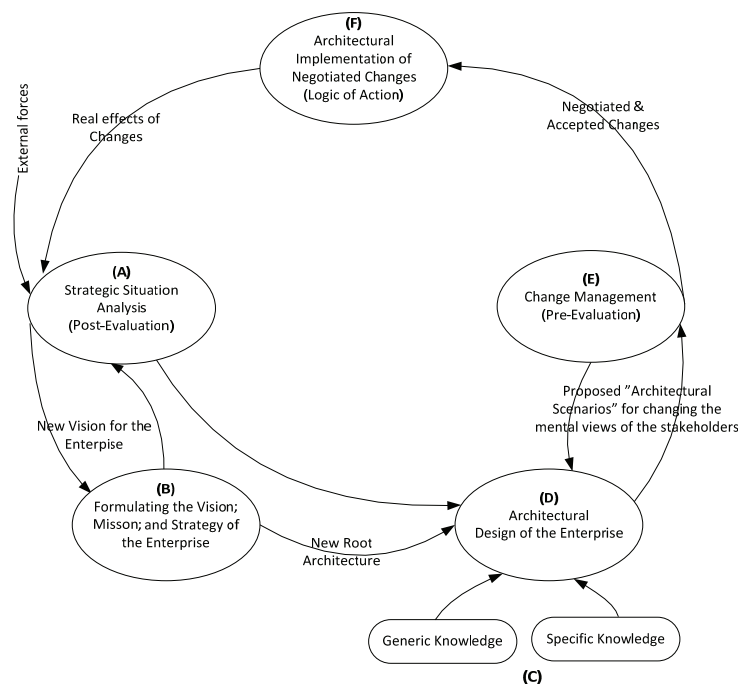


Figure 1: Proactive enterprise development model (PED model)

The initial phase of the PED model is the strategic situation analysis (A) which entails the work of preparing those who should be involved in the change process including their opinions and thoughts regarding the current and future business of the enterprise. The second phase is concerned with the formulation of the vision, mission and strategy of the enterprise (B) hence the root architecture (core purpose) of the enterprise. Architectural design (D) of the enterprise is the third phase which addresses the current root architecture or new root architecture of the enterprise. This phase involves the methodical efforts by the enterprise architect

to develop various proposals for change by using both generic and specific knowledge (C). Change management (E) is the fourth phase in our model and it addresses what should be done in reaching a decision regarding the negotiated and accepted changes. Lastly, the Architectural implementation (F) phase addresses the implementation of the negotiated changes. After the implementation has been carried out, and the real effects of change have been experienced, an evaluation of the changes within the entire operation should be done through a strategic situation analysis, i.e. post evaluation. The relationship between (A) & (D) depicts the essential changes of re-optimization, reconstruction, or reorganization of the enterprise, whereas the relationship between (B) & (D) constitutes the new root architecture in terms of the new vision and mission of the enterprise.

4. Empirical results

The main purpose of our study has been to provide a sound ground for understanding the essential roles of the enterprise architect in a proactive enterprise development. Accordingly, we have focused on the phases covered by the process of proactive enterprise development from a circular, i.e. learning, rather than linear perspective.

4.1 Enterprise architect's role in strategic situation analysis

Evidently, during this phase, there is a strong empirical backing for the role of an enterprise architect as a *change agent*. In this role, the enterprise architect is able to convert experiences, knowledge, new ideas, plus new socio-cultural and technological trends into a proposal of meaningful changes. Such knowledge is expected to invoke awareness and understanding of the architectural concept of various stakeholders and top management of the enterprise i.e. the stakeholders' dreams and architectural requirements (Checkland, 1985; 1995). Accordingly, the involved stakeholders are able to deliberate on how proposed changes can impact the root architecture of the enterprise (core purpose), or changes in the current EA. Thus, the enterprise architect is charged with the task of determining various forms of communication in order to ensure a continuous and effective dialog between the stakeholders during the enterprise development process. Such forms of communication can be understood in terms of metaphors given in natural or visual language, seminars/workshops, and informal meetings.

4.2 Enterprise architect's role in formulating the vision, mission, and strategy of the enterprise

The interviews confirm that the primary role of an enterprise architect within the domain of establishing root architecture is that of a *facilitator*, *consultant* and *conflict resolver*. As a *facilitator*, the enterprise architect plays a significant role in facilitating the formulation of the vision, mission and strategy of the enterprise hence, supporting the creation of the root architecture (core purpose). It's important at this stage to ensure that the enterprise architect endeavours to communicate the vision and mission to various audiences of stakeholders (Bredemeyer & Malan, 2004).

The root architecture forms the basis for sustainable EA and provides a sound direction for a meaningful proactive enterprise development. Moreover, as a *consultant*, the enterprise architect should have a good understanding of the constitutional parts of the enterprise's root architecture which include mission, vision, ultimate purpose, core values, core activities goals and objectives, stakeholders' expectations, and so forth. It is imperative that the enterprise architect understands the correct way of establishing root architecture. Based on our interviews, there is a substantial empirical support for the enterprise architect's need for understanding the current state of the root architecture or how it should be established. We have identified empirical support on the need for enterprise architects to understand the criteria that root architecture must fulfil in order to gain acceptance by the leadership of the enterprise. Due to stakeholders' varying views and opinions associated with the formulation of the vision, mission and strategy of the enterprise, we have observed that the enterprise architect can play a vital role of a *conflict resolver*. This relates to the role of an arbitrator (Strano and Rehmani, 2007) where the enterprise architect helps in balancing the disparate needs of people, management, and business requirements.

4.3 Enterprise architect's role in architectural design

It is within the domain of architectural design that the essential role of an enterprise architect as an *design expert* of the future enterprise is more distinct. He/she is responsible for the design of architecture and the creation of an architectural description (Sessions, 2006,). Since, the designing and redesigning of the

architecture of the enterprise is carried out in this domain, the enterprise architect should develop a clear understanding of the scope of the EA i.e. its essential parts and how they relate to each other (Potts, 2013). EA does not necessarily refer to the technical components such as information systems, information infrastructure, and business processes alone, but it also covers other aspects such as stakeholders; employees; enterprise purpose, vision, mission and strategy; structure of authority and responsibilities, etcetera (Potts, 2013). Consequently, we have observed a very strong empirical support for the need of the enterprise architect to grasp all the essential parts of the architecture of the enterprise. A clear understanding of the various kinds of existing relationships between the information systems and the essential parts of the EA has been strongly emphasized. Furthermore, we have received substantial empirical support concerning the enterprise architect's need for understanding the various forms of interoperability (Hugoson et al., 2008; Simon 1962) that belong to the architecture of the enterprise. A closer observation indicates that information-based integration, collaboration, standardization, and information-based differentiation are the forms of interoperability that have received much empirical support.

4.4 Enterprise architect's role in change management

The primary roles of an enterprise architect during the change management phase may be acknowledged as a *facilitator* and *conflict resolver*.

The primary aim of the enterprise architect in this phase is to improve upon the awareness and understanding of stakeholders regarding a need for change through the use (i) architectural scenarios of the redesigned current architecture as well as (ii) the desired or undesired impact of the impending changes. Thus, a meaningful decision to change presupposes that stakeholders have updated their mindset before any real change can take place within the enterprise. Through this approach, stakeholders come to appreciate that change is not only inevitable, but is being carried out to safeguard rather than threaten their future. This awareness for change can be facilitated through encouraging formal as well as informal channels of communication (Burnes, 2009; Potts, 2013).

Furthermore, communication in favour of change can be facilitated through the following: seminars, workshops, formal or informal meetings and through the use of metaphors in natural or visual language, use of holistic models, etc. Moreover, this form of articulation in terms of hard and soft knowledge is a necessary precondition for stakeholders' awareness and understanding regarding change. We believe that various groups of stakeholders play a very significant role during the change management process depending on the type of business and change at hand. At this juncture, the role of the enterprise architect as a *conflict resolver* becomes evident since change within the architecture of the enterprise will have a definite impact on the interests of stakeholders. Therefore, any form of redesign should be established by way of negotiation and should have the acceptance of all the stakeholders. Consequently, such design leads to win/win effects rather than win/lose effects. As a matter of fact, if some stakeholders are not given the opportunity to be part of the change management process, they can delay or even frustrate the progress of the enterprise development process by creating resistance against the implementation of the change project(s).

In summary, the role of the enterprise architect during the change management process has received substantial empirical support.

4.5 Enterprise architect's role in architectural implementation

In this domain, it is vitally important for the enterprise architect to grasp the essential factors which contribute towards a successful implementation of the redesigned current architecture. Therefore, the primary role of an enterprise architect that we have identified during this phase is that of a *coordinator* of change. Although not primarily responsible for the implementation per se, the enterprise architect coordinates those changes that have been negotiated and accepted upon by the various stakeholders during the change management phase. In essence, the top management of the enterprise assumes the main responsibility for architectural implementation of the negotiated changes.

In summary, the role of the enterprise architect during architectural implementation of the negotiated changes has received considerable empirical support.

5. The roles of the enterprise architect with reference to the PED model

The empirical study has identified various roles of the enterprise architect during the different phases of proactive enterprise development as illustrated in figure 2 below:

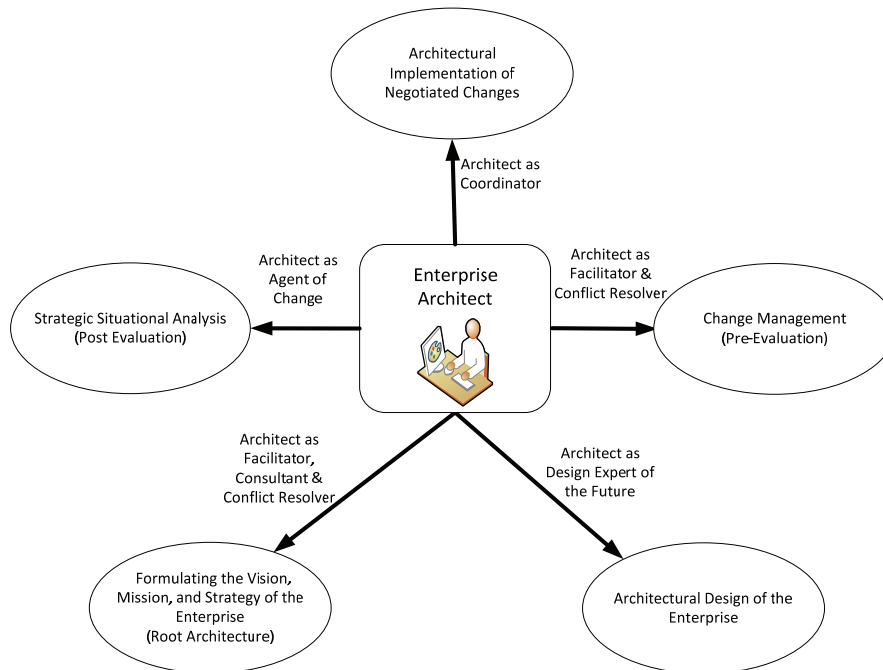


Figure 2: The roles of the enterprise architect with reference to the PED model

According to our empirical findings, the roles of an enterprise architect are: *agent of change*, *design expert*, *facilitator*, *consultant*, *conflict resolver*, and *coordinator*. These essential roles can be categorised as follows:

Enterprise architect as an agent of change

First and foremost, the enterprise architect may be perceived as an *agent of change* during the strategic situation analysis phase. This is because he/she is capable of seeing the future impacts of technology in general and social trends in particular on the enterprise and hence assist in guiding stakeholders towards a new vision of the enterprise. Thus, this new vision can help update the root architecture of the enterprise i.e. new identity and therefore new orientation of the future enterprise. Otherwise, when the old vision remains the same, the role of the architect is to collect and organize the opinions of stakeholders with respect to the dysfunctional issues of the current EA.

Enterprise architect as a design expert

The essential role of the enterprise architect as *design expert* is to convert the root architecture of the enterprise into a sustainable visionary future. Furthermore, he/she must be capable of updating the current architecture with the opinions of the stakeholders into a new view of the current EA.

In so doing, the enterprise architect can derive the changes to be considered, negotiated and implemented. The main function of such a procedure is to create awareness in general and mutual understanding in particular about the consequences of the proposed changes. However, the difference between the ideas of architectural design and the concept of EA can be given in terms of implemented and negotiated changes. In other words, the underlying ideas of the current architecture shape the architected reality of the enterprise. Therefore, the effects of implemented changes should reflect the stakeholders' expectations.

In summary, the architect is capable of evaluating the goodness of the current architectural design in terms of functional alignment, structural alignment, infological alignment, and socio-cultural alignment and also in terms of alignment with the visionary architecture of the future (Magoulas and Pessi, 1998).

Enterprise architect as a facilitator, conflict-resolver, consultant and coordinator

Another vital role of the enterprise architect is perceived as a *facilitator* of three essential management aspects, namely: facilitating the creation of root architecture, facilitating comprehensibility, shared awareness and understanding as well as the negotiation of meaningful changes, and facilitating the coordination and implementation of negotiated and accepted changes.

Facilitating the formation of vision, mission, and strategy (root architecture): The enterprise architect should use his/her capabilities in terms of external base of knowledge i.e. educational knowledge, as well as internal base of knowledge i.e. tacit experiential knowledge in order to guide the formation of a new root architecture i.e. purpose, strategy, culture, relevant core-actions, expected behavior, and the like, of the enterprise. Such formation takes place in cases where stakeholders have stated a new vision for the future. Besides, being a *facilitator* in this phase, the enterprise architect acts as a *consultant* and *conflict resolver* as well.

Facilitating the negotiation and determination of changes: As *facilitator* and *conflict resolver* among various stakeholders especially during the creation of new root architecture and while dealing with the issue of establishing shared awareness during the change management phase.

Facilitating the implementation and coordination of negotiated and accepted changes: In the last form of facilitation, the enterprise architect acts as a *coordinator* during the architectural implementation of local and negotiated changes as well as coordinating the global efforts intended for securing short term excellent performance, i.e. a sense of efficiency and effectiveness, long term sustainable innovation and growth, i.e. a sense of vision, as well as a strong sense of social cohesion between the enterprise and its stakeholders, i.e. a sense of mission and its reflected social responsibility, hence, avoiding undesired functional, structural and cognitive interdependencies.

6. Conclusions

The primary purpose of our study has been defined by the desire to categorize the roles of an enterprise architect in the enterprise development context. The research is based on a model of the operational logic of proactive enterprise development (PED model, see figure 1). The research has resulted into a categorization and clarification of the various roles played by the enterprise architect in different phases of proactive enterprise development (see figure 2). Accordingly, our inquiry has been carried out by elucidating the following issue:

“What are the essential roles of an enterprise architect in the different phases of proactive enterprise development?”

The enterprise architect plays essential and meaningful roles of *agent of change* during strategic situational analysis and *design expert* during architectural design. Besides, the role of the enterprise architect in the other three phases focuses on supporting the awareness and understanding of the stakeholders' involvement in these phases, namely: (i) as *facilitator*, *consultant* and *conflict resolver* during the phase of formulating the vision, mission and the strategy of the enterprise, (ii) as *facilitator* and *conflict resolver* in the change management phase, and (iii) as *coordinator* during the architectural implementation of negotiated changes.

The design and construction of PED model is based on specific and context dependent knowledge. However, the same kind of knowledge is provided by the involved respondents who are enterprise architects. This fact demonstrates a clear distinction between the general and context free scientific knowledge employed in the design and construction of engineer-oriented enterprise architectures and the specific and context depended practical knowledge employed by the management oriented enterprise architectures.

In summary, it is the wisdom of the enterprise architect that guides the mindset of the stakeholders in converting the gained situational awareness and understanding into an attractive, meaningful and socially cohesive enterprise. Thus, the enterprise architect's role makes sense because he/she can manage the unmanageable issues of a promising future through: (i) the contingent context of a proactive development, (ii) the situational and mostly subjective knowledge of the stakeholders, and (iii) the active participation and co-determination of the stakeholders.

Although we have interviewed eight respondents in eight large organizations, we believe that this is an interesting area capable of igniting further research pertaining to addressing the enterprise architect roles in a proactive development context.

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A Staff Utilisation-Resource Simulation Model: Towards a Hybrid Decision Support System in Retail Banking

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Abstract: Within a retail environment the scheduling of staff to accommodate the dynamic nature of customer throughput is of utmost importance. However, in outlets that face unpredictable patterns of customer activity, suboptimal staff schedules are a common occurrence. This event adversely affects the staffing rota, service time, and queue length thereby affecting the level of customer satisfaction. At present the vast majority of retail environments make use of a number of estimation techniques based on past experiences and historical data, sometimes supported by the ad-hoc observation of customer throughput. However, the lack of pervasive monitoring technologies may hide weaknesses within current staffing rotas and standard service times. A Decision Support System (DSS) with a real-time data logging architecture, referred to as the Staff Utilisation-Resource Simulation Model (SU-RSM) is the subject of this paper. The SU-RSM is designed to assist retail managers in assessing the efficiency of their staffing rotas to a high degree of granularity. In this paper, design, implementation and evaluation of SU-RSM in a single retail bank is presented. This research offers the opportunity to perform a back-to-back comparison between the existing paper-based estimation models used in the bank and the SURSM. Findings provided in this paper reveal a lack of awareness on the actual customer flow by managers and staff, and as a result a suboptimal allocation of resources within the branch. This knowledge gap provides a strong justification for the use of real-time data logging technologies combined with a simulation model (i.e. DSS). Such an approach will assist retail managers in achieving near optimal staff resource allocation.

Keywords: utilisation of resources, decision support system, customer simulation model

1. Introduction and theoretical grounding

Decision making in terms of distributing resources plays an imperative role in ensuring that organisations operate efficiently. One major decision managers' encounter is the allocation of staffing resources to accommodate the dynamic nature of customer throughput. Due to unpredictable patterns of customer activity within retail environments, assigning staff resources in an optimal manner is extremely challenging. Furthermore, increased competition within the retail sector has made it far more challenging to entice and more importantly retain customers (Dash, Swain, Das, Samantaray and Sahoo 2012). It is therefore of the utmost importance that customer service is efficient and of a high standard but delivered in an optimal manner. To achieve this, the retail sector needs to maintain a balance between timely and efficient customer service while keeping staff resources to a minimum.

According to Athansopoulos and Giokas (2000), performance metrics (such as customer waiting times and staff utilisation) can be utilised to predict the appropriate staff resources within retail environments. However, at present the vast majority of retail environments make use of a number of estimation techniques based on past experiences and historical data, sometimes backed up with simple observation of customer throughput carried out on an ad-hoc basis (Pritsker 2006). Furthermore, an experienced retail branch manager may base their maintenance of operational activities on their regular observations, for example, observing a long customer queue. The allocation decision trigger itself is dependent upon the attention of a manager who may be occupied at the time when the symptoms appear. The lack of a systematic assessment of customer loads can lead to an inefficient utilisation of resources, which in turn leads to higher staffing overheads and potentially poor customer service (Themido, Arantes, Fernades and Guedes 2000). To go beyond the limitations of the current paper-based and fragmented data collection approach, this paper leverages emerging technologies in the area of real-time data capturing (i.e. Brickstream® 2009) and a simulation base approach to develop a DSS (known as Staff Utilisation- Resource Simulation Model). This model is then tested in a banking retail industry to identify optimal or near optimal staff utilisation levels.

The remainder of this paper is structured as follows: A literature review surrounding uncertainty and decision making is provided in Section 2. This section argues that uncertainty surrounding staff resourcing according to customer throughput levels can be overcome by implementing DSS incorporated with simulation modelling techniques. Section 3 provides a description of the proposed DSS model, that is, Staff Utilisation-Resource Simulation Model (SU-RSM). Section 4 presents the methodology employed in this study. The results generated by the SU-RSM are evaluated in Section 5. The conclusions in Section 6 examine the effectiveness of the SU-RSM in determining staff utilisation within retail environments.

2. Literature review

In outlets that face unpredictable patterns of customer activity, suboptimal staff schedules are a common occurrence. This event adversely affects the staffing rota, service time, and queue length thereby affecting the level of customer satisfaction (Kyngäs, Goossens, Nurmi and Kyngäs 2012). Organisations need to use existing datasets to help reduce uncertainty around staff scheduling and customer throughput. For instance, Earl and Hopwood (1980) have analysed the role of information in organisations and concluded that the crucial relationship between information and decision making has been presumed rather than described or analysed accurately. Earl and Hopwood's work is based in part on Thompson and Tuden's (1959) observations on decision making, which distinguishes between the uncertainty over the objectives of the organisation and the uncertainty over the cause and effect relationships which are embodied in particular organisational actions. Figure 1 represents Earl and Hopwood's prescriptions, linking these decision modes to the role information systems should play in the case of each decision mode. In the context of this paper the "uncertainty over preferences" relates to the decisions that need to be made surrounding staff schedules whereas "uncertainty over cause and effects" pertains to impact of staff schedules on staff utilisation.

		Uncertainty over preferences	
		Low	High
Uncertainty over cause and effects	Low	Answer Machines	Dialogue Machines
	High	Learning Machines	Idea Machines

Figure 1: Relationship between information systems and uncertainty (Earl and Hopwood, 1980)

In Earl and Hopwood's view, 'enquiry systems' have artificially been designed to provide specific answers and uncertainty tends to be voluntarily masked by the development of quasi-certain systems where assumptions are made to fill the gap in a managers' understanding of their environment. The fact that traditional information systems often attempt to remove the uncertainties in the environment can be dangerous when it involves mechanisms or protocols that managers do not understand fully (the cause and effect relationships in Figure 1). It is even more dangerous when it comes to the parameters in the environment which are not known or even predicted yet, such as the interest rates in three months' time or the design of a competitor's next new product (King 1985; Pritsker 2006). Within a retail environment this uncertainty may be viewed in not knowing potential customer throughput trends over the next six to twelve months.

The implementation of Decision Support Systems (DSS) can change the complexion of the decision making process by managers by helping them refine their understanding in terms of uncertainty and test their assumptions in a definitive manner (simulation model). The level of uncertainty faced by managers can thus be reduced and it becomes easier to implement the new understanding into the DSS (Earl and Hopwood 1980).

Due to the fact that decision making in retail environment is highly dependent on events and factors that are beyond the control of the decision maker, i.e. the branch manager in the case of this paper, Dynamic Decision-Making (DDM) (Brehmer 1992; Gonzalez, Lerch and Lebiere 2003) may be carried out using simulation models to provide analogues for the real-life scenarios.

A DSS, referred to as the Staff Utilisation-Resource Simulation Model (SU-RSM) will be described in the following section. The role of the SU-RSM architecture (cf. Figure 2) is to demonstrate that the level of uncertainty over cause and effect can be reduced by providing branch managers with relevant finely granulated data on an hourly, daily, weekly or monthly basis. This in turn may help managers develop an

improved rounded view of the fundamental factors of performance in their branch and even change the set of preferences which they apply to their decision making. The focus of this paper is on the balance between staff utilisation and customer service times. Subsequent sections evaluate and compare SU-RSM (DSS) with a paper based approach.

3. Staff utilisation-resource simulation model (SU-RSM)

Simulation and simulation modelling are engineering processes and need to work in a well-defined structure where items of significant importance need to be understood. Simulation refers to a process of designing a model of a real system and performing experiments with this model to evaluate various behaviours/strategies for the operation of the system (Shannon, 1976). Simulation modelling enables the engineer/researcher/analyst to classify a problem and break it down into logical blocks.

Once the simulation model is verified and validated to represent the intended real-world environment, analysis may begin. A number of review meetings were held during the development of the SU-RSM to help identify key areas of interest and to avoid common simulation development pitfalls. The SU-RSM was verified and validated by the managers and staff at the branch where the study is evaluated to reflect the real-world environment.

At the heart of the proposed SU-RSM (cf. Figure 2) is a discrete simulation model. The simulation application software called Arena™ is used to model the banking retail outlets. This enables a rigorous comparison to be made between the existing estimation models (i.e. paper based) and the proposed pervasive tracking technologies. Within the SU-RSM model, two manually collected datasets are utilised (i.e. staff schedules and a manual log of customer throughput) along with a pervasive real-time customer metric data logging device (i.e. Brickstream®).

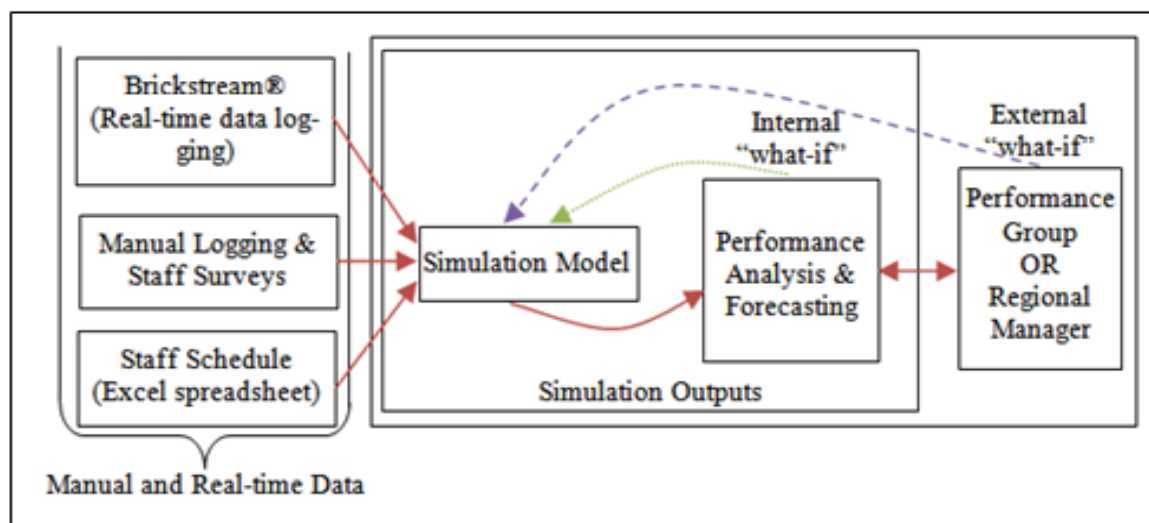


Figure 2: The staff utilisation-resource simulation model

An optimal staffing solution is derived through an iterative approach with local branch management (labelled as “Internal” in Figure 2) and engagement with the corporate performance group/regional management (labelled as “External” in Figure 2). This enables internal management to assess their staffing resource at a granular level as they would be able to interpret the generated outputs based on local knowledge and adjust accordingly. This information can be utilised by external bodies such as the regional managers where long term staffing decisions can be made and factored back into the simulation model for further analysis. To help alleviate drawbacks of simulation models the SU-RSM utilises the BrickStream® queue metric technology to automatically collect relevant datasets. These datasets are subsequently fed into the Arena® model, where the appropriate simulation model template is configured and where analysis may begin.

4. Research method: Implementation of SU-RSM

A single branch of a retail bank was selected as the reference point in evaluating the potential impact of how real-time logging and simulation technologies can play in the operational decision making process. The BrickStream® technology was installed and configured to monitor the customer throughput and service time

for two cash tellers and two customer service staffing points (cf. Figure 3). The results presented in this paper are based over a one week period and are part of an on-going investigation in this branch. During this timeframe data was collected from bank staff in the form of questionnaires, staff schedule and transaction logs. Finally the Brickstream® datasets were verified through a manual clip board exercise (monitoring customers and timing service periods) and further correlated with bank staff data logs.

The SU-RSM architecture (cf. Figure 2) was built and configured to model the relevant aspects of the selected branch i.e. two cashier and two customer service points. The standard opening hours are 9:00am to 5:00pm. Each member of staff was assigned an individual schedule for that week. Within this rota a member of staff may be assigned to a service point (frontline) or back office accounting activities. This part of this research examines the utilisation of staff with regards to the provision of services to customers (i.e. frontline services); back office tasks are beyond the scope of this paper. To assist in the evaluation of the quantitative findings, an associated questionnaire was distributed cross ten local branches of the same banking organisation. This questionnaire depicted the understanding that branch staff held in relation to queue metrics such as peak periods and customer satisfaction.

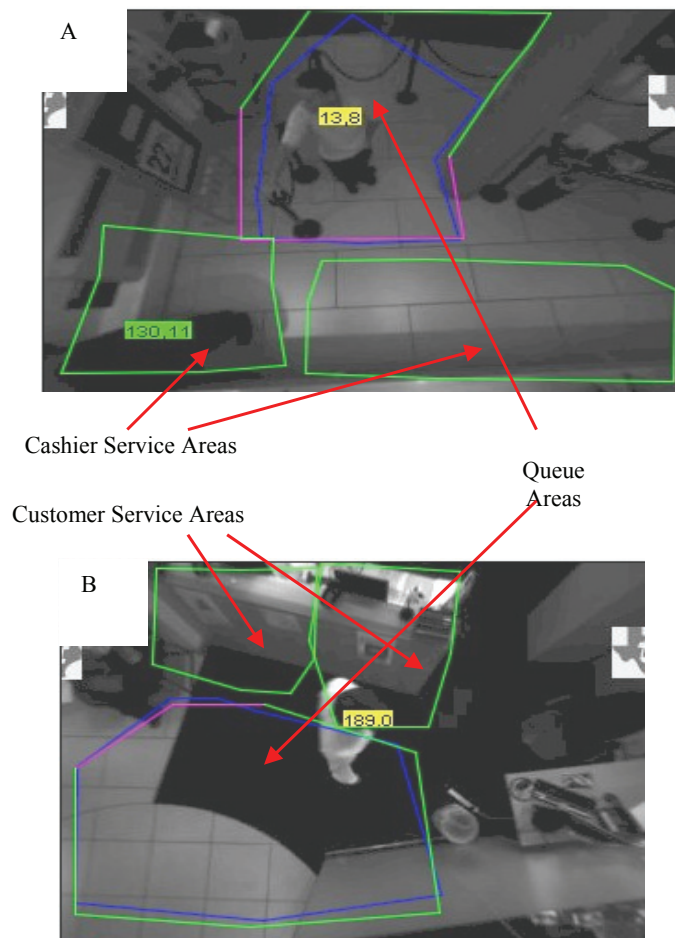


Figure 3: BrickStream® screenshots of (A) cashier and (B) customer service within the branch environment. As a customer enters or leaves one of these regions the Brickstream® software collects and processes the collected metric data

The effectiveness of the real-time data logging device and simulation approach within the SU-RSM architecture (DSS) was assessed from three distinctive perspectives, cf. Figure 4.

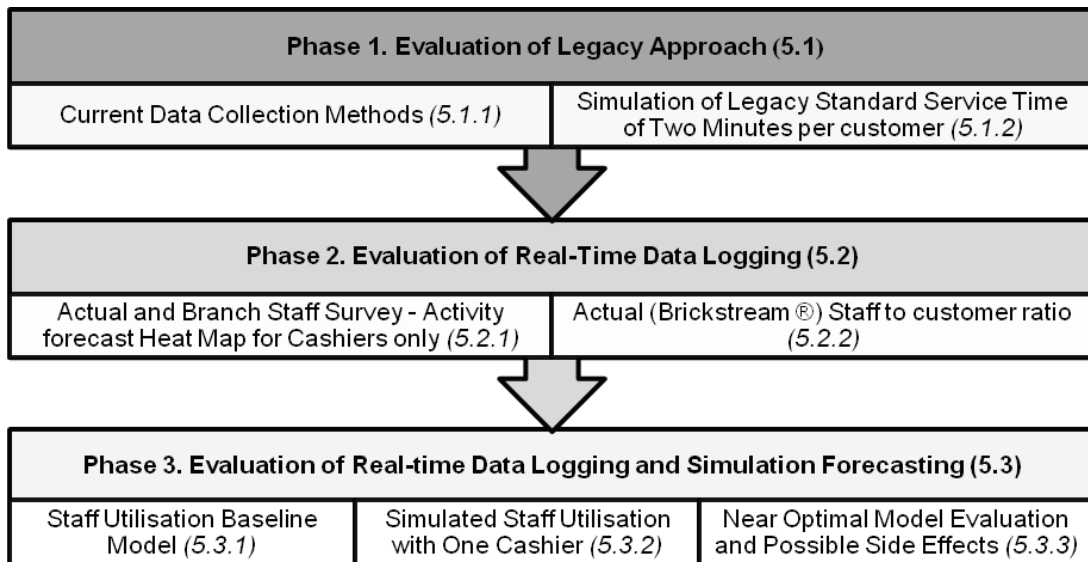


Figure 4: Three phases of evaluation

5. Evaluation and results

The SU-RSM was evaluated in three phases 1) examining the legacy approaches, 2) real-time data logging capabilities and finally 3) which are presented in the following subsections. Throughout all three phases the Arena™ simulation model is used to calculate the staff utilisation figures.

5.1 Phase 1: Evaluation of legacy approach

A number of organisations have internal dedicated performance management teams to assess the overall effectiveness of each individual branch; however the vast majority of these groups collect customer queue metrics and customer service time only to ensure that the current staff configuration is meeting their “time to service” targets. Such an approach was found to be very labour intensive and only captured a snapshot of that particular branch at irregular intervals (typically, in organisations that administer large network of branches, such audits can only be carried out once every few years).

5.1.1 Current data collection methods

The current approach by the host organisation on collecting queue data is differentiated based on the size of the branch. The larger branches have a rudimentary standalone queue metric system which is updated by the cashier pressing a button every time a new customer is served, whereas the smaller branches have no supporting systems. The results generated by the existing system are only viewable in a standard printed format with little or no capability for any meaningful analysis. The shortcomings of the system were highlighted when a member of staff commented that “the results generated by that system are collected and immediately discarded”. Several branch staff commented that any queue management system that requires continuous manual input even during their busiest periods tend to produce erratic and unreliable results. It was noted on a number of occasions that staff “forget” to use the system and the quality of the data collected is further polluted when they press the button multiple times to make up for missed transactions. Reports are negatively impacted by having several customers recorded as served in a matter of seconds.

5.1.2 Simulation of legacy standard service time of two minutes per customer

This experiment evaluates the effectiveness of the legacy standard service time of two minutes, which is the standard time allocated to staff to deal with one customer. Customer throughput is based on data collected from Brickstream® while the SU-RSM model generates staff utilisation statistics. This experiment is designed to highlight the current utilisation loads for frontline activities with a fixed service time of two minutes.

In Table 1, the standard service time for each customer transaction is set at two minutes. From the branch manager’s perspective, this enables the cashier to attend to the customer and file away any documents pertaining to that transaction. On Monday of the trial week, cashier 1 and 2 had an utilisation figure of 46%

(approximately 55 seconds) and 32% (approximately 38 seconds) respectively and their statistics go as low as 16% for cashier 2 on the Friday. Prior to this experiment (i.e. based on the legacy approach and without the benefit of real-time data), it would be difficult to gauge the efficiency of the cashiers based on these figures alone. The 'actual' service time for each customer is needed to gain an improved understanding as to how long a member of staff attends to a customer. This is achieved by simulating the 'actual' service time as collected by Brickstream®. It is important to note that fully optimised bank staff (based on maximum customer throughput) may reach an utilisation figure of 85% (including frontline and back office duties).

Table 1: Staff utilisation with a standard service time of two minutes per customer

	Staff Utilisation %				
	Mon	Tue	Wed	Thurs	Fri
Cashier 1*	(46%)	40%	28%	48%	48%
Cashier 2*	(32%)	29%	25%	23%	(16%)

*Each customer transaction is set at two minutes

5.2 Phase 2: Evaluation of real-time data logging

Real-time data logging has the potential to highlight customer patterns with a high degree of accuracy, which may not have been observed in the past through the legacy approach. To emphasise this point a comparison is made between the Brickstream® customer throughput and the staff's perceived footfall patterns for the trial week. Finally staff to customer ratios for this period is also analysed.

5.2.1 Actual (Brickstream®) and branch staff survey - activity forecast heat map for cashiers only

Presented in Table 2 is the actual throughput from Brickstream® and branch staff survey – activity forecast. Highlighted are the busiest hours of each day, with the peak hours shaded in black (footfall) and grey (bold and italics) (forecast).

Table 2: BrickStream® and branch staff survey

	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00
Monday								
Footfall (Brickstream® *)	9	10	21	15	22	20	17	14
Forecast (Survey)**	10	7.67	7.33	6.33	6.33	2.33	4.00	3.00
Tuesday								
Footfall (Brickstream®)	7	6	14	20	20	21	19	9
Forecast (Survey)	9.67	7.33	6.67	4.00	2.00	2.67	4.33	4.67
Wednesday								
Footfall (Brickstream®)	4	11	7	16	12	22	13	3
Forecast (Survey)	9.67	7.33	7.00	5.00	2.67	1.67	4.00	4.67
Thursday								
Footfall (Brickstream®)	7	10	24	26	26	15	14	13
Forecast (Survey)	9.00	5.00	4.33	4.00	2.00	1.33	2.33	4.33
Friday								
Footfall (Brickstream®)	7	8	17	16	15	22	18	20
Forecast (Survey)	9.00	7.67	6.67	3.33	1.67	2.33	4.33	2.67

*Brickstream footfall refers to the number of customers in the bank

**Forecast Survey (Scale 1-10, 1 equals peak activity and 10 equals quiet period)

The forecasting figures were provided by both cashiers and managers, without significant difference between the two assessment groups. From this table, Wednesday 14-15 hrs is the only forecasted peak period that matches the Brickstream® data. Peak hours for the three other days (Monday, Tuesday and Friday) are predicted with an hour difference to the data collected by Brickstream®. Branch staff estimated that it was busiest in the afternoon on Thursday, when in fact the peak hour on Thursday was two hours before the predicted hour. These findings highlight the important role that pervasive tracking technologies can play in assessing the true nature of customer patterns. With this approach branch managers are provided with higher quality datasets to make a more informed decision when generating staff schedules.

A cursory glance at the throughput figures could lead to the belief that there is an underlying normal distribution, however careful attention is required in assessing throughput figures as it is common for an influx of customers to enter the branch ten minutes before closing time on a Friday (end of working week). The SURSM uncovered other discontinuities in the distribution of customer arrivals which were not evident to branch management because of the lack of data logging and analytic software solutions.

5.2.2 Actual (Brickstream®) staff to customer ratios

In Table 3 the total customer throughput and the associated total staff hours per day are presented. On Wednesday a total of 88 customers entered and executed at least one transaction. This represented the quietest day of the week yet the branch had allocated the highest number of staff hours. In comparison, the total customer count for Thursday was 135 with a total of ten staff hours. This almost represents a doubling of staff to customer ratios between Wednesday (7.04) and Thursday (13.50).

Table 3: Staff to customer ratios

	Mon	Tues	Wed	Thurs	Fri
No of Customers	128	117	(88)	(135)	123
Total Staff Hours	12	11	12.5	10	9.5
Ratio	10.67	10.64	(7.04)	(13.50)	12.95

5.3 Phase 3: Evaluation of real-time data logging and simulation forecasting

In phase one, the branch simulation model focused on the “AS-IS” approach, in phase two, basic customer throughput data logging highlighted potential weaknesses with the current staffing schedule. In phase three, the staff schedule is examined from a number of dimensions which are:

- 1) Staff utilisation, for the entire week based on Brickstream® service time periods in comparison to the legacy two minute approach. All staff utilisation figures are generated by the Arena™ simulation model i.e. when an event (staff member) enters an entity (counter to service a customer) this adds their their overall level of engagement with the customer or utilisation.
- 2) The impact of operating one cashier instead of the two staff members normally in place.
- 3) The potential side effects associated with optimising staff resources.

5.3.1 Staff utilisation baseline model

Actual customer throughput numbers were collected by Brickstream®, whilst staff schedules were compiled based on transaction sheets during the trial week, with two cashiers and two customer service (CS) points. The staff utilisation figures presented in Table 4 are based on the actual (i.e. Brickstream®) customer throughput and average service time periods. For example, it was calculated that cashier 1 and 2 serviced a customer on average for 1.6 and 1.5 minutes respectively on Monday. By comparing the staff utilisation figures for cashier 1 and 2 on Monday in Table 4 (actual baseline model) with Table 1 (standard service time) the figures drop from 46% and 32% to 37% and 24% respectively. This differential of approximately 9 percentage points represents staff underutilisation resulting in a suboptimal staffing schedule.

The disparity of utilisation figures between cashiers and customer service may be clarified by the duration of their respective service time periods. For example, a typical cashier transaction would involve the processing of cheques or cash while a customer service member of staff tend to answer rudimentary questions regarding specific account packages. This can be demonstrated for CS1 in Table 4, which has an average service time of 1.04 minutes on Monday while cashier 1’s equivalent comes out at 1.6 minutes.

Table 4: Brickstream® baseline model

	Mon	Tues	Wed	Thurs	Fri
Actual Average Service Time (minutes)					
Cashier 1	(1.60)	1.56	1.84	1.53	1.46
Cashier 2	(1.50)	1.44	2.26	1.94	1.54
CS1	1.04	1.54	2.11	1.76	2.30
CS2	0.73	1.35	1.16	1.22	0.98

	Mon	Tues	Wed	Thurs	Fri
Actual Average Service Time (minutes)					
Cashier 1	(37%)	32%	26%	37%	35%
Cashier 2	(24%)	21%	28%	22%	12%
CS1	15%	18%	18%	16%	31%
CS2	10%	17%	11%	13%	12%

5.3.2 Simulated staff utilisation with one cashier

Previously a two cashier model generated utilisation figures of 37% and 24% for cashier 1 and 2 respectively on Monday (cf. Table 4). Conversely, simulating a one cashier model (Table 5), based on the Monday dataset, revealed an average service time of 1.56 minutes per customer with a staff utilisation outcome of 42%. In this revised model, cashier 1 is now assigned to the service point for the full day. While the workload for cashier 1 has increased (taking the previous cashier 2 customers) the overall workload is within a reasonable operating range (i.e. the standard two minute customer metric). These findings highlight that a single cashier model is more than efficient to manage the customer throughput.

Table 5: Reconfigured simulation model with 1 cashier only

	Mon	Tues	Wed	Thurs	Fri
Cashier 1	(1.56)	1.53	2.03	1.70	1.48
Cashier 1	(42%)	37%	39%	48%	38%

5.3.3 Near optimal model evaluation and possible side effects

In Table 6 the staff to customer ratio is presented with a 1 cashier model throughout the entire working day. In theory the presented ratios are well within the operation range (i.e. two minutes), however as presented in Table 2 the rate of customers entering the branch can interfere with this ratio. For example, during the 13-14 hours period (cf. Table 2) a total of twenty-six entered the branch, drastically raising the average ratio of 16.88 to 26. This figure is now on the border line of requiring the services of a second member of staff.

Table 6: Staff to customer ratios based on a default of one cashier i.e. a maximum of 8 hours per day

	Mon	Tues	Wed	Thurs	Fri
No of Customers	128	117	88	135	123
Total Staff Hours	8	8	8	8	8
Ratio or Customers Per Hour	16.00	14.63	11.00	(16.88)	15.38

6. Discussion and conclusion

Within a retail environment the scheduling of staff resources to accommodate the dynamic nature of customer patterns is of significant importance. To obtain an optimal or near optimal staffing schedule is a complicated task. For branch managers a high degree of uncertainty exists around customer footfalls, average service times and queue length. Findings provided in this paper reveal a lack of awareness on the actual customer flow by managers and staff, and as a result a suboptimal allocation of resources within the branch. Firstly, the findings reveal that the existing paper based approach restricts meaningful analysis of basic customer throughput. More importantly the utilisation of staff was well within the recommended operating threshold of two minutes per customer. This finding presents an opportunity for branch managers to reassess their staff schedules. Secondly, with the usage of real-time data logging a high level of granularity in relation to customer throughput and staff to customer ratios was achieved. This level of detail provides the branch manager with a rich dataset to make more informed decisions pertaining to the allocation of staff resources. Thirdly, the benefit of real-time logging devices integrated with a simulation model (SU-RSM) was demonstrated. By merging these two technologies the researchers identified that staff resources were underutilised. This was reflected in that a single cashier approach throughout the full working day resulted in a near optimal staff utilisation model. This potentially could save the branch one cashier per working day. Caution, however, should be noted in regards to the potential side effects (cf. Table 6) of trying to achieve an optimal staff schedule. Primarily when such an approach is put in place (i.e. optimal staff schedule) the ability of that configuration to accommodate unexpected parameters (peak customer throughputs) may jeopardise the usefulness to the proposed model.

When drawing up a staff schedule these parameters may be based on historic estimations with basic customer patterns if any. Furthermore, based on the work of Earl and Hopwood (1980) traditional information systems often attempt to remove the uncertainties in the environment. This can be dangerous when it involves mechanisms or protocols that managers do not understand fully. The Staff Utilisation-Resource Simulation Model SU-RSM presented in this paper utilises real-time data loggers to gather rich quantities of customer and service patterns. Allied with a simulation model which enables managers to investigate a number of 'what-if' scenarios, it begins to tackle this high level of uncertainty and presents managers with tools that are more akin to Earl and Hopwood's ideal and powerful learning machines.

Although this research identified improvements in staff scheduling vis-à-vis real-time data logging in association with the SU-RSM (DSS), only front line staff utilisation was examined. Moreover, it did not take into account customer queue waiting times. It would be counterproductive if the staff utilisation figures were maximised to the detriment of the average waiting time in the queue. Future research examining the SU-RSM model will factor in the actual average service time, staff utilisation and the average customer queue waiting times. All three metrics processed within the SU-RSM will enable the branch manager to near optimise the front line performance. This will ensure that an appropriate balance is found between staff optimisation, customer service times and maximum customer queue waiting time targets.

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From Strategy to Operations and Vice-Versa: A Bridge That Needs an Island

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Abstract: The Information Systems support particularly for Tactical Management is not an explicit or distinct term. There are many concepts and artifacts that are providing contemporary foundations for Information systems in the companies, both in theory and in practice. We tried to analyze different approaches, in order to determine their support specifically for tactical management. Out of this attempt, the realization is that these seemingly overarching bridges from Operations to Strategy and vice-versa appear to be overshooting an important island – the tactical management level, particularly in recognizing its distinct characteristics to be served with adjusted concepts and solutions. We see tactical management as the managerial function that implements strategies, by deploying and utilizing specific resources from the operational level in order to gain that specific competitive advantage prescribed in the strategy. The diversity of approaches and tools is provided for the strategic and overwhelmingly for operational management issues. This theoretical research is analyzing the specifics of the Sense-and-Respond Framework on a tactical level towards perfecting the sensing part of it (in terms of sustaining “low latency” (instead of operational “no latency”) and striving for tactical need for “right-time” (instead of the current and hot operational “real-time”) information), and how it is being closed in theory and practice on a strategic, tactical and operational level with ‘endings’. Also, the tactical management characteristic of working in unpredicted environment and needing high adaptability, requires involvement of concepts and approaches that provide adaptability such as, in our opinion, the Sense-and-Respond managerial concept and the SIDA loop. To some extent, tactical management is being assimilated either by strategy or by operations, as this research confirms. Hopefully, we will result with increased perceptiveness that tactical management needs special theoretical and practical focus and output propositions. The specific sensing and interpreting, deciding and acting, in the role of a tactical manager is neither only automatic, data-capturing process nor a person-independent or company-independent one. If, and after this viewpoint is shared, much more efforts will be streamlined in the tactical management “how” to do “what” is expected, on theoretical and on practical level.

Keywords: tactical management, sense-and-respond loop, low latency, right-time information

1. Introduction

There is hard time behind doing the tactical management job, trying to coordinate, translate and/or align operations/strategy, details/summaries, management/employees, clients/company, manual/automatized information systems, human, technical, business, ... aspects of work. The translation and alignment of the mismatch of all these signals, observed from the point of view of the person, is highly complex, diverse and changeable, and should be addressed properly. The successful performance of this function differentiates the success of the company throughout the time, and it is person- and company- specific. “Tactics play a crucial role in determining how much value is created and captured by firms” (Casadesus-Masanel et al. 2009).

Our standpoint is that tactical management is distinctive from other managerial functions with the:

- High need for adaptability and flexibility
- Complexity of issues of different nature to be dealt with and

Hence, tactical management need for information systems is very specific, and can’t be satisfied only with reports and automatized processing logic. It needs theoretical specification, relevance confirmation by real-business research, and special provision from the information systems, in direction of individualized extraction and combination of inputs, dynamic processing logic and customizable outputs in terms of information and decisions. It also needs adaptability loop to be able to sustain towards an outcome in changing environment and preconditions.

In terms business pursuit for an “ending” (strategic guidelines, KPIs, targets), it is generally a ‘given’ variable, at least on a yearly basis. In terms of operations, the prescription of business processes, the pursuit for efficiency and optimization, gives throughout the time (year(s)) certain rigidity and repetitiveness in their existence.

However, in terms of tactical management, there are numerous and various in nature specific aspects to be taken care of, while pursuing a goal, with somewhat fixed operational inputs, in terms of alternative paths and adaptations to a very dynamic and uncertain environment. We see the tactical management as a very important and flexible crossroad that should have number of alternative paths for the existence of any business. This specific nature of tactical management does need specific addressing with Information Systems and with Managerial Concepts, both in direction of assisting the handling of complexity, as well as adaptability and flexibility.

This research of literature aims to point out current concepts, approaches and implementations with regards to Operational, Tactical and Strategic Management; appropriate Information Systems and implementation of the adaptability concept of the Sense and Respond framework and the Sense – Interpret – Decide – Act (SIDA) Loop in theoretical approaches and practical solutions.

The organization of the paper is as follows: after brief definition of the concepts used as baseline, the research strategy and criteria according which the subject papers have been filtered, are explained. The analysis is performed upon the research categories and interpretation of results and conclusions are given in the last chapter.

1.1 Concepts in the research

We perceive *tactical management* as the managerial function that implements strategies and deploys and utilizes specific resources from the operational level in order to obtain the specific competitive advantage prescribed in the strategy. To phrase the tactical management definition in terms of ‘adaptability’ (or the ‘Sense and Respond’ business concept), we see it as the managerial function that by complying with the ‘governing principles’ negotiates and fulfills the ‘outcome’ ‘accounted’ for and in a consistent strive towards accomplishment of the ‘reason for being’ or ‘purpose’.

The importance of tactics is seen in the different paths of utilization of resources. The “how” of “what” is being achieved, while its importance in “Sense and Respond” terms (Haeckel 1999) is in its provision of adaptive way of sailing in nowadays business waters.

In terms of offering *support for handling the complexity* of tactical management issues to be dealt with, the tactical management proper positioning of information sensors is important. It provides (Sense) potentials with the intangible resource of right information, fueling upstream of Interpret and Analyze, proper Decide and Act Loop. Furthermore, the constant revisions of the sensors, their positioning and content, provide the “control” part of the Loop that enables consistent path (until changed according new circumstances and developments) towards fulfillment of goals.

The performance measurement framework, the Business Plan, the KPIs and the overall prescribed Goals, Targets, Strategic guidelines are providing the ends for which to utilize means. Hence, the tactical manager’s duty is to continuously (Sense) properly position the sensing of information, and (Interpret) align the mismatch of information received, processes and actions, with some reasoning and maneuvers and (Decide) to translate them in order to provide and control the right path to fulfillment (Act).

In terms of *adaptability* and *modularity*, we see the SIDA loop as a perpetual engine that provides dynamic adaptability to any, which can be enhanced further more to tactical, level of management.

2. Research strategy/process

With the abovementioned concepts in mind, we have performed a theoretical research in order to get deeper insight in the support that the tactical management is having at this point in time, with broad information systems artifacts, frameworks, methods and tools. To be more specific, the literature research was guided by the following: (1) understanding of the essence of the paper, the proposed artifact and its integration in management per level (Operational, Tactical, Strategic) and the proposed combinations; (2) analyzing the specific information and processing input for Tactical Management, depending on the used Tools, Methods, Approaches, Artifacts; (3) detection of how the proposed artifact takes in consideration (used the term “closing” with) an Ending – may it be performance measurement framework, such as Balanced Scorecard, Triple Bottom Line, ... or Business Plan, KPIs, Goals, Targets, Reason for Being, Purpose, Accountability; (4) how

the work handles the mismatch of the information for tactical management; (5) the prescription of Real-time or tactical management specific Right-time information need; (6) The presence or absence of Sense-and-Respond Framework and the Sense-Interpret-Decide-Act (SIDA) Loop; (7) the support for Adaptability and Modularity and (8) the perception of Predictability in the specific approach.

The background idea that is guiding this research is to detect the provisions of adaptability i.e. support for the Sense and Respond concept (the adaptability loop Sense-Interpret-Decide-Act) for the role of the tactical manager. Complementary to this, we are incorporating the Sensing of information aspect to investigate approaches to handle the tactical management complexity, the Processing and Outputs of information specific to tactical management and connections with the endings. The selection criteria for the papers subject to this research is their overarching approach of all enterprise business, not only on lines or aspects of business such as CRM, SCM, etc. Also, there are numerous commercial tools and solutions to which these research questions may be extended. However the purpose of such an examination would go beyond the primary goal – to discover the tactical management support with information systems artifacts and tools towards assessing contextual and performance attributes of an implementation, which is not the aim of this research.

3. Analysis

The literature review was performed on 20 papers published in the time frame of the past 10 years (2004-2014) that are contributing with information systems artifacts, implementations and knowledge to the operational, tactical and strategic management, with various technologies and combinations, and from different viewpoints, generally polarized as traditional or make-and-sell vs. sense-and-respond adaptive approaches (Haeckel 2004).

The lens through which the selected literature has been reviewed, and the derived understanding follow:

3.1 Primary orientation in terms of operational, tactical, strategic management and combinations of the contributions

The Information system support for tactical management, we argue, should be approaching the target audience according its specificities not generalization as any type of management. As discussed in the introduction, the tactical management is facing high complexity and high unpredictability. Since it is being the way to achieve the expectations of the company's existence, and since it is so much diverse and person- and company-dependent, it is addressed with the general principles of a certain level of management. From this standpoint, it was an interesting quest to see in what way which artifacts are assisting tactical management. Hence, the initial categorization is to be made by which level of management the analyzed papers are focusing on.

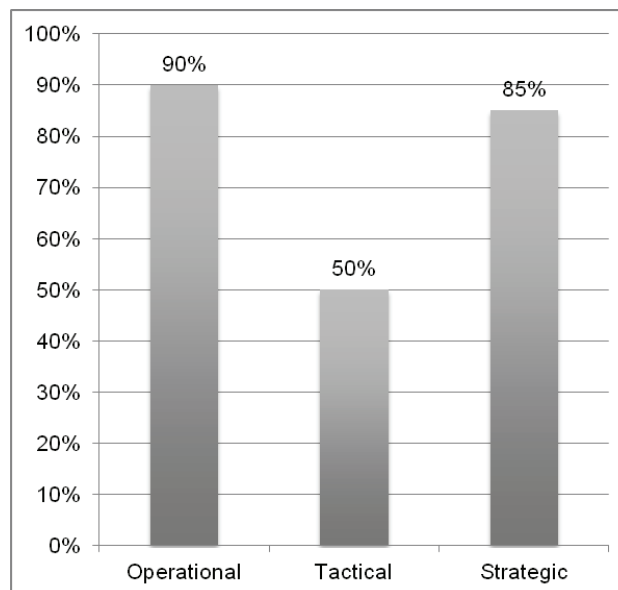


Figure 1: Coverage of the managerial functions (Operational, Tactical, Strategic) by the investigated works

Of course, one can argue that this is not complete and thorough literature review but more an “emerging issue that would benefit from exposure to potential theoretical foundations” (Webster and Watson 2002) and as such, conclusions about absence of focus to the specificity of the tactical management and appropriate information systems can't be made. However, this investigation shows that there is significantly less coverage of tactical management in general, present in only 50% of the papers, while Operational is in a hive of solutions with 90% followed by Strategic with 85% (Figure 1).

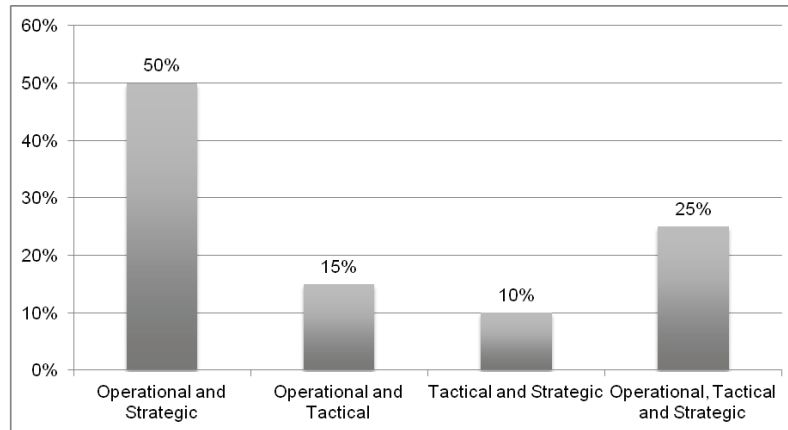


Figure 2: Combinations of focus of the information system solutions of the analyzed works in terms of operational, tactical and strategic management

Since this research restrained from contributions purely for operational or strategic management, Figure 2 shows the combinations that exist in the reviewed artifacts and approaches: intriguingly, 50% of the investigated works tend to overarch Operations to Strategy (Iafrate 2013), (Buckley et al. 2005), (Werner 2013), (Kapoor et al. 2005), (Hoogervorst 2009), (Ba et al. 2008); the one end of Operational and Tactical issues is being tackled by 15% of the works (IBM 2008), (Hoontae et al. 2007), (Hill 2009); and the other end of Tactical and Strategic by 10% of the works (Maes 2007), (Cherbakov et al. 2005) and complete solutions for Operations, Tactics and Strategy are being given (Barone et al. 2010), (Gill 2013), (Berkem 2008), (Forno 2012), (Haeckel 2004).

3.2 Information and processing input for tactical management, depending on the used tools, methods, approaches, artifacts

This aspect is browsed through the literature in order to perceive the provision of tactical management with information from the operations and/or wider entities and processes that are happening in the everyday work. This is one aspect that supports our idea that the tactical management is facing mismatch of incoming information vs outgoing information flows and outcome expectations. The idea behind is that tactical management proper information is much more than standard reports or automated dashboards because there are many operations, modifications and maneuvers that need to be done to any incoming data prior the tactical management information is appropriate for use. The solutions in literature are diverse. Starting from wide range of event driven and on-demand data with near-zero-latency Business Intelligence, predictive modeling, incorporating best practices and exceptions management (Iafrate 2013), through big analytics, massive data capture and business intelligence, “what-if” analysis, forecasts and trends (Buckley et al. 2005), support with processed data and integrated business intelligence (Werner 2013), as well as use of Business Event Processing, heterogeneous event types, internal and external multiple sources, important viewpoint of this research - event processing logic maintained by user – dashboards (IBM 2008) and personalized monitoring dashboards (Hoontae et al. 2007) that incorporate event-driven and on-demand information to be given at hand (Kapoor et al. 2005). Number of contributions are noted using enterprise architecture to facilitate context analysis (Hoogervorst 2009) (Gill 2013), ‘Business Execution layer’ feeding information (Simon et al. 2013). Enterprise modeling is being used in providing design of the sensing mechanism based on the Business Intelligence Model (BIM) and i* (Nalchigar 2013), in order to monitor the achievement of strategic goals, develop alternative responses, select the most suitable alternatives, implement and monitor the response, with the BIM defined by Barone et al. for the input of tactical management providing a set of constructs for modeling and analyzing a business context to support decision making (Barone et al. 2010). Frequent is the observation that the tactical choices that are available depend on the business model chosen by the firm in the first stage that depends on the strategy (Casadesus-Masanell 2009), while Ba et al. develop

method aimed at effectively organizing, integrating, reusing knowledge and model components in direction of providing information and knowledge input for the alternatives, scenario models and model solutions of the decision maker (Ba et al. 2008). With Component Business Model (CBM) (Cherbakov et al. 2005) have seen information support through the componentization and the dynamic processes, while the Business Motivation Model (BMM) and Service Oriented Architecture (SOA) are the basis for designing 'The Why (Business motivation), the What (Services) and the How (Service Description and Realization)' (Berkem 2008) to provide organized information supply. Business Process Execution Measurement Model (BPEMM), Business Activity Monitoring (BAM) and Process Mining (PM) are the basis for Overall Business Process execution measurement and Improvement approach that serves the levels of management with relevant BP information (Delgado et al. 2014). Noteworthy designs for information provision and automated decision-making are seen in the SIFT framework an abstract artifact (a framework comprising of models, measures and a method) for Information Quality improvement (Hill 2009), Integrative framework for Information Management (Maes 2007) where Strategy, Structure and Operations are differentiated and in the Adaptive Enterprise Service System Model (Gill 2013). To end with the other side of this spectrum, with the approaches of Forno and Haeckel, where proper positioning of information sensors with regard to the current accountability is recommended. (Haeckel 2004) (Forno 2012)

3.3 Output expected of tactical management ('endings')

With regard to the expected outputs or outcomes from the tactical management function, the literature analysis has resulted with the notion that most of the contributions expect the 'endings' to be Key Performance Indicators (KPIs), some of which using the Balanced Scorecard (BSC) as strategic framework, with the following modalities: KPIs (Ba et al. 2008) (IBM 2008) (Delgado 2014); Indicators and KPIs (Hoontae et al. 2007); KPIs that align with strategic goals (Iafrate 2013); KPIs, Goals and Objectives (Buckley et al. 2005); KPIs and projections (Maes 2007); two loops for monitoring KPIs and ex-post periodic analysis (Werner 2013); KPIs through BSC perspectives (Kapoor et al. 2005) (Nalchigar et al. 2013) (Barone et al. 2010). 'Endings' in broader sense are defined and used as Mission, Goals (Hoogervorst 2009); Goals and Priorities (Gill 2013); Targets, Goals (Cherbakov et al. 2005); Strategic guidelines reflected in the selected business model (Casadesu-Masanell et al. 2009); Business motivation, Business Model (Simon et al. 2013); and Metrics (Hill 2009). Business goals as part of the ends drive courses of actions (strategy and tactic), directives (rules and policies) till business processes in the (Berkem 2008) paper. To complete the horizon with the Reason for being (Purpose) and the Outcomes accountable for, that are used as 'endings' defined and used by (Forno 2012) and (Haeckel 2004) while achieving whatever indicators a company needs.

3.4 Handling mismatch of information

According the previous two concepts, our standpoint that the tactical management position in the middle of Strategy and Operations, Clients and Company and Management and Employees faces mismatch of incoming and outgoing information that needs to be handled in some way. Usually, the additional operations of data exported from the existing systems are performed by the manager him/herself (research in progress); but there is significant variance in time, quality, personal approach and effects when that operation is performed individually. The theoretical approaches offer different solutions for this problem: starting from Automated conversions and reasoning of data (Iafrate 2013) and automated decision making (Hill 2009); Sense and Respond Business Performance Management that orchestrates dynamic, structured and unstructured information within a continuous, adaptive event-based planning process, also determines business rules and policies and orchestrates among the value partners to achieve better overall performance (Buckley et al. 2005) through management by exception, most of the data is automatically converted with some prescribed reasoning and processing logic (IBM 2008). Business Process design and KPI definition (Werner 2013) and essential alignment of measures that are related to business strategy and goals for the entire organization with the ones that are specific for each business process (Delgado et al. 2014) are another type of approaches trying to address the mismatch of information on tactical level. Modeled conversions and reasoning of data are visible in the papers of (Kapoor et al. 2005), (Nalchigar et al. 2013), (Ba et al. 2008), (Hoontae et al. 2007), all the way to more specific, short-term, semi-structured modeling possible for Mid-level management control (Barone et al. 2010). "Means (Strategy, Tactics) and Ends (Vision, Goal, Objective) to cover the "total disconnection" of the business processes with the business goals and rules" (Berkem 2008). Heads Up displays for every role (Haeckel 2004) and no ambiguity in the defined Purpose and Governing principles together with proper communication and sensors while negotiating towards the outcome (Forno 2012) are the approach that can be adapted to any level of management, including tactical.

3.5 Right-time information or real-time information

Our idea for tactical management underlines the necessity of right-time information, which has some low latency in terms of time and frequency and almost no latency in terms of structure and scope. However, nowadays theoretical contributions all discuss and strive for real-time information (Iafrate 2013), (Buckley et al. 2005), (Werner 2013), (Kapoor et al. 2005), (Ba et al. 2008), (IBM 2008), (Hoontae et al. 2007), (Cherbakov et al. 2005), (Delgado et al. 2014), (Barone et al. 2010); or in terms of shortening the latencies (Nalchigar et al. 2013), (Forno 2012), (Haeckel 2004). Some of the papers are not addressing this issue at all, not being focus of their approach.

3.6 Sense-and-respond framework and the sense-interpret-decide-act (SIDA) loop

We perceive the Sense-and-Respond managerial concept as introduced by Haeckel in 1999 as good starting point for attempting to solve the complexity and uncertainty the tactical management is facing with. Its component, the SIDA Loop is the revising mechanism that provides the adaptability to changing environment, circumstances, stakeholder needs and accountabilities. From this standpoint, we submit the reviewed contributions also to these concepts to perceive whether they have been used or not, and with which understanding and implementation. No explicit use of these concepts has been noted in the papers of (Hoogervorst 2009), (Ba et al. 2008), (Hoontae et al. 2007), (Hill 2009), (Berkem 2008), (Maes 2007), (Simon et al. 2013), (Delgado et al. 2014), (Casadesus-Masanel et al. 2009). However, according our perception, the SIDA loop has been implicitly integrated in the BPCIP (Delgado et al. 2014); in the Plan-Do-See-Act design (Hoontae et al. 2007); and addressed through the Input of the Knowledge Provider, the Processing of the Knowledge Broker and the Output of the Decision Makers (Ba et al. 2008) and Scan&Sense, Interpret&Analyze, Decide&Respond (Gill, 2013). In own interpretation, both terms have been used by (Barone et al. 2010) and separately with BIM to sense and interpret and with their artifact to decide and act (Nalchigar et al. 2013). IBM's definition and approach to these concepts is visible in the work of (IBM 2008), (Cherbakov et al. 2005), (Buckley et al. 2005), (Werner 2013) and in a way that the S&R system uses available data, such as forecasts, customer orders, and supply commitments, and aims to provide an early warning system for conditioning with an important innovation - a new algorithm that identifies potential problems by using historical information and future indicators to forecast trends for customer orders and to compare trends and forecast as lead indicators of future occurrences (Kapoor et al. 2005). The core definition, Knowing earlier, Managing by wire, Dispatching capabilities from the event back, Designing a business as a system (Haeckel 2004) as Sense-and-Respond basics are explicitly used by (Forno 2012).

3.7 Adaptability and modularity

The concept of Adaptability is analyzed in conjunction with Modularity, and the deduction is as follows: when the discussion of the authors is in terms of business processes, the adaptability is perceived in their adjustment (Iafrate 2013), predefinition (Werner 2013), corporate agility (IBM 2008), Monitoring Modeling, Event Modeling, Indicator Modeling, Alert and Response Modeling (Hoontae et al. 2007), Business Processes and Stable and loosely coupled services (Berkem 2008) all the way to setting up continuous improvement cycle for business processes implemented by services in organizations based on BP execution measurements (Delgado et al. 2014). Enterprise design and architecture create the ability to adapt and change for the future and systems thinking is significantly present in the adaptability aspect of the work of (Hoogervorst 2009). Enterprise-wide business processes and setting the context, designing for change, executing the SIDA loop - process for re-engineering the enterprise are significant for (Kapoor et al. 2005), while composite services and dynamic processes based on componentization, partner networks; value nets, service oriented enterprise are discussed by (Cherbakov et al. 2005). (Maes 2007) sees the modularity and the adaptability prescribed in the Structure of the company, while their determination by the selected business model is present in the work of (Casadesus-Masanel 2009), (Barone et al. 2010) (Simon et al. 2013), (Ba et al. 2008), culminating with continued focus on responsiveness and adaptability provided by a a model-driven capability design and an architectural framework of loosely coupled components for adaptive business management (Buckley et al. 2005). Adaptive Enterprise Service System Model and underlying adaptive enterprise architecture into adaptive enterprise architecture capability for handling complex enterprise transformations based on the view of the enterprise as a system with subsystems are largely discussed by (Gill 2013). The SIDA loop as generator of adaptability, the constant negotiations and the system design of the enterprise existence with flexible role occurrences are used in their generic sense by (Haeckel 2004) and (Forno 2012).

3.8 Predictability

For indirect support of our choice of the Sense-and-Respond concept is the investigation how do all these different authors perceive predictability or unpredictability of the environment into account for their contributions, we performed the scan of the approaches through the lens of this concept. If we set aside the works where this issue hasn't been addressed or not being focused on, there are two general standpoints: attempts to provide forecasting, what-if alternative analysis, extrapolation, optimization and predicting ability to the management, by different tools, algorithms and business intelligence activities (IBM 2008), (Hoontae et al. 2007), (Hill 2009), (Delgado et al. 2014), (Barone et al. 2010), through the variation of identifying runtime variations (Werner 2013) and maintaining lowest latencies possible (Nalchigar et al. 2013) all the way to assuming unpredictability and uncertainty (Hoogervorst 2009), (Gill 2013), (Forno 2012), (Haeckel 2004), (Cherbakov et al. 2005).

4. Interpretation of the results and conclusions

The tactical management specificity (especially the need for adaptable information sensing, processing, deciding, acting, adapting and handling complexity) should be stressed to a great extent when designing information systems for the companies. The feeding with information to the tactical management is done mostly on a technical level of implementation, and usually with structured, automatized data and automatic connections and dashboards. The present tendency of closing with endings by shooting real-time operational data towards strategic dashboards that are performing some sort of KPI monitoring on different levels of management is visible in 50% of the papers (Figure 2), which, according to our standpoint, is too big of a distance, and too present of mismatch for feasible implementation in the real business world. Hence, the current support for handling the mismatch of information in the middle is done with automatized logic, that can't always be prescribed, with modeling and incorporation in business processes, but maybe with not exploited enough governing principles and purpose, that individualize the conversion logic and bring it down to context and structure. The top-down approaches starting from strategic level, cascading outcomes, quantitative but also qualitative expectations, are somewhat assimilating tactical management specifics.. There is significant 'ingestion' of the tactics by operations or strategy, in the last period of time. In terms of adaptability and modularity, still, the solutions base on the somewhat rigidity of business processes, which is to a certain extent on the opposite side of modularity, while tactical management needs flexible support in flexible/unstructured/dynamic processes. Unpredictability is still little concern to the contemporary solutions, which for the whole companies and especially for tactical management should not be assumed.

Hopefully, this research will turn the lights towards tactical management, as present and making a difference in every pore of life, especially in business, with its specifics and elasticity, rather than general managerial treatment; which should be addressed with appropriate identification of characteristics and followed up by innovative information systems concepts and solutions.

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Some Ps are Missing in the Governance of Projects, Programs and Portfolios (PPP)

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Abstract: The Governance of Projects, Programs and Portfolios (PPP) is the subset of Corporate Governance focused on ensuring that the projects, undertaken by one company, are selected right and also deliver the expected value. After the successful development of PPP management techniques, applied to different company assets, there are initiatives to norm this board responsibility for Information Technologies (IT). In this paper, we show that the implementation of Governance of IT standards, through IT governance frameworks, contributes significantly to the implementation of the principles of the good Corporate Governance, particularly for PPP governance for IT. We illustrate our findings reminding some real cases where PPP governance for IT could be expressed through a subset of an IT governance framework (Juiz, C., et al., 2012). Subsequently, we claim that there are more Ps to be considered in the possible PPP Governance standardisation. All these arguments and their relation with Corporate, IT and PPP Governance are also shown. Thus, future standardisation for Governance of PPP should consider these insights and past experiences in Governance of IT, specially the compatibility with the ISO/IEC 38500 activities and behavioural principles.

Keywords: corporate governance; governance of PPP; governance of IT; ISO/IEC 38500; IT governance and alignment

1. Introduction

The Governance of Projects, Programs and Portfolios (PPP) must ensure that the projects undertaken by an entity (company or public enterprise) are selected, developed, and deployed right and also deliver the expected value, from the corporate governance viewpoint. In the recent past, there have been successful developments of PPP management and operation techniques, applied to different assets, particularly in Information Technologies (IT). Lately, there are new initiatives coming from standard bodies to norm this essential responsibility for the board (often delegated to senior executives). Moreover, good governance is designed to ensure accountability without diminishing the ability of project, program and portfolio managers to deliver the goals they have to accomplish. However, governance structures and processes are merely the mechanisms of governance since these procedural techniques do not assure good governance itself. The key to developing an effective governance framework that makes effective use of these processes is behavioural, i.e. creating a culture of good governance in the company. Thus, good governance behaviours achieve excellence through accountability structures in which the board or senior executives take responsibility for the projects and their outcomes, and that these projects are stakeholder focused and aligned with the company strategy and its interests. In particular for IT assets, the ISO/IEC 38500 standard for the Governance of IT and their corresponding behavioural implementations, not only cover all the good governance issues, e.g. responsibility, accountability and outcomes-strategy alignment but also include (implicitly) the governance of PPP for IT assets. This inclusion of PPP governance is not explicitly included in the management area but in the activities of IT governance: Direct, Evaluate and Monitor (ISO, 2008).

However, two main conflicting questions arise from the possible governance of PPP standardisation, without considering these previous works and real experiences, particularly for IT asset governance. First, the PPP governance should be coherent with the current ISO/IEC 38500 standard for Governance of IT and also consequent with the behavioural implementation of IT governance frameworks based on the standard (ACSIC, 2013). It is difficult to imagine how to govern IT assets in any company without considering the governance of IT Portfolios, IT Programs and IT Projects together. Second, the effort in Project Management and Project Governance for IT in the last decade (Müller, R., 2011) suggest that there are more important Ps to consider than just three, e.g. Policies, strategic Plans, business Plans, business Processes, Project Planning and Project Products, among others. While some of these Ps belong to management processes, others are clearly related to the behavioural scope of Governance. Therefore, we believe that future standardisation of Governance of PPP not only has to consider previous Corporate Governance standardisation but also the Governance of IT and their behavioural components as well as the existing links with the past experience on Project Governance and Project Management of IT. In the following sections, we present a model for the Governance of PPP compatible with the Governance of IT framework based on the ISO/IEC 38500.

Thus, in section 2 we briefly introduce some related work. Then, we argue the factors leading to include the possible future PPP Governance standardisation for IT below the umbrella of the Governance of IT, particularly the ISO/IEC 38500 standard. Finally, we present our conclusions and some open problems.

2. Related work

Despite PPP governance is a vital topic in which companies are starting to believe in, it is almost impossible to come across with updated and reliable information. Even more, a review of the (not easily found) literature does not provide a clear definition or conceptualisation about PPP governance. On the contrary, there are a lot of works related to the Management of PPP and widely known de facto and de jure standards. Our work is devoted to clarify PPP Governance within the existing Governance of IT standards and the consequences for the board (or its delegates).

From our knowledge, among the analysed references, we have been able to distinguish two main trends:

- Management of PPP. Although governance activities are not forgotten, they are considered part of management. Very interesting examples can be found in IBM (2007) and Queensland (2010).
- Governance of PPP. They strive to clearly separate governance activities from management, even informally depicting a future standardisation. (Mosaic, 2013).

Notwithstanding the good intentions of the analysed work to date, all, regardless of the trend they follow, eventually have problems in establishing the frontiers between the governance and management of PPP. The confusion about the corresponding roles of governance and management is not new at all, in fact it is something that was studied and discussed when groundwork was laid during the establishment of the ISO/IEC 38500 for Governance of IT. What is truly remarkable is that, once again, the discussion seems to resurface in the arena of IT.

With the PPP governance proposed in our work, we seek to “defog” these reappearing shadows that challenge the correct differentiation of what means to govern and manage IT projects, programs and portfolios, as they seem to be the source of problems. To that end, in accordance with what ISO/IEC 38500 principles, it can be seen that, in a similar way to IT governance, the PPP governance system supervises, controls and receives information with the sole purpose of making decisions (efficiently, effectively and transparently) on which projects, programs and portfolios are the most suitable for the organisation to achieve its business objectives and outcomes (Garland, R., 2013).

3. Governance of PPP and governance of IT

Most of the confusion in the last decade between the roles of management and Governance of IT at companies has been cleared with the standardisation of the term “Governance of IT” as the system by which the current and future use of IT is directed, evaluated and monitored. The term Governance of IT is usually understood as equivalent to the terms Corporate Governance of IT, Enterprise Governance of IT and Organisational Governance of IT. Since the issuing of the ISO/IEC 38500 standard, Governance of IT is the usual way to define how to provide principles, definitions and a model for governing bodies to use when evaluating, directing and monitoring the use of IT in their organisations, whereas IT Management exercise of control and supervision within the authority and accountability established by Governance of IT.

Without a good Governance of IT, a company structure does not have clear roles and responsibilities in the context of IT. Good governance of IT assists governing bodies (the Board and/or senior executives) to ensure that the use of IT contributes positively to the performance of the organisation through:

- Innovation in services, markets, and businesses;
- Alignment of IT with business needs and requirements;
- Appropriate implementation and operation of IT assets;
- Clarity of responsibility and accountability for both the supply of and demand for IT in achieving the goals of the organisation;
- Business continuity and sustainability;
- Efficient allocation of IT resources (including human capital);

- Good practice in relationships with stakeholders;
- Realisation of the expected benefits from each IT investment, ensuring the delivery of value for money and fostering new product and market generation.

In Figure 1, Toomey's clarified conceptual model for Governance of IT (and its relation with IT management) is simply depicted.

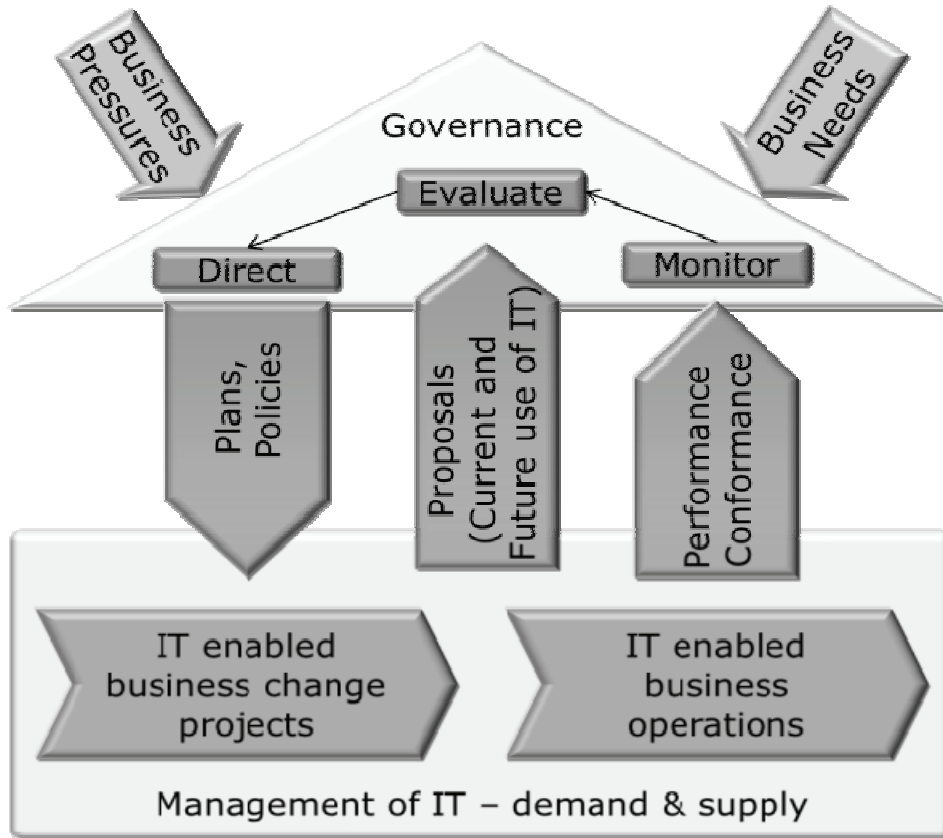


Figure 1: Model for corporate governance of IT ISO/IEC 38500 as appears in (Toomey, M. 2009)

An informal interpretation of Figure 1, focused on business strategy and projects is:

- Business units and IT staff work together to propose a business strategy and policy that drives the intended use of IT, and subsequently to propose projects that should be evaluated for inclusion in the investment portfolio which implements the strategic plan.
- Investment in projects to deliver IT-enabled business change should be undertaken as directed from the strategic plan and in conformance with policies approved by the board (Juiz, C. 2012).
- Project team with business change and technology skills work with line managers to build IT-enabled business capability.
- In order to close the virtuous cycle (see Figure 1), once the projects become a reality, they serve to operate and enable the capabilities of the business.
- All activities and systems involved in delivery of projects and in ongoing business operations should be subject to ongoing monitoring of performance (indicators and outcomes) against expectations and conformance to internal and external rules as appropriate (De Haes, S. 2004).

ISO/IEC 38500 sets out six principles for good Governance of IT that express the preferred behaviour to guide decision-making. By merging and clarifying the titles from ISO/IEC 38500, we derive a clear summary of these principles:

- Responsibility: Establish clearly understood (and appropriate) responsibilities for (decisions relating to use and supply of) IT;
- Strategy: Plan (supply and use of) IT to best support the organisation;

- Acquisition: Acquire (invest in new and ongoing use of) IT validly;
- Performance: Ensure that IT performs well (particularly in respect of business needs), whenever required;
- Conformance: Ensure that (all aspects of decision making, use and supply of) IT conforms with formal rules;
- Human behaviour: Ensure that (planning, supply and use of) IT respects human behaviour.

Thus, it is difficult to consider that IT Projects, Programs and Portfolios (PPP) can be governed outside the scope of the general Governance of IT. Moreover, we should not repeat the confusion experienced in the past about management and Governance of IT. PPP Governance differs from the classical PPP Management. The Governance of Projects, Programs and Portfolios (PPP) is the sub-set of corporate/organisational/enterprise governance focused on assisting and ensuring that the projects and programs undertaken by the organisation deliver the maximum value to the organisation (Juiz, C. 2011). As a fundamental principle, PPP Governance is not about governing project management, it is about governing the organisation that undertakes projects as a part of its business.

However, PPP Governance needs to be thought through carefully to cater for the environment in which they are delivering. The key to developing an effective governance framework that makes effective use of these processes is cultural. Well governed organisations develop an open culture focused on achieving excellence through the creation of meaningful ownership and accountability structures in which senior executives take responsibility for the company and its outcomes, e.g. applications and solutions coming from IT projects. The objective of good governance is to optimise the efficient use of resources to the benefit of the company (Mosaic Projects, 2013). PPP Governance applies the general Governance of IT principles to the use of resources within projects, programs and portfolios, to generate benefits and value through the mechanism of the governing body (the Board and/or senior executives) requiring the PPP management to develop and implement an effective culture of excellence and accountability. In the next subsections, we propose a PPP Governance model within the Governance of IT framework proposed in the ISO/IEC 38500 standard.

3.1 Explicit PPP governance in ISO/IEC 38500

Following what ISO/IEC 38500 states about the implementation of the governance of IT, the implementation of PPP Governance should also be based on a cyclic approach where the first cycle of activities involves the establishment of the initial baseline and the subsequent cycles support and enhance the governance of PPP by means of continual reviewing and improvement.

Figure 2 shows an adaptation of the IT governance implementation model presented in ISO/IEC 38500. In this adapted Figure, the activities related to PPP governance that were already considered in the initial model are marked in light grey and the new/modified activities appear in dark grey. We are not trying to substitute or modify the ISO/IEC 38500 standard; just the opposite, we want to point out that the standard itself is enough to consider the general Governance of IT, including services, operations and, of course, projects, programmes and portfolios. However, we want to remark this last feature for the ISO/IEC 38500 applicability by detailing which, where and why the specific needs for PPP governance are covered already. We argue that creating a general PPP governance standard out of the umbrella of the ISO/IEC 38500 has no sense for the IT projects. In a similar way, we cannot consider Governance of IT out the scope of Corporate Governance of companies and organisations, since IT assets are not the only ones in these entities, we believe that PPP governance for IT should be developed within the ISO/IEC 38500.

As Figure 2 shows, it is difficult to consider IT Projects, Programs and Portfolios (PPP) Governance outside the scope of the general Governance of IT; therefore, in this implementation approach we have not only utilised the main activities of general governance of IT (Direct, Evaluate and Monitor) but also we have included particular activities related to PPP Governance. Specifically, the virtuous cycle shown in Figure 2 comprises the following activities, which will be further discussed in subsection 3.2:

- Establish and Sustain Enabling Environment. It commences by establishing an enabling environment, which ensures that business strategy and principles are appropriately established. Subsequent cycles will analyse which PPP proposals and investments are approved or not.
- Govern IT and PPP. It includes evaluate, direct and monitor activities to perform the governance of IT and PPP.

- Continual Review. Review the governance of IT and PPP arrangements to determine whether desired outcomes are being achieved. If not, initiate a re-entry of the implementation cycle to effect the necessary changes ensuring continual improvement.

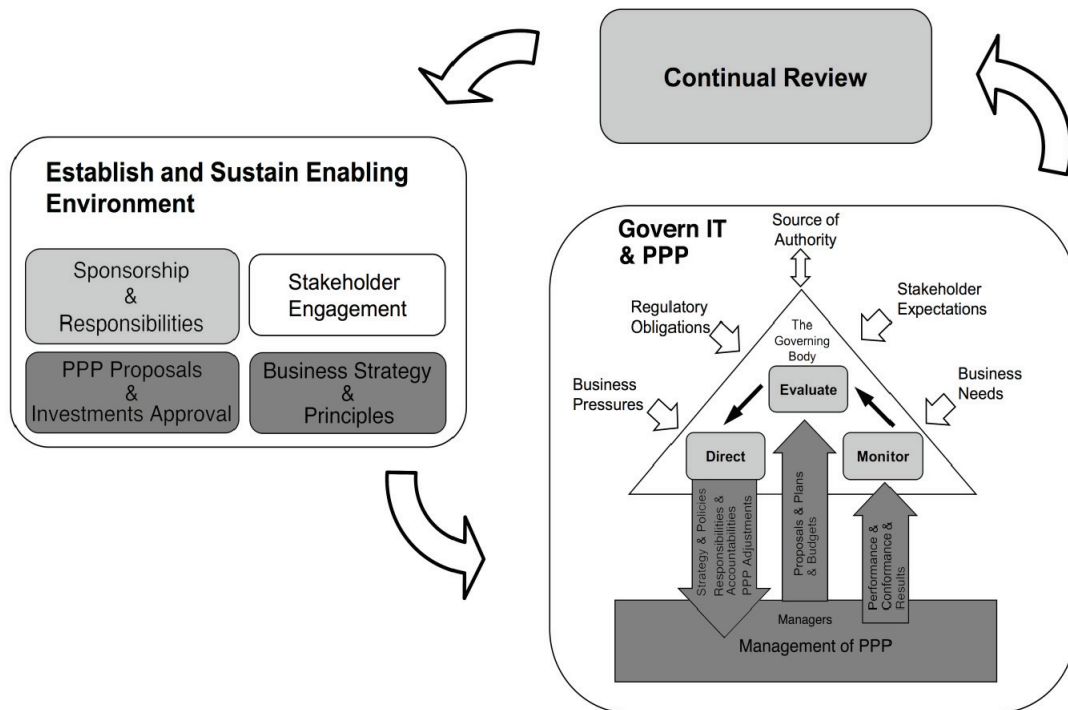


Figure 2: Proposal of PPP governance within ISO/IEC 38500

3.2 A layered model for PPP governance inside the governance of IT

The model that we propose in this work (see Figure 3) aims to show, in the most generic sense, what means to govern PPP, not only by informally commenting what should be done in the governance layer: Corporate Governance and Governance of IT, but also what should be taken into consideration from/to the Management and Operation layers. This solution should not be taken as unique and static, but rather a starting point from which organisations can understand how to govern (do the right thing and be responsible of it) and manage (do it right) for their PPPs.

Although the model may seem rather detailed, in reality it is based on three main activities:

- Doing the right projects, programs and portfolios (PPP) constrained by the organisation capability and capacity.
- Creating the environment that facilitates the doing of the selected projects and programs right.
- Implementing the right ways to monitor and adjust the projects, programs and portfolios so that they can achieve the business objectives of the firm in the most efficient way.

The solution explained below is derived from Figure 2. In particular, it represents a "zoom in" of what the figure already shows, detailing in every layer the whole PPP governance process, where each layer represents a key role in the governance of PPP.

Therefore, we have developed the layered model for PPP governance shown in Figure 3. The model contains four layers, namely: Corporate Governance, Governance of IT, IT Management and IT Operation. However, the PPP governance details are mainly developed in the Governance of IT layer due to the nature of the problem we are researching. In the following, we briefly explain each layer of our model (see Figure 3):

- Corporate Governance: The board (or senior executives) should define and establish business principles and strategic plan. Another important activity of this layer is to delegate decisions on IT governance body by setting roles and responsibilities of IT Governance structures (e.g. the CIO office). The core functions of the Corporate Governance for the PPP governance are, particularly, to approve the PPP solutions

(applications) in order to ensure their alignment with the strategy and future achievement of the business objectives and outcomes. Classical products of this layer are the corresponding reports of PPP and the final result of their execution.

- Governance of IT: Special attention should be paid to this layer as it will help to distinguish between the roles of governing PPP vs. managing PPP (next layer). We remind that our model tries to follow the activities defined in the ISO/IEC 38500: Direct, Evaluate and Monitor, but specifically applied to PPPs governance. From left to right in the model, the activities (data flow arrows) are:
 - *Direct.* In the initial phase of IT Governance of the organisation, the principles and the IT strategy must be aligned the business strategy and principles that were established by the corporate governance should be accomplished. Therefore, the IT governance structures (for PPPs) should communicate the PPP Governance framework itself for the selection and prioritisation of PPP, so that the business units (and anyone in the company) know the criteria for choosing PPPs. Consequently, procedures and rules in deciding whether to start, freeze or cancel PPPs should be communicated. Assigning roles and responsibilities for managing new PPPs are part of the Governance of IT layer. The ulterior PPPs' possible changes and adjustments should be reported from lower layers, as soon as PPPs are modified during their execution.
 - *Evaluate.* During the initial stages of PPP Governance, portfolios of programs of the organisation should be defined. Therefore, in case a new program is created, it should be assigned to a program sponsor. The program should be classified, preferably, in one portfolio. The definition of the program includes the identification, approval and addition of the projects that will constitute the new program and finally specify which objectives should be fulfilled for the development of the program. In the case of a new portfolio, there are similar activities but an owner of the portfolio should be assigned. Next, the owner (or the corresponding governance structure) should identify, adopt and insert programs that make up the new portfolio. Finally, the portfolio objectives should be established in accordance with the business strategy (see corporate layer). In the case of new projects creation, the activities are also similar, however we have to pay attention to the project pre-selection process conducted by the Governance of IT layer and managed by lower layers. Business units and IT staff fill out the standardised forms (in order to be able to compare them) to ask for new projects. Each organisation should have its own process for converting the project ideas into some abstract in the form including the criteria to evaluate the project for upper layers (Juiz, C. 2012). So that, the business units, together with the IT staff (Project Management Office, PMO), should ensure that only the project proposals with the required information, abstract, inter-dependencies, benefits, risks, business case, etc. are preselected. The CIO office should also include the governance values (if any) that management and business units cannot fill out in this process, e.g. the alignment. This pre-selection of projects should be pre-classified in any of the programs of the organisation. After this pre-selection, the PPP approval process should be started, minimising the overhead, bureaucracy and unnecessary iterations. Once the new PPP has been defined, a summary will be raised to the layer of corporate governance which decides the definitive PPP selection and the prioritisation. There should be also rules and processes to starting/freezing/pausing/cancelling PPPs.
 - *Monitor.* PPPs should be monitored not only for the PMO at Management layer but also from the Governance of IT viewpoint. It is necessary to control the delegation of management and operation in PPPs, e.g. if a project continues to meet business objectives or compliance with internal rules and external norms. Several products as summary reports for Corporate Governance can be delivered in this activity.

After monitoring PPPs, a new evaluation may be performed in order to change direction, as other activities of Governance of IT. Therefore, the virtuous governance cycle is repeated not only for PPP but also for IT services / operations (see Figures 1 and 2). The main result of this layer is the PPP approval process along with a continuous evaluation to ensure that the PPP selection is right for the company and the lower layers which are developing projects are controlled so that there are no hidden costs or risk surprises for the upper layers.

- IT Management: In order to clarify the general model, we include a brief depiction of the processes and procedures covered by PPP management as PMI states (PMI, 2013).
- IT Operation: In order to clarify the general model we include a mention to the execution of individual projects by project teams controlled by the PMO.

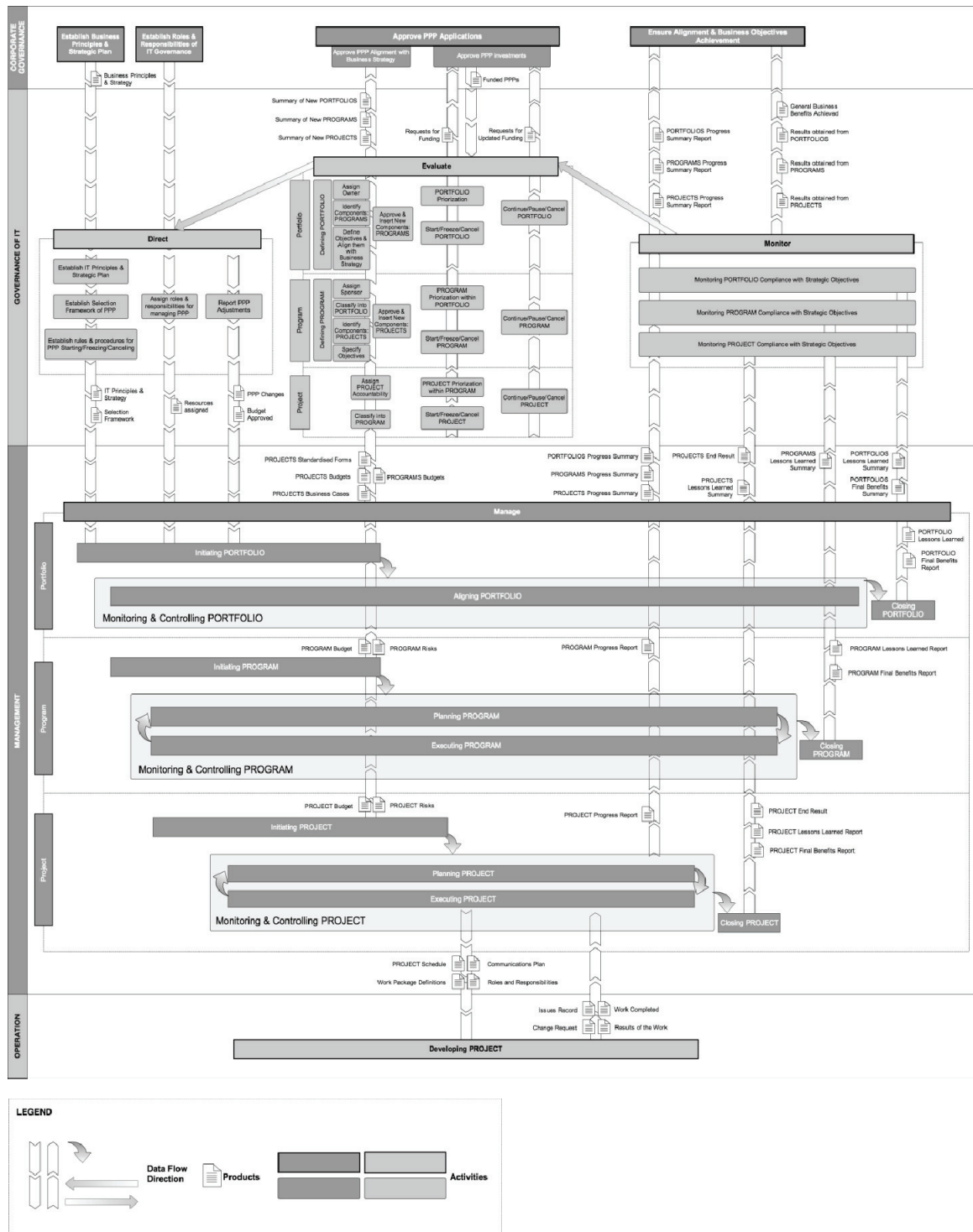


Figure 3: Layered model for PPP governance inside the governance of IT

4. Conclusions and open problems

For Governance of IT staff, there is an inescapable conclusion. Like other company asset specialists (e.g. financial, human resources, etc.) their job as stewards of a vital resource is to help the board and senior executives to perform their roles of primary responsibility as effectively as possible, but without ever overreaching and exceeding their role. One of these responsibilities is the PPP governance for IT. Doing so creates the opportunity for Corporate Governance to focus on the accomplishment of business objectives due to the right selection and execution of the corresponding IT projects by managers and IT staff. However, the PPP governance has to be coherent and compatible with the recent standardisation of Governance of IT. We argue that separating PPP governance for IT from the umbrella of the ISO/IEC standard would result in the

eventual and seemingly inevitable consequence of disharmony, sub-optimal outcomes and, in the worst cases, major IT project failures. We provide an initial layered framework to understand how PPP governance could be integrated in an ISO/IEC 38500 implementation.

Achieving best practice in Governance of IT demands a fundamental and comprehensive rework of the mindset in both business and technology leadership cycles. Corporate leaders must learn and understand new responsibilities and develop the capability to discharge these responsibilities effectively. Information Technology managers must relinquish some of what they thought was their primary responsibility. As we move deeper into the digital era where organisations and markets are being profoundly transformed through the innovative use of IT to create new business capabilities through IT projects, it is imperative that both IT Governance and IT Managers build new models for engagement, so that they can work effectively together to the benefit of the organisation and its stakeholders. However, these new models cannot be separated from the last decade's effort in standardising Governance of IT together with the PPP Management experience developing IT projects. The model presented in this work reveals that there are some Ps missing in PPP governance, mostly Products, Plans, Project Proposals, Proposal Pre-selection, Progress report, etc. Most of them are reports either from the Governance of IT to the board or from the management to the Governance of IT. Thus, PPP governance should be conducted from the top, focusing on business capability, performance and outcomes as the normal behaviour of IT assets in any company.

Our future work will be:

- Sharing the model with other WG from national standardisation bodies in order to rethink the possibility of creating a brand new standard without considering the ISO/IEC 38500 principles.
- Testing the layered model in a real case.
- Improve the model with the lessons learned in this real case.

Acknowledgements

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Challenges and Success Factors for Collaborative Business Process Modelling

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Abstract: In recent years the field of Business Process Modelling (BPM) has gained increasing attention from both the business and research communities. One of the primary drivers for BPM is the improved understanding of business processes, improved communication and the competitive advantage gained over competitors. BPM is a collaborative activity that needs to be carried out in a team environment, and Collaborative Business Process Modelling (CBPM) promotes improved accuracy and quality of process models. In spite of the increased popularity of CBPM, there is limited research related to the collaborative nature of the modelling tasks performed by modellers and specifically to the synchronisation of shared process models. The main research problem addressed by this study is that modellers experience difficulties conducting BPM activities in a co-located collaborative environment. The first research question addressed relates to the benefits and challenges of CBPM, whilst the second research question involves identifying the critical success factors and measures for CBPM. A survey of modellers in South African Information Technology (IT) consulting companies is reported on in order to provide a more in-depth understanding of the status, benefits and challenges of CBPM in IT consulting organisations. The survey results revealed that CBPM provides for sharing of ideas and increased understanding of the processes being modelled. Several challenges were reported with regards to the integration and synchronisation of models. The study provides a valuable contribution to the field of process modelling and will assist IT management with understanding the problems and challenges involved in CBPM. Analysis of these factors can contribute to the improved planning for CBPM. This in turn can facilitate improve BPM in organisations thereby providing them with a competitive edge.

Keywords: collaborative business process modelling; business process modelling; business processes; modelling tools; modelling software

1. Introduction

Business processes are important to an organisation and form part of the corporate assets and differentiators in the competitive business environment (Seethamraju 2010). Effective business processes are also essential in developing countries such as South Africa which want to expand on their global trade (Sonteya and Seymour 2012). Business Process Modelling (BPM) forms a vital part of the larger field of business process management (Aleem *et al.* 2012), and should be carried out before organisations start process improvements or engage in process management initiatives (Bandara *et al.*, 2005; Indulska *et al.* 2009a). An efficient process modelling project is one that is completed within the outlined time and budget constraints. The benefits of BPM are improvements in process quality, increased understanding of the processes and improved communication in an organisation (Havey 2005; Indulska *et al.* 2009a). Modellers who need to design and draw process models mostly work in teams of modellers in a collaborative manner and need to synchronise and integrate process models. The benefits of Collaborative Business Process Modelling (CBPM) include brainstorming, increased understanding of the process amongst modellers and more accurate modelling. However the collaborative aspects of modelling introduce additional benefits and challenges into the activities of modelling. Empirical studies of the benefits and challenges of CBPM are limited. Challenges related to the collaborative aspects of BPM include standardisation of models and the ease of use of the BPM software (Indulska *et al.* 2009b).

The main objectives of the study were to identify and analyse the benefits and challenges of CBPM in Information Technology (IT) consulting companies, as well as the success factors and measures for CBPM. In order to achieve these objectives, a literature study was undertaken followed by a survey of business process modellers in South African Information Technology (IT) consulting companies. The results were analysed in order to provide a more in-depth understanding of the benefits and challenges of CBPM encountered by stakeholders in BPM activities. This study fills a gap in the research fields of BPM and collaborative BPM relating to benefits, challenges and success factors encountered by stakeholders in the modelling activities. This paper will be structured as follows. Section 2 discusses the field of BPM languages and software, whilst

Section 3 analyses several benefits and challenges of BPM for organisations, with a particular emphasis on CBPM. In Section 4 success factors of BPM and CBPM are identified and a theoretical model for CBPM is proposed. Section 5 provides a discussion of the research methodology used in this study. The participant profile of the sample is presented in Section 6 whilst the results of the survey are analysed and presented in Section 6, whilst some conclusions and recommendations are made in Section 7.

2. Business process modelling (BPM) languages and software

A diagram of a business process can be referred to as a process map, workflow diagram, a business process model or an activity diagram (Harmon 2007). The way the elements of a model are represented varies depending on the process modelling language and business rules defined by the organisation. A modelling tool refers to an application that is used to build a model, maintain the model and distribute the model whereas a modelling language refers to the grammar within the modelling technique (Bandara *et al.* 2005; Sedera *et al.* 2004). Different BPM languages exist with different rules and shapes representing the elements in a BP (Grossmann *et al.* 2008). Users and creators of BP models use different modelling notations relating to their definition and understanding of a business process and a business process model. Event-driven Process Chains (EPC) is a modelling language used in Architecture of Integrated Information Systems (ARIS) and SAP R/3 (Grossmann *et al.* 2008). Unified Modelling Language (UML) is a standard for modelling in the software industry and the latest released version is UML 2.0 (Object Management Group 2012). Business Process Model and Notation (BPMN) is another process modelling standard language developed by the Business Process Management Initiative (BPMI) and has been adopted as a standard notation to be used for BPM by the BP community as it incorporates the best aspects of other notations (Object Management Group 2012). In 2005 the BPMI and the Object Management Group (OMG) merged and the OMG therefore maintains the BPMN standard, amongst other standards.

Enterprise Architect (EA) is an enterprise-wide BPM solution which caters for the entire lifecycle of the BP including modelling, visualising, testing, analysing and maintaining processes, systems and software (Sparx Systems 2013). IBM WebSphere is a middleware software solution created for a Service Orientated Architecture (SOA) environment that enables interconnected BPs and the delivery of application infrastructures for any business situation (IBM 2013). Many other BPM tools are available such as AccuProcess Modeller (AccuProcess 2013) and UModel (ALTOVA 2013). Software tools which are proposed for collaborative BPM have also been developed and can be used by stakeholders to collaborate in co-located or remote locations. An example of such a tool is SAP Gravity, which uses Google Wave, and allows stakeholders to collaborate via the web whilst documenting process models.

3. Benefits and challenges of collaborative BPM

Some of the benefits of BPM identified in literature focus on project-specific benefits such as reduced costs (Indulska *et al.* 2009a), increased productivity (Havey 2005; Indulska *et al.* 2009a) and decreasing of employee head count (Havey 2005). Other benefits relate more specifically to the actual activities of the modelling task and can be referred to as the modelling-related benefits. The focus of this study is on the activity of drawing models (modelling-related) and not on project-specific or management-related issues. Therefore five benefits and six challenges which specifically related to the activity of modelling were identified from the studies of Havey (2005), Indulska *et al.* (2009a) and Indulska *et al.* (2009b) are illustrated in Figure 1.

Havey (2005) identified several benefits of BPM relating to the improvement of processes and process measurement. One modelling-related benefit of BPM identified in the study of Havey (2005) is the facilitation of automated and efficient process flow as there is less downtime when BPM software drives the processes. This benefit can be classified as *process improvement* since the quality of processes can thereby be improved. Process improvement is the ability to enhance business processes and was also identified as a benefit of BPM by Indulska *et al.* (2009a). Another benefit is the formalising of current processing and being able to spot needed improvements as BPM forces businesses to think through the existing processes. This benefit relates to the term *process performance measurement* described by Indulska *et al.* (2009b) who also confirmed this as a benefit of BPM. Process performance measurement refers to matters relating to the identification, modelling or definition of acceptable levels of abstraction of processes (Indulska *et al.* 2009a). Three other benefits of BPM identified by Indulska *et al.* (2009a) are understanding of the process, communication and model-driven process execution. *Understanding of the processes* is the term used to describe an enhanced and steady understanding of processes. The *communication* benefit refers to the enhancement of communicating

business processes between diverse stakeholder groups. The ability to enable or provision process automation, enactment or execution based on the models is known as *model-driven process execution*.

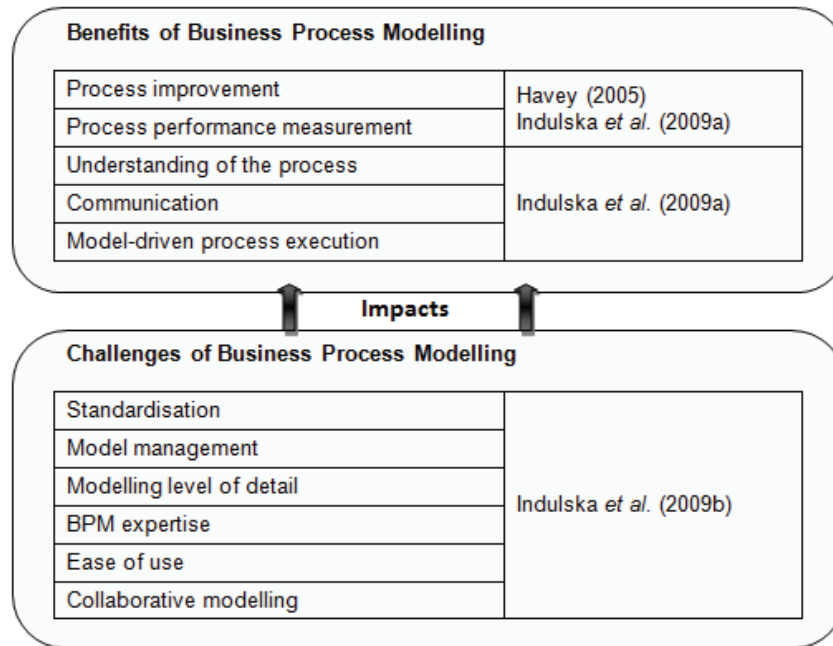


Figure 1: Modelling-related benefits and challenges of BPM

Whilst there are several potential benefits to BPM, some challenges have also been reported. Six challenges of BPM reported by Indulska *et al.* (2009b) are standardisation, model management, modelling level of detail, BPM expertise, ease of use of the BPM tool and collaborative modelling. *Standardisation* refers to issues that relate to the standardisation of tools, methodologies and notations used for modelling. *Model management* relates to issues related to the management of process models such as publication, version, variant or release management. Issues related to the definition, identification or modelling of adequate levels of abstraction are referred to as the *modelling level of detail*. *BPM expertise (modeller)* refers to the work experience that the modeller has (Sedera *et al.* 2004; Bandara *et al.* 2005; Indulska *et al.* 2009b). *Ease of use* relates to the complexity of the business process modelling tool.

One of the challenges of BPM identified by Indulska *et al.* (2009b) was collaborative modelling. The activities involved with collaborative modelling also bring many benefits to modelling activity and these benefits and challenges can be further analysed and classified. The collaborative aspects of BPM can result in an increased understanding amongst modellers and a shared ownership of processes (Barjis 2011). A later study by Barjis (2011) revealed two additional benefits of CBPM, namely, confidence amongst the process users and more accurate modelling. Other benefits of CBPM are brainstorming amongst modellers (Twining *et al.* 2005; Berry and Hamilton 2006) and learning from other modellers (Twining *et al.* 2005). The challenges of BPM identified by Barjis (2011) relate to time management in terms of co-ordinating the time of all the people involved in the team and challenges related to the different interpretations of the process from each modeller. The benefits and challenges of collaborative BPM identified in the studies discussed are summarised in Figure 2.

At the time of this research studies of the challenges of co-located, collaborative BPM activities were limited, therefore a preliminary field study of 20 participants comprising of BPM students and industry participants in the modelling industry was undertaken. After the field study the participants completed a survey regarding the benefits and challenges of CBPM. The field study identified two additional challenges of CBPM relating to time management but from a technical perspective and challenges relating to integrating and combining different versions of models into one set of models. Time management from a technical perspective refers to the complexity of the modelling tool used and the time taken to master the tool. The benefits and challenges of collaborative BPM (Figure 2) identified in literature were added to those of BPM (Figure 1) in order to compile a comprehensive framework of benefits and challenges which apply to the modelling-related aspects of collaborative BPM (Figure 3).

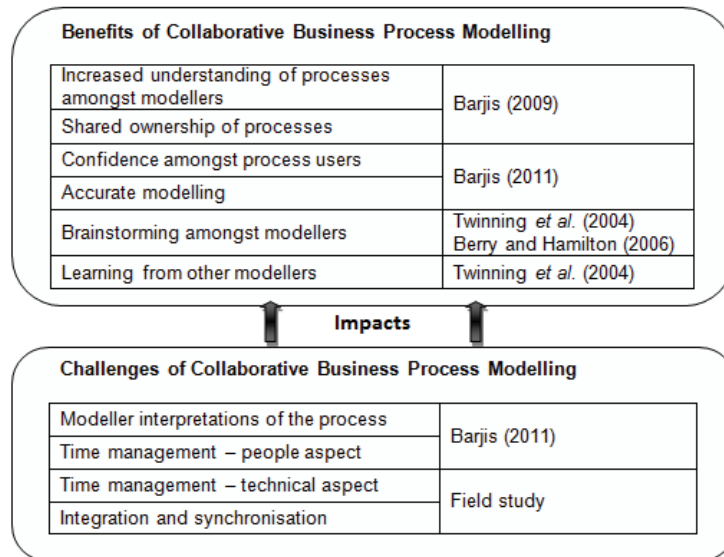


Figure 2: Modelling-related benefits and challenges of collaborative BPM

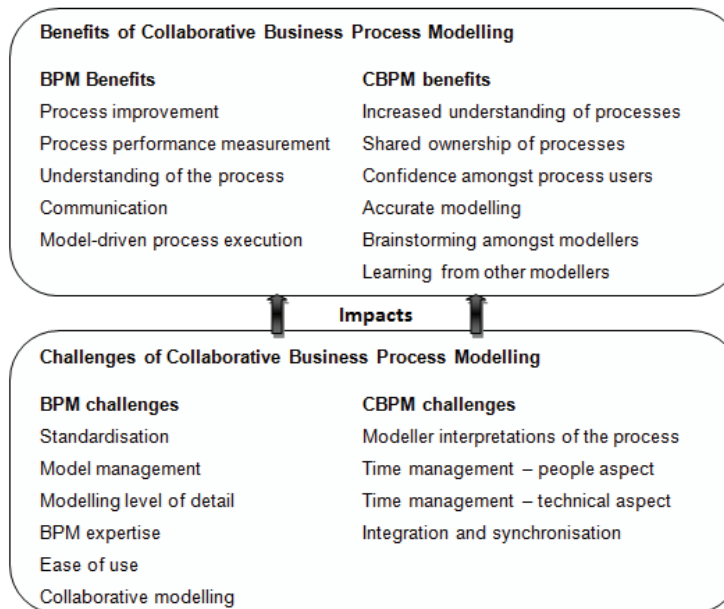


Figure 3: Comprehensive framework of modelling-related CBPM benefits and challenges

4. Success factors and success measures of collaborative BPM

Bandara *et al.* (2005) derived a model in which they documented success factors as well as success measures for business process modelling. Research related to factors impacting the success of BPM are limited, but two studies (Sedera *et al.* 2004; Bandara *et al.* 2005) identified the three factors of modelling methodology, modelling language and modelling tool (Figure 4). The modelling methodology refers to instructions that guide the modelling process.

At the time of this paper no recent studies focusing on a set or framework of success factors for CBPM were found. The preliminary field study therefore assisted with identifying potential success factors for CBPM, and the results of the field study confirmed all five success factors for CBPM which were identified in literature (Table 1). Coordination within a group of participants increases the effectiveness of the communication and collaboration factors (Denise 2010). Coordination limits group conflict and repetition of actions and work within a group. It also involves notifying each part of the group how to act and when the right time would be to act. The study of Barjis (2011) also identified coordination as a success factor of CBPM since the problem of drawing only one diagram and sharing input to that diagram impacted the success of the process model.

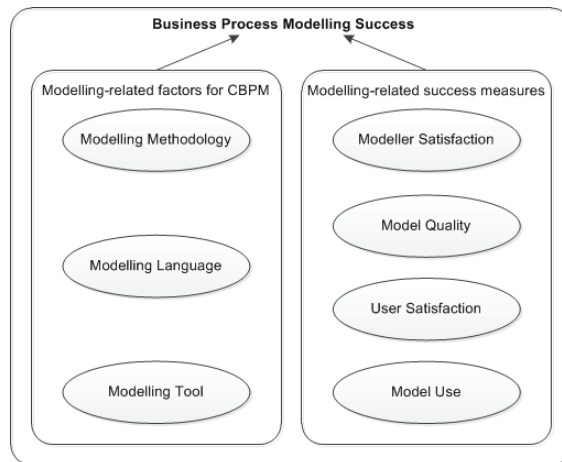


Figure 4: Modelling-related BPM success factors and measures [Adapted from Bandara *et al.* (2005)]

Table 1: Success factors of collaborative BPM

Success factors of CBPM	Reference
User participation	Barjis (2011); Lee <i>et al.</i> (2000); Poppe <i>et al.</i> (2011)
Coordination	Barjis (2011); Denise(2010)
Time resources	Barjis (2011)
Modeller inputs and interpretations	
<i>Modelling tool</i>	

User participation was identified as a success factor for CBPM in several studies (Barjis 2011; Poppe *et al.* 2011) and refers to the degree of participant input, related to the specified business process. Another factor impacting the success of collaborative BPM is the different inputs and interpretations of the process provided by the modellers (Barjis 2011). The amount and quality of the available time resources and the modelling tool are two other factors identified by Barjis (2011) which can impact the success of collaborative BPM. The modelling tool has already been identified as a modelling-related success factor in BPM (Figure 4) and is therefore listed in italics in Table 1. Since the factors for BPM must also be taken into account with collaborative BPM, the four remaining factors of collaborative BPM can therefore be added to the list of modelling-related success factors for BPM (Figure 4) in order to provide an updated, more comprehensive theoretical framework of seven modelling-related success factors for collaborative BPM (Figure 5).

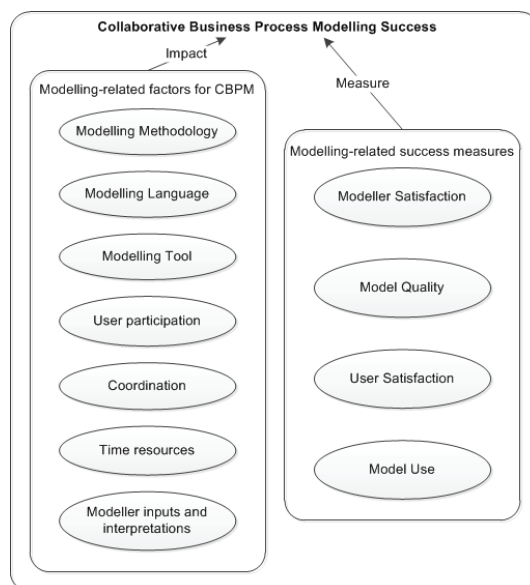


Figure 5: Modelling-related CBPM success factors and measures

5. Research design

The primary purpose of this study was to investigate the status of CBPM as perceived by stakeholders involved in the modelling process with regards to benefits, challenges and success factors. The two main objectives of this research study were therefore, 1) *To analyse and classify the benefits and challenges of CBPM*; and 2) *To analyse and classify the success factors and success measures of CBPM*. In order to meet these objectives a literature review of existing studies in the field of CBPM was undertaken and a preliminary field study was carried out (Sections 3 and 4) and the theoretical frameworks were derived (Figure 4 and Figure 5). In order to empirically validate these findings a survey strategy was initiated by means of an online survey. The self-selection sampling method was used to select participants as it is a method that allows participants to be collected by asking them to take part in the study (Saunders *et al.* 2009). Several IT consulting organisations operating in various major cities in South Africa were asked to participate in the survey which took place over a period of six months in 2013. The questionnaire used in the survey consisted of statements which the participants had to rank on a 5-point Likert scale, with 1 being *Not Important* and 5 being *Very Important*. Three statistically defined ranges for a 5-point Likert scale were used: negative [1 - 2.6), neutral [2.6 - 3.4] and positive = (3.4 – 5]. One sample *t* tests were performed to determine the significance of positive scores. The face validity of the questionnaire used in the survey for this study was established since all of the questions were derived from literature and content validity was established by means of a pilot study (Saunders *et al.* 2009). Reliability was established since all of the Cronbach’s alpha values were larger than 0.7 except for the success factors ($\alpha = 0.64$), which is still acceptable for an initial exploratory study (Nunnally 1978) (Table 2).

Table 2: Cronbach’s alpha of questionnaire sections

Section	Cronbach’s alpha (α)
The Benefits of BPM	0.82
BPM Challenges	0.80
Success Factors for CBPM	0.71
Benefits of CBPM	0.89
Challenges of CBPM	0.73
CBPM Success Factors	0.64

6. Participant profile and results

The questionnaire was completed by 45 participants from 19 companies. The majority (67%) of companies had less than 100 employees, 22% had between 100 and 500 employees and 11% had over 500 employees. Most (45%) of the organisations had between five and 20 employees involved in the BPM process (Table 3). The majority of known job titles who completed the survey (Figure 6) were Business Analysts (33%) whilst many participants selected “Other” as their job title (35%). Some of the other job titles were: Software Developer, Project Manager, Industrial Engineer, Support Executive. The participants were asked to indicate which roles they had played in BPM sessions and were allowed to select more than one role. Figure 7 indicates that most participants have played the role of an expert modeller (76%) or an analyst (71%).

Table 3: Organisation profile with regards to BPM roles (n = 45)

Number of Employees Involved with BPM	Percentage of Respondents’ Answers
< 5	33 %
5 – 20	45 %
> 20	22 %
Total	100%

Participants were asked to rate the perceived benefits of BPM and CBPM for their organisation (Table 4). All of the BPM benefits had mean scores which were in the *positive* range ($\mu > 3.4$). To test if the scores in the positive range were significantly positive, *t* tests for significance of the positive scores were performed. The results showed that all of the *positive* scores for BPM were statistically significant ($p \leq 0.01$) and are therefore written in italics in Table 4. The Cohen’s *d* value was used to determine the level of significance; small ($0.2 < d \leq 0.5$), medium ($0.5 > d \leq 0.8$) or large (> 0.8). The three highest mean ratings for BPM benefits were *Understanding* ($\mu = 4.62$), *Process improvement* ($\mu = 4.60$) and *Communication* ($\mu = 4.47$) had. Participants

confirmed all of the benefits of CBPM as well since they all had mean ratings in the *positive* range. However, only the four highest ranked benefits of CBPM were significantly *positive*. The two lowest ranked benefits, *Shared ownership of processes* and *Confidence amongst modellers* were not statistically positive. The benefit *Learning from other modellers* scored the highest mean value ($\mu = 4.20$) amongst all of the listed benefits of CBPM. *Confidence amongst modellers* received the lowest mean score ($\mu = 3.53$) out of all the CBPM benefits; however it is still a *positive* rating.

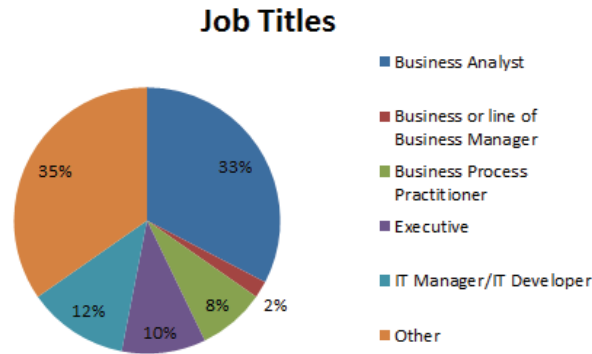


Figure 6: Job titles (n = 45)

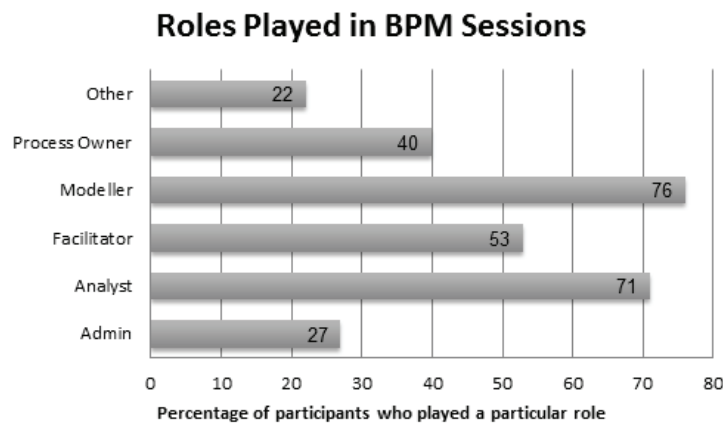


Figure 7: Percentage of roles played in BPM sessions (n = 45)

Table 4: Benefits of BPM and CBPM (n = 45)

BPM Benefit	Mean	SD	t	p	Cohen's d	Prac.Sign.
Understanding of the process	4.62	0.49	16.72	0.0000	2.49	Large
Process improvement	4.60	0.65	12.32	0.0000	1.84	Large
Communication	4.47	0.66	10.83	0.0000	1.61	Large
Model-driven process execution	4.02	0.92	4.55	0.0000	0.68	Medium
Process performance measurement	4.00	0.88	4.58	0.0000	0.68	Medium
CBPM benefit	Mean	SD	t	p	Cohen's d	Prac.Sign.
Learning from other modellers	4.20	0.87	6.18	0.0000	0.92	Large
Increased understanding of processes	4.09	0.82	5.63	0.0000	0.84	Large
Brainstorming amongst modellers	4.09	0.87	5.28	0.0000	0.79	Medium
Accurate modelling	3.84	1.09	2.74	0.0044	0.41	Small
Shared ownership of processes	3.60	1.16	1.16	0.1260	N/A	N/A
Confidence amongst modellers	3.53	1.06	0.85	0.2011	N/A	N/A

Participants gave all the challenges of BPM (Table 5) mean scores in the *positive* range, except for *Model management* which was in the *neutral* range and is therefore written in bold and italics in Table 5. However, none of the results for BPM challenges were statistically significant. The standard deviation scores are all mostly above one ($0.99 \leq \sigma \leq 1.41$) however, this is still fairly low indicating that all of the responses were close to the mean score. Participants gave all the challenges of CBPM a mean *positive* rating, but only the challenges ranked first and second were statistically significant, with small practical significance.

Participants agreed with all of the success measures of CBPM (Table 6) identified by Sedera *et al.* (2004) and Bandara *et al.* (2005), since all of the mean ratings were in the *positive* range and were statistically and practically significant. The measure with the highest mean rating was *User satisfaction* ($\mu = 4.56$) and the lowest mean rating was *Modeller satisfaction* ($\mu = 3.73$). All of the standard deviation scores are below one or close to one ($0.58 \leq \sigma \leq 1.01$) indicating that all the participants selected values close to the mean value. Participants agreed with all of the CBPM success factors (Table 6) since all factors were in the *positive* range with statistical and practical significance. The standard deviation scores ($0.53 \leq \sigma \leq 1.19$) show that all of the ratings were close to the mean score. *User participation* received the highest mean score ($\mu = 4.64$) and *Modelling tool* received the lowest mean score ($\mu = 3.73$).

Table 5: Challenges of BPM (n = 45)

BPM Challenge	Mean	SD	t	p	Cohen's d	Prac.Sign.
Modelling level of detail	3.58	0.99	1.21	0.1170	N/A	N/A
Standardisation	3.58	1.08	1.11	0.1370	N/A	N/A
Ease of use (modelling tool)	3.42	1.41	0.11	0.4580	N/A	N/A
BPM expertise	3.33	1.09	N/A	N/A	N/A	N/A
<i>Model management</i>	3.20	1.12	N/A	N/A	N/A	N/A
CBPM Challenge	Mean	SD	t	P	Cohen's d	Prac.Sign.
Modeller interpretations of the process	3.87	1.06	2.96	0.0025	0.44	Small
Integrating and synchronisation	3.69	1.04	1.86	0.0346	0.28	Small
Time management - people aspect	3.62	1.25	1.19	0.1194	N/A	N/A
Time management - technical aspect	3.47	1.22	0.37	0.3575	N/A	N/A

Table 6: Success factors and measures of CBPM (n = 45)

Success measure of CBPM	Mean	SD	t	p	Cohen's d	Prac.Sign.
User satisfaction	4.56	0.59	13.23	0.0000	1.97	Large
Model use	4.51	0.59	12.66	0.0000	1.89	Large
Process model quality	4.42	0.58	11.75	0.0000	1.75	Large
Modeller satisfaction	3.80	1.01	2.65	0.0056	0.39	Small
Success factors of CBPM	Mean	SD	t	p	Cohen's d	Prac.Sign.
User participation	4.64	0.53	15.78	0.0000	2.35	Large
Time resources	4.02	0.72	5.78	0.0000	0.86	Large
Modeller inputs and interpretations	3.87	0.89	3.50	0.0005	0.52	Medium
Coordination	3.78	1.06	2.38	0.0108	0.36	Small
Modelling tool	3.73	1.19	1.87	0.0340	0.28	Small

7. Conclusions and recommendations

The benefits and challenges of collaborative BPM which were identified in the literature review were added to the benefits and challenges of BPM in order to derive an extended, more comprehensive framework of modelling-related benefits and challenges of CBPM. This extended framework was used in the survey in order to empirically validate it. The results showed that the survey participants confirmed the majority (90%) of the benefits, and challenges for BPM identified in theory since they were all in the *positive* range except for one which was in the neutral range (model management). All (100%) of the benefits and challenges for CBPM were

rated in the *positive* range and therefore were all verified by the results of this study. This satisfies the first objective of this study which was “*To analyse and classify the benefits and challenges of CBPM*”. The modelling tool had been identified by previous studies (Sedera *et al.* 2004; Bandara *et al.* 2005) as a success factor for BPM. Four additional success factors relevant to CBPM were identified in the studies of Barjis (2011) and Poppe *et al.* (2011). The success factors and measures of CBPM (Figure 5) which were identified in literature were verified by the survey since they were all in the *positive* range. This satisfies the second research objective of this study “*To analyse and classify the success factors and success measures of CBPM*”.

This study provides a valuable theoretical contribution to the research fields of BPM and collaborative BPM. The framework of modelling-related benefits and challenges of CPBM as well as the framework of success factor and measures can be used by researchers for future research studies. The practical contribution of this study are the factors of CBPM which can be used by BPM stakeholders for planning these projects, thereby increasing the chances of process model success and thus BPM project success. An improvement in business process quality and in project success can in turn facilitate an organisation’s competitive edge. This study formed part of a larger study into the design and evaluation of a collaborative BPM system using touch technologies (the BPMTouch system). An improved understanding of the challenges involved in the process of collaborative BPM and in particular with the integration and synchronisation of process models between modellers working in teams. Future planned steps related to this project involve the implementation, testing and evaluation of the BPMTouch system. In order to better understand the problems and challenges with collaborative BPM, other future research is required; for example additional empirical studies could be undertaken to investigate the challenges and benefits of collaborative BPM experienced in other environments and in other countries. Studies regarding the success factors and success measures of collaborative BPM could also be undertaken.

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Scoring Model of Information Systems Sustainability

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Abstract: This paper deals with the issues of Russian and international researches in the field of design of sustainable information architecture of management systems in the context of spatial economics. It is theoretical and empirical research in equal measure. Research methodology is methods and procedures of modeling. The main purpose of this paper is consideration the features of application of contemporary intelligent information technologies and systems for spatiotemporal analysis. The paper is devoted to the study of issues of stability of architecture of spatial information system. Now modern intelligent methods and technologies are essential components for developing management decision process that will enable companies to succeed in a rapidly changing environment. The latest achievements in the field of intelligent technologies in economy and management, including the methods and tools of agent-based modeling and soft computing are the key factors in improving organizational performance and increasing its competitiveness. Fuzzy technologies as technologies of artificial intelligence are having a significant influence on information systems (IS) design and analysis. At the same time IS sustainability is now one of the key drivers of business success. Original contribution of the work is based on the applying of intelligent information technologies and modern modeling methods for creating scoring model of IS sustainability. The paper also contains theoretical foundations of information systems architecture and the brief overview of spatial sciences development in Russia.

Keywords: sustainability of information systems, soft computing, Fuzzy logic methods, scoring model

1. Introduction

In Russia today the use of advanced information technologies in economy and management is a key factor in improving organizational performance and increasing competitiveness. Distinctive features of the successful companies are sustainable business model, innovation, adaptability, and a deep understanding of consumer preferences. 80% of Russian executives believe that information communication technologies are playing a dominant role in the use of innovative business models and strategic goals realization. Information communication technologies (ICT) can reduce operating costs and increase profitability. Influenced by information technologies the activities of the company's basic departments (marketing, sales, and finance) are changing. This is due to the more efficient accumulation and analysis information. ICT can govern the ability of companies to generate the sustainable business models (Chesbroug, 2003, 2006; Osterwalder and Pigneur, 2010; Serova, 2013a). In industrial countries the questions of selection and application of modern information systems and technologies for strategic business objectives and market needs are in the spotlight. At the same time spatial science, as an area of interdisciplinary scientific research, has become especially popular in the last decades. Attention of many scientists, including researchers in the field of spatial sciences, in particular, spatial economics, more and more focuses on the study of such important elements in formation of spatial relationships, as information infrastructure and architecture of spatial information systems.

At present intelligent information systems and technologies are evolving actively. These technologies and systems are based largely not on tangible, but on information and communication resources that belong to the class of synergistic resources. The class of intelligent information technologies (IIT) and systems, including multi-agent systems (MAS), neural network (NN), and fuzzy logic (FL) continues to improve (Serova, 2013c). IIT are developed rapidly over the past ten years and they allow creating models of interaction between different kinds of spaces. Simultaneously IS sustainability is now one of the key drivers of business success. Paper contains the brief review and comparison of soft computing methods and techniques, and it focuses on the various intelligent modeling methods that are employed in evaluation of sustainability of information systems architecture in management and economy. The paper describes the main features of soft computing, discusses its implementation for design of sustainable information systems, and considers the role of fuzzy logic method and using scoring model of IS sustainability. It does so from research base that draws from theoretical underpinnings as well as international and domestic industry practices.

2. Theoretical background

2.1 Information system architecture

Variety of information systems applications for solving problems in management and economics has led to the requirement of using of information processes and technologies together with systems approach based on information systems architecture. When it comes to what actually is meant by the term "information system architecture", there is not usually lack of definitions. For example, there are a few tens of system architecture definitions on the site of Software Engineering Institute (SEI, 2014). Here are some of them:

- The architecture of a system is an abstraction of the system giving the semantics and specification for the patterns of information content and context.
- System architecture defines the physical, logical and information elements of the system which come together to realise a required set of functionality
- Architecture is the identification of different building blocks of the system according to their responsibilities, external properties of these blocks and their interrelationships.
- Architecture - the organizational structure of a system
- Architecture defines the data, processes, and components that make up the overall information system, and provides a plan from which products can be procured—and systems developed—that will work together to implement business solutions. Simply put, architecture provides the direction to make technology work for the business.
- Architecture is defined by the recommended practice as the fundamental organization of a system, embodied in its components, their relationships to each other and the environment, and the principles governing its design and evolution.

Architecture of management information system can be considered as a concept, which determines the model, the structure, functions and components' relationship. The term "Enterprise architecture" is usually used concerning organizations and as shown in Figure 1, the next main types of architectures are assigned (Sovetov et al, 2012):

- Business architecture,
- Information technologies architecture,
- Data architecture,
- Application architecture or Software architecture, and
- Hardware architecture.

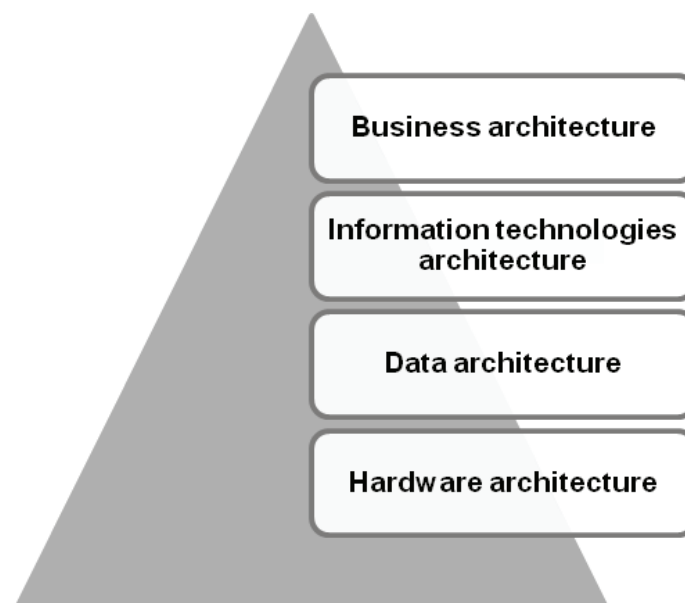


Figure 1: Information system architecture

Typically, information systems are focused on the use and satisfaction of customers' needs within a specific subject area. As examples of information systems application for solving problems in economics and management can be specified the following:

- Enterprise management information systems,
- Trading information systems,
- Marketing information systems,
- Geographic information systems,
- Health care information systems, etc.

Sustainability of architecture of information system is determined by the stability of its structure, state parameters, and the most important is the stability of the current processes of its functioning and development. Adaptability of information system first of all means its flexibility and property of adjusting itself under varying changes. Adaptive architecture of information system is a methodology to create a more flexible and rational, customizable architecture that allows organizations of any size to react promptly to market and information flow changes. Design of sustainable and adaptive information architecture of information systems is possible based on the applying of such intelligence information technologies as neural networks and fuzzy logic.

The group of modern enterprise management systems, in the first place, includes Enterprise Information Systems (EIS) - systems using various information technologies. EISs serve for data processing of different information flows on the different management levels.

It should be noted that there is no generally accepted classification, but as a rule, the strategic level systems include analytical retrieval systems technology-based Data Mining, expert information systems (EIS), Executive Support Systems (ESS), and Decision Support Systems (DSS). IS of the middle management level include Knowledge Management Systems (KMS) and Management Information Systems (MIS). Transaction Processing Systems and Office Automation Systems are used on the operation level of management (Pearlson et al, 2006; Rainer et al, 2006; Kazantsev et al, 2007; Turban et al, 2008; Serova, 2012b). Today in the publications on the topic of business efficiency and competitiveness of enterprises, many names and acronyms are mentioned, such as Product Lifecycle Management (PLM), Supplier Relation Management (SCM), Customer Relation Management (CRM) (Payne, 2006), and ERP. These names come after the concepts and management techniques used by successful companies. Interest in them is growing in Russia. Leaders of Russian companies are increasingly turning to the experience of the use of solutions that help integrate the people, information and business processes to effectively manage all areas of business. The term ERP — Enterprise Resource Planning, is one of the key issues in this series of current concepts. According to Serova (2012b), the recent trends in the development of enterprise information systems are associated with the intention to use information generated within the company, in the external environment to ensure cooperation with other enterprises, customers and partners. Today we should take into account the new concept of Enterprise Information System: the emphasis is placed on the EIS which is opened for the all partners operating in common business interests instead of on traditional internal business process management optimization. This concept includes five new tendencies (Serova, 2012b):

- *Change the role of ERP system.* Automation the internal business processes as well as external, counteragent relationships: customers, suppliers, banks, tax authorities;
- *The system technologies move towards an openness and transparency.* Internal processes are becoming more open. Information and data about activity of an enterprise can be available for business society member. Use of Web-technologies.
- *Structural changes of system architecture.* Instead of closed monolithic platform – open multilevel applications built on concepts of service-oriented architecture (SOA). Use E-SOA;
- *Expansion of system implementation.* Adaptation for enterprises of different kinds and sizes;
- *Deepen the system functionality.* All enterprise business processes should be automated;

2.2 Brief history and theory of the “economic space”

The definition and conceptual framework of the Spatial Sciences are still in the stage of discussion and debate. Several scientific schools of spatial economics were founded in Russia: in St. Petersburg and Moscow, Far Eastern school, Siberian school, and the Ural school. The Economic Research Institute of the Russian Academy of Sciences (RAS), with the support of the Scientific Council for Regional Development at the RAS Presidium, has been publishing the academic journal “Spatial Economics” since 2005. RAS’s research program “Fundamental Problems of Spatial Development of the Russian Federation: an Interdisciplinary Synthesis” was started in 2009.

In accordance with the basic hypothesis of the program, spatial science is defined as an interdisciplinary scientific direction, and objects of research are forms and processes of a modern society, which are space-dependent (Granberg, 2009). Three statements are offered as a conceptual basis. They related to the spatial, regional and international aspects.

In the other countries the attention of the public to scientific research in the area of spatial sciences and spatial development is also growing. “Journal of Spatial Science” has being published in Australia (information available from the website: MSIA mapping science institute, 2012).

Famous international publisher Springer has produced more than 40 volumes of the series “Advances in Spatial Science” (information available from the website: Springer, 2013). U.S. National Science Foundation (NSF) has approved a strategic plan for research in 2008-2012 entitled “Geography Spatial Sciences” (information available from the website NSF National Science Foundation, 2013).

Great importance, both in Russia and in the other countries, is given to the development of global, regional and national spatial data infrastructure. The most important initiatives in this direction are the existing international programs: Infrastructure for Spatial Information in Europe, National Spatial Data Infrastructure, Global Spatial Data Infrastructure, and Global Monitoring for Environment and Security. What is important concerning Russia is, that the general architecture has created and the main components of the Russian segment of the information infrastructure and its integration into the world system have defined (Krasnopol’skii, 2010).

The concept and theory of the “economic space” was formed in compliance with geographic, geopolitical, and regional concepts. And now an economic space is considered in the framework of concepts of globalization, industrial spatial clusters, “cumulative causation”, high information technologies and network. Analysis of points of view on the economic space can be divided into four approaches to the study of this category: territorial, resources, information and process (Bagiev et al, 2012).

3. Intelligence information technologies for architectural design of spatial information systems

The increasing demand for optimization of architecture of spatial information systems has caused leading modelers to consider intellectual information technologies and computer modeling in order to obtain deeper insights into complex and interdependent processes.

Modern modeling tools should facilitate mutual understanding at different organizational levels when making strategic management decisions thus bridging the gaps between a strategic vision and its implementation (Pidd, 2004). One approach involves multi-agent systems (MAS) which, as a class, have developed rapidly over the last decade. The advantage of a multi-agent approach relates to the economic mechanisms of self-organization and evolution that become powerful efficiency drivers and contribute to enterprise’s development and prosperity. New intellectual data analysis can be created, through MAS which is open, aimed at flexibly adaptive problems solving, and deeply integrated in decision support systems (Serova, 2012a). Modern business modeling tools use special software, programming languages and systems to develop models of business processes, relations between people and areas for optimization in the organizational structure as a whole. Building a sustainable and adaptive architecture of spatial information systems is possible on based of the applying of modern modeling methods and technologies.

The major approaches (or methods) in simulation for business are: System Dynamics (SD), Discrete Event (DE) and Agent Based (AB). While SD and DE are traditional approaches, AB is relatively new. Compared to SD or DE models, AB models do not allow the definition of global system behaviour (dynamics); instead, the modeler defines behaviour at individual level, and global behaviour emerges as a result of the actions of multiple actors, each following its own behaviour rules, living together in some environment and communicating with each other and with the environment (Borshchev, Filipov, 2004; Serova, 2013c).

Multi-Agent Systems as a system of distributed artificial intelligence, integrated into the information structure of the company, may be considered as an effective tool for spatiotemporal analysis of marketing information resources and creating of architecture of spatial marketing information system. With the using Agent Based Modeling we can obtain and analyse geospatial data, create models, linked to geographic coordinates and to develop of geoinformation architecture of complex marketing systems. Multi-Agent systems and agent-oriented programming represent a step forward from object-oriented programming (OOP) and integrate the latest advances in the areas of artificial intelligence, parallel computing, and telecommunications.

Any MAS consists of the following components:

- A set of organizational units with a subset of agents and objects;
- A set of tasks;
- A business ecosystems - a space where agents and objects exist;
- A set of relations between agents;
- A set of agent actions (operations on objects).

Intellectual agents have the most comprehensive set of qualities; their intellectual capacity allows them to build virtual worlds where they form action plans. Minimum set of basic characteristics for any agent includes qualities such as activity, autonomy, adaptability, and reactivity.

As systems of distributed artificial intelligence, Multi-agent Systems have the following advantages which can be successfully use for marketing spatial research (Serova, 2013):

- They speed up task fulfilment through parallelism and reduce the volume of data transmitted by passing high-level partial solutions to other agents;
- They are flexible since agents of various capacities are used to carry out a task dynamically cooperatively;
- They are reliable given that functions that one agent is unable to carry out will be passed to other agents.

Agent technologies usually involve the use of certain typologies of agents, their models and MAS architectures. These technologies are based on appropriate agent libraries and tools which serve for support development of different types multi-agent systems.

Applying multi-agent systems in order to design information architecture of marketing spatial systems can consist in the following (Serova, 2013c):

- To simulate and forecast clients' behaviour, both adopted and potential ones';
- To coordinate dealers and remote divisions based on multi-agent system;
- To automate and improve the customer support process within the CRM concept;
- To store knowledge and skills of marketing and sales specialists in the relevant agents' databases;
- To develop an integrated multi-agent Internet portal for agents to keep users' personal contents;
- To create a search agents to monitor outside information;
- To organize a distance-learning portal.

3.1 Fuzzy logic method for design of sustainable architecture of information systems

Design of sustainable and adaptive information architecture of spatial information systems is possible based on the applying of such intelligence information technologies as neural networks and fuzzy logic. Neural networks and fuzzy logic - are methods related to Soft Computing (SC). Applying the information and communication technologies, which are used in Soft Computing, allows achieving the quantitative results,

which is very important for manager to make a decision. Fuzzy set (FS) was introduced by Lotfi A. Zadeh (Zadeh, 1994) as a means of representing data that was neither precise nor complete. There are two main characteristics of fuzzy systems that give better performance for specific applications: the first is that fuzzy systems are suitable for uncertain or approximate reasoning and the second is that fuzzy logic allows problem solving and decision making on the basis of incomplete or uncertain information. Fuzzy technologies as technologies of artificial intelligence are now having a significant influence on information systems design and analysis (Kecman, 2001; Krichevskii, 2005; McNelis, 2005).

Soft computing techniques are meant to operate in an environment that is subject to uncertainty and imprecision. According to Zadeh (Zadeh, 1994), the guiding principle of soft computing is: exploit the tolerance for imprecision, uncertainty, partial truth, and approximation to achieve tractability, robustness, low solution cost and better rapport with reality. Fuzzy technologies as technologies of artificial intelligence are now having a significant influence on information systems design and analysis. At the same time IS sustainability is now one of the key drivers of business success. On the application level fuzzy logic can be considered as efficient tool for embedding structured human knowledge into useful algorithms. Mathematical models simplify and conceptualize events in nature and human activities by employing various types of equations which must be solved. However, the use of mathematical models gives rise to the question how accurate they reflect reality. In complicated cases the creating of such models might be impossible. Fuzzy models will become more and more popular as solution schemes, and it will make fuzzy systems theory a routine as opposed to its previous status as a “new, but curious technology”. Fuzzy logic models employ fuzzy sets to handle and describe imprecise and complex phenomena and use logic operations to find a solution. The goal of control process in management is making the decision. It might be also suggestion, instruction, conclusion, evaluation, forecasting. A block diagram of Fuzzy logic model is represented in Figure 2.

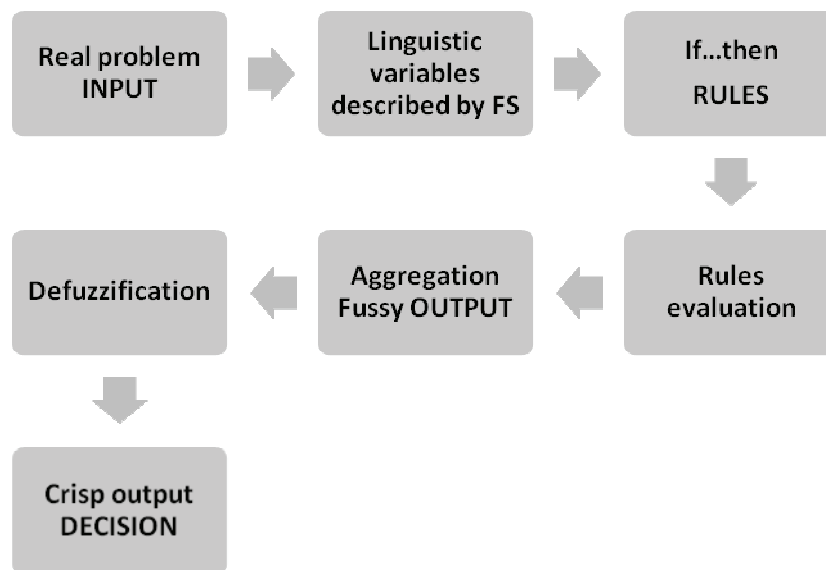


Figure 2: Block diagram of FL model creating

4. Creating model of assessment of IS sustainability

This section of the paper is devoted to the creation of FL model with the purpose of assessment of product diffusion system sustainability. Potential Adopters become Adopters at Adoption Rate that depends on advertising and word of mouth promotion. The figure 3 shows the fuzzy inference system (FIS) for three input variables and one output parameter. This FIS is destined for the assessment of the IS sustainability. The input parameters are advertisement (ad), contact rate (cr), number of potential adopters (npa). Three selected attributes are included as input data to a fuzzy inference system. The output parameter determines the IS sustainability as the adoption fraction (af). The control objective is to find the output value for a particular set of input variables. Each of input parameters is the linguistic variable with three terms: *low*, *middle*, *big*. Membership functions characterize the fuzziness in a fuzzy set in a graphical form for eventual use in the mathematical formalisms of fuzzy set theory. The Figure 4 gives the information about the membership functions for the input and output variables. All calculations were performed in MATLAB v. 7.01.

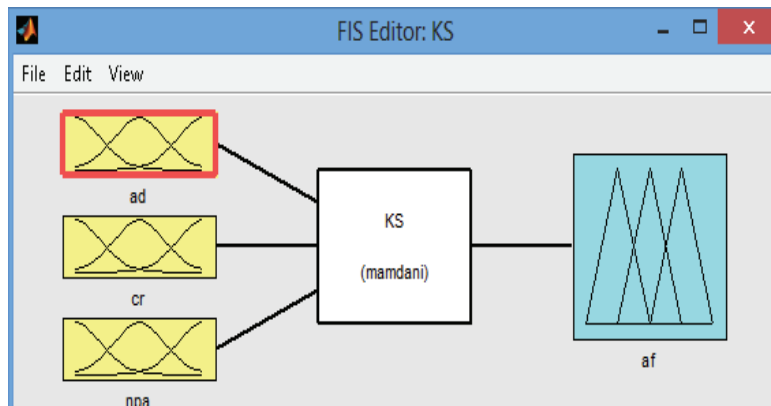


Figure 3: Fuzzy inference system (FIS)

The next step is definition of the FIS rules. The number of the rules is the product of the number of terms in each input variable: $3 \times 3 \times 2 = 18$. After forming bases of rules FIS gives the values of IS sustainability as conditional units. We finally get a crisp value of the output which represents the values of IS sustainability. Figure 4 displays the value of sustainability equal 0.12 for given set of input variables: $ad = 6.8$; $cr = 26.1$; $nap = 11$. The fuzzy approach for assessment of IS sustainability was supplemented by the regression equation in conclusion. In the first step all input variables were modeled by Monte-Carlo method. In the second step the modeled inputs were introduced into the FIS and the values of IS sustainability were formed as outputs of the FIS.

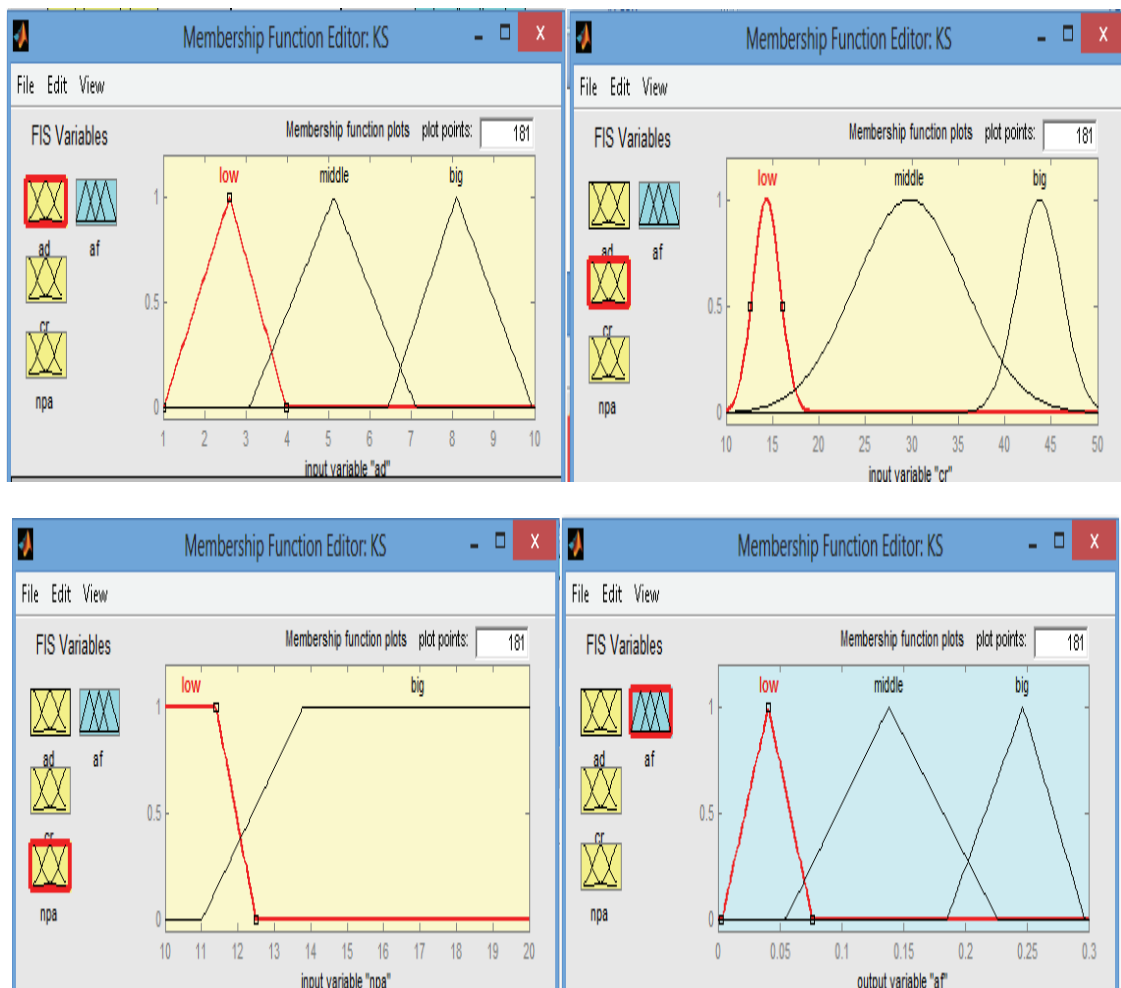


Figure 4: Membership functions for the input and output variables

Table 1 contains the modeled inputs and the values of IS sustainability calculated by FIS (the fourth column).

Table1: The modeled inputs and calculated outputs

1	X1	X2	X3	Y (Fuzzy Logic)	Y(Regression)
2		5,0	34	0,18	0,04
3		3,6	20	0,11	0,092
4		5,9	35	0,14	0,041
5		7,4	36	0,12	0,153
6		7,3	38	0,20	0,149
7		8,1	42	0,15	0,163
8		2,2	22	0,26	0,102
9		5,1	32	0,13	0,04
10		7,1	35	0,08	0,14
11		3,9	29	0,07	0,063

In the third step the regression equation was derived with the use the first four columns of Table 1. The regression equation is of the form

$$Y = 0.085 + 0.046 * X1 - 0.01 * X2 + 0.33 * X3,$$

where X1, X2, X3 - are advertisement, contact rate, number potential adopter; Y - numerical value of IS sustainability.

The last column of Table 1 contains the value of IS sustainability which is calculated by the regression equation. The comparison of the values of IS sustainability calculated by FIS (the fourth column of the table 1) and the regression equation (the fifth column) shows their similarities. Thus the derived regression equation can be used to assess the numerical value of IS sustainability.

5. Conclusion

At present the use of the latest achievements in the field of Information Communication Technologies (ICT) in economy and management, including the contemporary methods and tools of computer modeling is one of the key factors in improving organizational performance and increasing its competitiveness. Formation of architecture of spatial systems is determined by the problem increased use of spatial information in sustainable development of the territories and is one of the perspective areas of research in the field of spatial information systems. Theoretical and empirical researches prove that spatiotemporal analysis of data can be performed through applying of contemporary intelligent information technologies with using multi-agent systems as systems of distributed artificial intelligence. Architecture of spatial information system can be considered as a concept, which determines the model, the structure, functions and components' relationship. Building a sustainable architecture of management information systems, including marketing information system, is possible with the use of soft computing methods, such as fuzzy logic.

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Value of Social Media From the Perspective of the Users

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Abstract: This paper reports a study on the willingness to pay for the services of online social networks (OSNs). The relevancy of the question is derived from indications that these OSNs are considering charging their users for more advanced services in order to develop from the advertisement-based business model. The value of these OSNs has been studied mainly from the perspective of the advertiser. This paper reports a study into the value of OSNs from the user perspective. More specifically, the study investigated the willingness to pay for the use of the OSNs Facebook, Twitter and LinkedIn, and the factors influencing this willingness. Based upon a survey amongst 202 Dutch users of OSNs, we found what percentage of users would be willing to pay for the three social networks in our study. We also tested the correlation between the willingness to pay and the eight potential factors of influence, that were derived from literature. The contribution the study makes is that it provides insight in the factors influencing the value of OSNs from the perspective of the users. For the organizations behind social media, this is useful information in developing new business models that include charging users for specific services.

Keywords: social networks, facebook, Twitter, LinkedIn, value

1. Introduction

Over the last 10 years, the use of online social networks (OSNs), such as Twitter, LinkedIn and facebook, has grown at a spectacular rate (Mislove, 2009). With now over 1.3 billion active users (Statisticbrain, 2014), facebook should be considered as the most significant OSN, with Twitter and LinkedIn following on some distance (eBizMBA, 2014). Leading brands integrate social networks in their marketing mix and American users are reported to spend roughly a third of their time online on facebook (Sachov, 2010). Users are so engaged in OSNs, that this tendency prompts the idea, that social networks are an inseparable part of the lifestyle and existence of these users.

The business model of OSNs relies heavily on revenues from online advertisements. And although, for example, facebook promises to stay free for basic services (Cochran, 2009), it is also suggested that in the future, users may be charged for more advanced services or an ad-free experience. These developments sparked the research project reported in this paper, in which we explore the extent to which users of facebook, Twitter and LinkedIn would be willing to pay for their use of it, and the factors influencing this willingness.

The next paragraph reports our review of the relevant literature. Based upon the findings of the review, we constructed the conceptual model and derived a questionnaire for our study. We applied this questionnaire to a un-random sample of 202 respondents in the Netherlands. The findings section of this paper reports the results and analysis of this study. The paper concludes with the conclusions on the willingness to pay for the use of the OSNs, and the factors influencing this willingness.

2. Literature review

2.1 Social network use in the Netherlands

The Netherlands is a social networking country. In a recently published study by the British Office for National Statistics, the Netherlands tops the list, with 65% of the population active on one or more OSNs (Office for National Statistics, 2013). facebook, Twitter and LinkedIn are the top three most used OSNs, with the local former market leader Hyves being diminished to a marginal position (Oosterveer, 2013).

In a study of social network usage, Mike Read, senior vice-president of ComScore Europe stated, that "Another interesting facet to this market is that the Netherlands has the highest Internet penetration worldwide for two of the other key global social networking sites, Twitter and LinkedIn. The Netherlands is in many ways a nexus of global social networking behavior" (European Travel Commission, 2011).

2.2 Willingness to pay

The impressive use and growth of OSNs can create an illusion, because economic doctrines states that things, which are complimentary usually are used unlimited, without thinking of their real value. Technological writer, Leigh Beaton claims that willingness to pay for social media doesn't depend on such parameters as the amount of friends, social circles or time spent on networks, and adds that the main reason why social media is such a phenomenon is because it is free of charge.

According to Blanchard (2011), the value, which every individual attaches to social network, depends on lifestyle, needs, budget, habits, cultural differences, online engagement patterns and degree of emotional investment in their social media accounts. This complements Dutta's (2010) opinion, that each of these networks satisfies different human needs: to meet new people and to strengthen existing relationships people use facebook, in order to share the ideas users are choosing Twitter and for more sector-specific communities with professional competence and recognition, tools such as LinkedIn and Twitter are more applicable.

So, different profiling in terms of users segmentation suggests different value attached and corresponding significance. For example, people who are engaged in LinkedIn are willing to pay more for their account and necessary access to their connections, which are relevant for their carriers and professional knowledge, than people who have facebook or Twitter accounts just for the private use. The fact that LinkedIn successfully charges its users for certain 'premium' services, reinforces this hypothesis.

2.3 Influencing factors

Based on a review of opinions and views on factors that may influence the perceived monetary value of social media, the following section presents two groups of factors: Usage factors and Personal factors. It is expected that each of these factors have an effect on the willingness to pay and therefore should be examined in our study.

Usage factors

- *Motivation:* The Pew Research Center's Internet and American Life Project study (Hampton et al., 2012) released findings that the most common motivations users use social networks, are: (1) to connect with current friends; (2) to connect with family; (3) to connect with an old friends; (4)to connect with others with shared interests; (5) to meet new friends; (6) to read statements by public figures; (7) to find dating partners; (8) to accomplish work tasks.
- *Role:* A recent study by ComScore (European Travel Commission, 2011) revealed the most common kinds of roles users take in social media. Qualifications are dependent on time spent, engagement and activities performed on social networks. Users can be divided into 6 subgroups: (1) creators (posting, uploading, publishing); (2) joiners (visiting, maintain profile); (3) critics (posting, commenting, contributing); (4) conversationalists (posting, updating, chatting); (5) collectors (using feeds, tagging, voting); (6) spectators (reading, listening, watching).
- *Number of friends/followers/connections:* A study by Hampton et al. (2012) disclosed the relationship, that the more friends people have, the more they are active on the network and the more they spend time on the internet. Based upon this conclusion, we generalize this relationship to the other OSNs in our study. For LinkedIn the term friends relates to connections, and for Twitter to followers.
- *Frequency of use:* The time spent on the networks is associated with frequency of visiting and the engagement in network activities. Based upon this we assume a relationship between the frequency the user makes use of the social network and his/hers willingness to pay.

Personal factors

- *Gender:* A study by Georgetown University's Center for Social Impact Communication and Ogilvy Public Relations Worldwide (2011) revealed that men and women use OSNs differently and in different frequencies. In general, several researchers have found that women tend to use OSNs more than men and for different and more social purposes, therefore gender could have an influence on willingness to pay.
- *Age:* Applying the findings of Makkonen et al. (2011), It can be stated that the younger the person is, the lower his willingness and ability to pay for some sort of service appears to be (*ceteris paribus*). At the

same time, a contradicting outlook may be right, that younger people are more engaged and used to social media networks, and this may mean, they are ready to pay for their access.

- *Financial Stability:* This research presumes that people will apply not only cost-benefit analysis approach in order to evaluate the social media networks, but also, their perception will be based on the method of willingness and ability to pay. According to Einhorn (1995), “richer” users would have a higher willingness to pay, because they have more resources, than “poor” users. who lack the funds to pay.
- *Level of education:* Making an assumption that education level is positively correlated with personal income, then the perceived financial stability and, particularly the amount of person's disposable income, may have an effect on the overall willingness to pay for the proposed service.

Based on the influencing factors identified in this previous section, we constructed the following conceptual model for our empirical exploration of the willingness to pay.

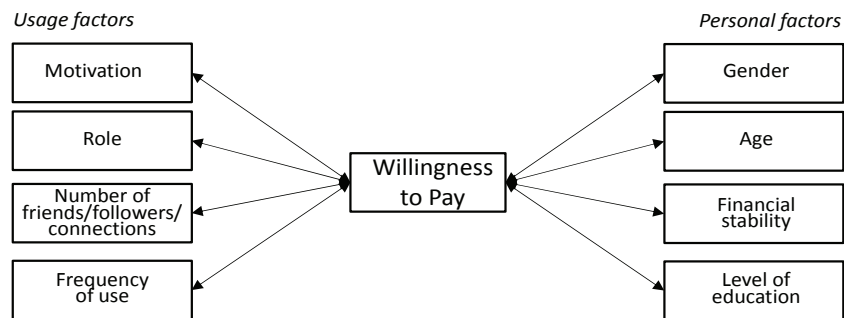


Figure 1: Conceptual model of the study.

3. Research methodology

Given the evaluative nature of our research question, we selected a survey as our research strategy. The questions were mostly of qualitative and closed nature, however some are qualitative and posed in the open way.

The target population for this research was defined as all people that are familiar with OSMs and that have an opinion in this matter. Respondents were chosen by taking a non-probability sample, using convenience sampling method. All the respondents were approached through personal and business networks from the authors. It is not likely, that the chosen way of sampling will damage the reliability of the study. Data collection was done partly through a self-administrated web survey and partly through personal collection. The process of data analysis was conducted using SPSS and Microsoft Excel programs.

4. Findings

4.1 Respondents

In the sample, 54% of the respondents was male and 46% female. The average age of the respondents was 40,6 years old. As appears from the frequency table (Table 1), about a third of the respondents are between 29 and 42 years of age. The younger group accounts for roughly a quarter of the respondents.

Table 1: Age of the respondents

	Frequency	Percent	Cumulative Percent
1-14	1	.5	.5
15-28	52	25.7	26.2
29-42	65	32.2	58.4
43-56	48	23.8	82.2
57-70	28	13.9	96.0
71-84	8	4.0	100.0
Total	202	100.0	

The survey also contained the question on whether the respondent had accounts on the OSNs in the study. In our sample, 92.1% of the respondents, had a facebook account, 41.6% a Twitter account and 56.7% a LinkedIn account. These numbers are in line with the penetration of these networks in the Netherlands. .

The majority of the respondents (82.1%), had a higher education: 46% on university level and 36.1% on college level (Table 2). Compared to the average of the Dutch population, the sample was biased towards high education. This bias may be due to the fact that many students were approached to participate in the study.

Table 2: Educational levels of the respondents

	Frequency	Percent	Cumulative Percent
No education	1	.5	.5
Primary	8	4.0	4.5
School graduate	27	13.4	17.8
College	73	36.1	54.0
University	93	46.0	100.0
Total	202	100.0	

Regarding the financial situation of the respondents, the respondents were asked to assess their income as low, middle or high. From Table 3 it shows that the majority of respondents think that they have middle or upper middle incomes, 38.6% and 29.7% respectively. This represents the normal distribution in the Dutch society.

Table 3: Income levels of the respondents

	Frequency	Percent	Cumulative Percent
Low	15	7.4	7.4
Lower/middle	34	16.8	24.3
Middle	78	38.6	62.9
Upper/middle	60	29.7	92.6
High	15	7.4	100.0
Total	202	100.0	

4.2 Willingness to pay

To question about the willingness to pay was designed to also test the value attributed to this willingness. When a respondent indicated that he/she was willing to pay for the use of facebook, Twitter or LinkedIn, we asked their willingness to pay resp. 1, 2, 5, 10, 20 or 50 euros per month. The last value marked to pay was considered as a limit to the value attributed. The results of the willingness to pay is summarized in Table 4.

Table 4: Value indication of the willingness to pay for use of the social networks

	Facebook			Twitter			LinkedIn		
	Frequency	Perct.	Cum. Perct.	Frequency	Perct.	Cum. Perct.	Frequency	Perct.	Cum. Perct.
€50 / month	1	.5	.5	0	0	0	0	0	0
€20 / month	5	2.5	3.0	2	1.0	1.0	6	3.0	3.0
€10 / month	11	5.4	8.4	5	2.5	3.5	4	2.0	5.0
€5 / month	8	4.0	12.4	2	1.0	4.5	10	5.0	10.0
€2 / month	10	5.0	17.4	3	1.5	6.0	9	4.5	14.5
€1 / month	14	6.9	21.3	5	2.5	8.5	9	4.5	19.0
€0 / month	153	75.7	100.0	185	91.5	100.0	164	81.0	100.0
Total	202	100.0		202	100.0		202	100.0	

Table 4 shows that 75.7% of the respondents are not willing to pay for the use of facebook. The remaining 24.3% are ready to pay at least 1 euro per month, with 8.4% of respondents willing to pay at least 10 euro per month. For Twitter, the willingness to pay scores lower. 91.5% Of the respondents indicated that they are not willing to pay anything for the use of the network. The remaining 8.5% are ready to pay at least 1 euro per

month, with 3,5% of respondents willing to pay at least 10 euro per month. There were no users who were willing to pay more than 20 Euros per month.

For LinkedIn, 81% of respondents are not willing to pay for the use of the network. Of the 19% that are ready to pay at least 1 euro per month, 5% are willing to pay at least 10 euro per month.

4.3 Correlations with usage factors

Motivation

The first possible relationship between usage and the willingness to pay, was expected in the motivation for having an OSN account. The question provided 8 possible motivations of having an account. They were: to connect with (1) current friends, (2) family, (3) old friends, (4) others with shared interests, (5) to meet new friends, (6) to read statements by public figures, (7) to find dating partner, (8) to accomplish working tasks. On this question, multiple answers/motivations were allowed. Table 5 shows the motivations provided by the respondents.

Table 5: Motivations for the use of the OSN

Motivation	facebook		Twitter		LinkedIn	
	Frequency	Perct.	Frequency	Perct.	Frequency	Perct.
to connect with current friends	160	79%	32	16%	41	20%
to connect with family	160	79%	13	6%	14	7%
to connect with old friends	139	69%	14	7%	35	17%
to connect with others with shared interests	54	27%	41	20%	66	33%
to meet new friends	38	19%	8	4%	11	5%
to read statements by public figures	10	5%	50	25%	10	5%
to find dating partners	7	3%	2	1%	3	1%
to accomplish working tasks	22	11%	25	12%	73	36%

From this table, the different use of the three networks shows. Facebook is mostly used to connect with friends or family, which indicates a more ‘private’ use. The usage of LinkedIn on the other hand, shows a more ‘professional’ use with accomplishing working tasks, connecting to others with shared interests and (also) connecting with friends, as most important reasons. Twitter shows another pattern, in which reading statements of public figures and connecting to others with shared interests are the most important motivations. All three have OSNs have in common that finding dating partners is the less mentioned motivation for using the networks.

Regarding the relationship of the motivations and the willingness to pay, the correlations appeared to be weak for all three networks. The overall correlation of motivation and willingness to pay turned out to be insufficient to declare any relationship between these two variables for all the three networks.

Role

An assumption was made that there may be influential relationship depending on the kind of role users take on the OSN. Based on literature, the questionnaire provided specific descriptions of 6 different roles: (1) creator, (2) joiner, (3) critic, (4) conversationalist, (5) collector, and (6) spectator. Table 6 presents the willingness to pay of the different user roles.

Table 6: Roles of the OSN users and their willingness to pay

Frequency	Facebook			Twitter			LinkedIn		
	Willing to pay		Total	Willing to pay		Total	Willing to pay		Total
	No	Yes		No	Yes		No	Yes	
No account	15	1	16	114	4	118	83	5	88
Creator	23	12	35	8	5	13	3	6	9
Joiner	16	6	22	4	2	6	21	18	39

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	Facebook			Twitter			LinkedIn		
	Willing to pay		Total	Willing to pay		Total	Willing to pay		Total
	No	Yes		No	Yes		No	Yes	
Critic	13	5	18	5	1	6	5	2	7
Conversationalist	31	17	48	8	2	10	6	2	8
Collector	1	0	1	2	0	2	4	1	5
Spectator	54	8	62	44	3	47	42	4	46
Total	153	49	202	185	17	202	164	38	202

The majority of facebook users appeared to be spectators or conversationalists, with 33.3% and 25.8% respectively. Creators and conversationalist were most willing to pay for the service. The Pearson Correlation test did not show significant relationship between the roles users take on facebook and their willingness to pay.

The majority of Twitter users appeared to be a spectator (56%). The correlation between user role of Twitter and willingness to pay is positive 0.123. This means a slight correlation. However, this correlation coefficient is not sufficient to approve the assumption that there is strong relationship between these two variables.

The most indicated roles of LinkedIn users are spectator (40.4%) and joiner (34,2%), of which the joiner role shows a high percentage of willingness to pay. However, using the Pearson Correlation test, we found no significant relationship between user role and willingness to pay.

Number of friends/followers/connections

Another assumption on usage factors, was that the number of friends, followers or connections might have an influence on the willingness to pay for social media. The respondents were ask to choose one of the range in which their approximate number of friends, followers or connections happen to be.

On average, the users of facebook in our sample had between 151 and 200 friends. The highest frequency was scored by the interval of between 51 to 100 friends (16.7%), and the intervals next to this, so the majority of respondents were having 1 to 200 friends on (accumulative 55,6%). From table 7 it also shows that people with a higher number of friends are more willing to pay for the use of the network. The Pearson correlation coefficient confirmed the expectation of a significant relationship, positive .208 significant at the 0.01 level (2-tailed), between number of facebook friends and willingness to pay.

For Twitter, the highest frequency was scored by the interval of between 1 to 50 followers (65,5%). Also here, the Pearson correlation coefficient, positive .251 significant at the 0.01 level (2-tailed), shows the existence of a significant relationship between the number of Twitter followers amount and willingness to pay.

For LinkedIn, the majority of users have 1 to 150 connections (55.3%). Also here the willingness to pay seems to grow with the number of connections and this is confirmed by the Pearson correlation coefficient: positive .360 significant at the 0.01 level (2-tailed).

Table 7: Number of friends / followers / connections and the willingness to pay

# of friends / followers / connections	Facebook			Twitter			LinkedIn		
	Willing to pay		Total	Willing to pay		Total	Willing to pay		Total
	No	Yes		No	Yes		No	Yes	
0	15	1	16	114	4	118	83	5	88
1-50	27	1	28	54	1	55	34	1	35
51-100	28	3	31	6	1	7	12	2	14
101-150	24	3	27	2	2	4	10	4	14
151-200	13	5	18	4	2	6	7	4	11
201-250	7	7	14	1	1	2	7	4	11
251-300	8	6	14	0	1	1	3	3	6
301-350	7	4	11	2	1	3	1	1	2
351-400	2	2	4	0	1	1	1	3	4
401-450	3	5	8	0	0	0	0	1	1

# of friends / followers / connections	Facebook			Twitter			LinkedIn		
	Willing to pay		Total	Willing to pay		Total	Willing to pay		Total
	No	Yes		No	Yes		No	Yes	
451-500	3	6	9	0	0	0	2	3	5
>500	16	6	22	2	3	5	4	7	11
Total	153	49	202	185	17	202	164	38	202

In conclusion, we found for all three networks a significant positive correlation between the number of friends / followers / connections and the willingness to pay, thereby confirming our expectation on this factor.

Frequency of use

Another assumption regarding the usage factors was that frequency of visiting the pages of social media would influence the willingness to pay. The assortment of the possible answers was given into ranges: 0, 1-30, 31-60, 61-90, 91-120, or more than 120 visits per month. The logic behind was that the user might be accessing the network from 1 time a day to 1 time per month, 1 time a day or 2 time a day and so on, calculating the perceived average. Table 8 shows the findings of our survey on this factor.

Table 8: Frequency of use and the willingness to pay

Frequency of use	facebook			Twitter			LinkedIn		
	Willing to pay		Total	Willing to pay		Total	Willing to pay		Total
	No	Yes		No	Yes		No	Yes	
0	18	1	19	133	4	137	83	0	83
1-30	78	6	84	36	1	37	21	6	27
31-60	23	8	31	12	2	14	28	12	40
61-90	6	12	18	2	4	6	6	3	9
91-120	8	6	14	2	2	4	8	6	14
>120	20	16	36	0	4	4	18	11	29
Total	153	49	202	185	17	202	164	38	202

From this table it is visible that the most comfortable to pay for social media accounts were those who were using social media from at least 4 times per day (>120 times per month).

Looking at the different social media networks separately and the exact value attached, the same tendencies are visible for all three networks. Twitter users were more inclined to pay when they logged 3 times per day (61-90 times per month range) and more than 4 times per day (>120 times per month). LinkedIn was most valued by those, who used it once-twice per day (31-60 times per month) and more than 4 times per day (>120 times per month). The Pearson correlation method has shown significant relationship between frequency of use and the willingness to pay: positive .270 significant at the 0.01 level (2-tailed).

4.4 Correlations with personal factors

Gender

In our study, about 33% of men were willing to pay for the social networks and a very similar percentage of 31.2% of women. This difference does not seem very significant. The Pearson correlation revealed, that no significant relationship between age and willingness to pay could be demonstrated.

Age

Regarding the relationship between age and willingness to pay and age, Table 9 shows that the most willing to pay for social media are people in relatively younger age, from 1-28 years old. In this age range, about 33% of the respondents indicate that they would be willing to pay at least 1€ per month for the different networks. In the later age groups this diminishes to 16% (29-42 age group), 11% (43-56 age group), 6% (57-70 age group) and 4% (71-84 age group).

The pattern that older people are less willing to pay for the use of OSNs than younger users proved to be significant in the Pearson correlation test: a negative 0.278 correlation, significant at the 0.01 level (2-tailed).

Table 9: Age and the willingness to pay

Age	Facebook			Twitter			LinkedIn		
	Willing to pay		Total	Willing to pay		Total	Willing to pay		Total
	No	Yes		No	Yes		No	Yes	
1-14	0	1	1	1	0	1	1	0	1
15-28	28	24	52	42	10	52	36	16	52
29-42	50	15	65	60	5	65	54	11	65
43-56	43	5	48	46	2	48	39	9	48
57-70	24	4	28	28	0	28	27	1	28
71-84	8	0	8	8	0	8	7	1	8
Total	153	49	202	185	17	202	164	38	202

Financial stability

For the factor financial stability, the assumption was made that upper middle income respondents were ready to pay the highest prices. The Pearson correlation test shows that there is slight 0.10 correlation between the perception of income level and the willingness to pay. se two variables. However, in our study, this correlation did not prove to be significant.

Level of education

The last factor of influence considered was the level of education. In our sample, the majority of the respondents had rather high education: 46% of respondents had university education and 36.1% are college graduates. In total 82.1% of the respondents had a higher education. The Pearson correlation test indicated a small positive 0.121 correlation that did not show to be significant.

Table 10: Level of education and the willingness to pay

Level of education	Facebook			Twitter			LinkedIn		
	Willing to pay		Total	Willing to pay		Total	Willing to pay		Total
	No	Yes		No	Yes		No	Yes	
No education	1	0	1	1	0	1	1	0	1
Primary	6	2	8	8	0	8	8	0	8
School graduate	21	6	27	24	3	27	24	3	27
College	55	18	73	68	5	73	61	12	73
University	70	23	93	84	9	93	70	23	93
Total	153	49	202	185	17	202	164	38	202

5. Conclusion

This paper reported a study on the willingness to pay for the services of social networks, such as facebook, Twitter and LinkedIn. In a study amongst 202 Dutch users of facebook, Twitter and/or LinkedIn, we found that for facebook, 75.7% of the respondents are not willing to pay for use. The remaining 24.3% are ready to pay at least 1 euro per month, with 8,4% of respondents willing to pay at least 10 euro per month. For Twitter, the willingness to pay scores lower. 91.5% Of the respondents indicated that they are not willing to pay anything for the use of the network. The remaining 8.5% are ready to pay at least 1 euro per month, with 3,5% of respondents willing to pay at least 10 euro per month. For LinkedIn, 81% of respondents are not willing to pay for the use of the network. Of the 19% that are ready to pay at least 1 euro per month, 5% are willing to pay at least 10 euro per month

Based on earlier studies, we identified eight factors that potentially influence this willingness to pay. These factors relate to the use of the OSNs (motivation, role of the user, number of friends and frequency of use) or to the person of the user (gender, age, financial stability and level of education). From our study it appeared

that three of these factors significantly correlated to the willingness to pay: number of friends/followers/connections, frequency of use and age.

Not surprisingly, the intensity of use, indicated by number of friends/followers/connections and frequency of use, relates positively with the willingness to pay. The fact that age appeared as a negative correlation may also not be surprising, given the popularity of social networks amongst young people. However, Oosterveer (2013) indicates that the group of older users is growing.

Perhaps more surprising than the correlations that appeared, are the correlations that did not appear as significant. For example, the motivation to have a facebook, Twitter or LinkedIn account and the role the user takes were expected to have an influence.

The contribution our study makes is that it provides insight in the factors influencing the value of OSNs from the perspective of the users. For the organizations behind these social networks, this is useful information in developing new business models that include charging users for specific services. The academic contribution of our study is that it adds the user perspective to the debate on the value of social media, where this value is mostly approached from companies and organizing advertising on OSNs.

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Drivers of Green Information Technology in Higher Education in South Africa

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Abstract: There is an increased demand for organizations to address the sustainability of their information technology (IT) and communication infrastructure. This research investigates the drivers for the adoption of Green IT in South African higher education institutions (HEI). A green IT adoption model derived from (Molla 2008) was used and Green IT drivers were classified into economic, ethical, response and regulatory drivers. Additionally, the role of institutional, organisational and value network Green IT was investigated. Instruments for the model were created through extensive literature review as well as some self-developed questions. Green IT adoption was operationalized as the use of server virtualization, storage virtualization, storage consolidation, having an environment-friendly IT procurement policy, having a policy on managing electronic waste and measuring the environmental impact of IT. IT managers in each of South Africa's universities were approached through an online survey. Given the small number of HEIs in South Africa, sample size was necessarily limited but the responses received represent a significant and representative portion of the South African HEIs and encouraging results were found. All Green IT drivers were found to be significant antecedents in the adoption of green IT, although the overall adoption of green IT is relatively low. However, most HEI stakeholders in the HEI value network, i.e. suppliers, investors, competitors and government, do not seem to exert a significant influence on green IT adoption. Our research instrument and findings should be of interest, not only to HEI stakeholder in South Africa and elsewhere in the world, but also to researchers in the field of sustainability of information technologies.

Keywords: green IT, sustainability, higher education institutions (HEIs), South Africa

1. Introduction

There is an increasing awareness of and call for organizations to address the sustainability of the information technology and communication infrastructure (Jenkin et al. 2011). Although data-centre sustainability accounts for a significant portion of IT sustainability, client side IT equipment is often overlooked and is one of the primary contributors to carbon emissions of ICT. For example, the amount of carbon dioxide emitted over the average lifetime of a single desktop computer is said to be 1096kg (Paruchuri 2011). Discarded ICTs, known as electronic waste or e-waste, are one of the major and fastest growing contributors to waste disposal. It is thus imperative that a comprehensive approach to adoption of Green IT is employed in order for it to be successful (Molla & Cooper 2010).

Although the adoption of Information Technology has been studied for some time, the adoption of Green IT is said to have additional motivational factors other than that of standard IT adoption (Molla 2008; Molla & Abareshi 2011). These motivational factors may include economic benefits, regulation requirements, stakeholder obligations and ethical reasons, which all need to be taken into account when exploring and analysing factors that may influence the adoption of Green IT. Few studies have studied the adoption of Green IT from a higher education perspective and apart from research in the Green IS field (Petzer et al. 2011), none seem to have studied Green IT from a South African perspective.

This research aims to address the question, "What motivates higher education institutions to adopt green and sustainable IT solutions?" The results of this study will assist in providing insight into the reasons behind the adoption of Green IT within the higher educational sector and from an emerging economy perspective. These insights are of use to HEI stakeholders and sustainability researchers alike. The empirical validation of the theoretical framework used here, and the new research instrument which we developed, make a theoretical contribution to the academic research in the field of Green IT evaluation.

2. Literature review

Current literature shows an increasing demand for organizations to address the sustainability of the information technology and communication infrastructure (Cooper & Molla 2010; Jenkin et al. 2011). Until recently information technology sustainability has received very little attention in terms of research (Chen et

al. 2008; Molla 2008; Nazari & Karim 2012). As a result of this there is still no mutual agreement on what the exact definition of Green Information Technology (Green IT) is.

People are becoming increasingly aware of the environmental impact of ICT and the necessity to reduce this impact on the environment (Jenkin et al. 2011). During their lifecycle, ICT components consume vast amounts of electricity which contribute significantly to their carbon footprint (Murugesan 2008; Hanne 2011). ICT carbon emissions are estimated to be equal to that of the aviation industry (Molla & Abareshi 2011). Green IT is often viewed purely from a data-centre perspective (Molla et al. 2008; Petzer et al. 2011). Although the sustainability of the data-centre plays an important role in the sustainability of information technology, it is necessary to adopt a comprehensive approach when addressing environmental sustainability (Murugesan 2008; Molla & Cooper 2010).

Client side IT equipment is one of the primary contributors to carbon emissions of ICT with an average of 1096kg of carbon dioxide emitted over the average lifetime of a single desktop computer (Paruchuri 2011). Energy consumption can be significantly reduced by adapting the way in which we use these computers (Murugesan & Gangadharan 2012). This can be achieved through the application of relevant technology for the activity, power management features and powering off the computer when not in use (Murugesan 2008; Harmon & Auseklis 2009). The majority of ICT components end up in landfills once they have reached their end of life (Murugesan 2008). These discarded components, labelled electronic waste or e-waste, are one of the major and rapidly growing contributors to waste disposal.

The design and manufacturing of sustainable ICT can also assist in reducing the overall carbon footprint of ICT. By reducing the amount of raw materials, increasing the use of non-toxic materials and by recycling parts, manufacturers may assist in reducing their impact on the environment. Additionally, the design of energy-efficient technologies can also help in reducing the overall energy consumption of ICT.

Inevitably the decision to adopt sustainable ICT comes down to either the individual or the organization. Although IT adoption and the motivation of individuals and organization have been researched at length, the adoption of Green IT is said to have additional motivational factors other to that of standard IT adoption. This has prompted the development of Green IT-specific models and frameworks. Although research in the area of Green IT adoption is still young, a number of studies have attempted to explain the adoption of Green IT from various viewpoints (Molla 2008; Nazari & Karim 2012; Schmidt & Ereik 2010). However, few of these studies have studied the adoption of Green IT from a higher education perspective and, apart from research in the Green IS field (Petzer et al. 2011), none seem to have studied Green IT from a South African perspective.

2.1 Defining green IT

In order to accurately assess the status of Green IT, it is important to have a clear understanding of the meaning and extent of Green IT, and the closely associated but different concept of Green IS. Green IT, also referred to as Green for IT or Green IT 1.0, is the application of sustainability to the design, manufacturing, use and disposal of IT. It is perceived to be the more mature and original form of Green IT. Lamb (2009) defines Green IT as, "Using IT more efficiently to achieve reductions in energy consumption, and therefore, considering the acquisition of energy-efficient IT solutions." This definition highlights two areas of Green IT: Sourcing of environmentally sustainable ICT equipment and efficient usage of ICT equipment. However, Green IT does not only refer to the economics and energy-efficiency of information technology but also environmental sustainability concerns within the design and manufacturing phases as well as indirect costs such as disposal and recycling (Murugesan 2008). The majority of ICT emissions are not a direct result of the ICT equipment but rather a result of the entire lifecycle of these components (Murugesan & Gangadharan 2012). Murugesan's (2008) definition incorporates additional components of the ICT lifecycle, such as the design and manufacturing together with the usage and the disposal of ICT equipment.

As research has progressed, a new area has become increasingly prominent, referred to as Green IS. Butler (2012) refers to Green IS as IT software applications that focus on sustainability and the effect of people, processes and technology. It facilitates a reduction in overall emissions of an organization. The application of Green IS can vary based on the context in which it is used. Butler (2012) lists various functions of Green IS including monitoring and reporting on GHG emissions, controlling waste, toxic and hazardous materials use, management of energy-consuming buildings, redesigning business processes (including logistics) to make them

more energy efficient etc. Thus Green IS can contain elements of Green IT but Green IT does not necessarily contain elements of Green IS (Ijab 2010; Butler 2011).

As Green IT is still a relatively new topic, there has been very little empirical research in this area until recently. One study in Sweden made use of a comparative case study on the adoption of Green IT between a municipality and a higher education institution (Nazari & Karim 2012). The results of the two case studies showed a definite contrast in the factors influencing the adoption of Green IT. Petzer et al. (2011) did a study on the adoption of Green IS from a South African perspective. Given the few similarities between Green IT and Green IS this research may offer some insight into the reasons behind the adoption of Green IT in South Africa. This study provided empirical evidence that adoption of Green IS is more due to economic benefits rather than regulatory or ethical reasons (Petzer et al. 2011). Other than this research, there appears to be no research around the adoption of Green IT from a developing country perspective and more specifically from a South African perspective.

2.2 Green IT adoption and drivers

This section explores the potential drivers of Green IT as outlined in the existing literature. *Economic Drivers*, namely cost reduction is one of the more significant drivers of Green IT, particularly in a South African context (Petzer et al. 2011). As a result of the rising cost of energy, the most recognized method of cost reduction in the ICT environment is through the reduction of energy consumption (Murugesan 2008; Murugesan & Gangadharan 2012).

Regulatory drivers such as regulatory and government compliance play an important role in the intention of organizations to adopt Green ICT. Certain regulatory acts require organizations to report their carbon emissions if they are above a certain level (Molla 2008; Murugesan & Gangadharan 2012). However, legislation around the adoption of Green IT is less of a concern in a South African context as there are no repercussions due to the absence of compulsion (Petzer et al. 2011)

Market opportunity drivers include the growing awareness of ICT's impact on the environment as well as ICT as a solution to the impacts of ICT on the environment. Businesses now have the opportunity of not only implementing sustainable ICT solutions, but also supplying green ICT equipment, products and software (Unhelkar 2011; Murugesan & Gangadharan 2012).

Social, cultural and political pressures can become a significant driving force in the awareness and subsequent adoption of Green IT. This may happen when the society becomes aware of the degradation of the environment and realizes the importance thereof, thus driving the organization to change their methods (Murugesan & Gangadharan 2012). Organizations may be compelled to adopt and implement Green IT solutions as a result of the requirements of the *industry* i.e. other organizations. Once one organization chooses to adopt sustainable methods, other associated organizations will invariably be driven towards the adoption of sustainable practices (Murugesan & Gangadharan 2012). Molla & Abareshi (2011) merge the market opportunity driver, industry drivers as well as the social, cultural and political drivers into so-called *response drivers*.

Self-Motivation can be seen as the *ethical* driver in the implementation of Green IT. Organizations can implement Green IT based on overall perception and beliefs of the organization and in order to do a common good. This can be due to a realisation of the cost benefit, to instil employee confidence or even to aspire towards a better brand image (Murugesan & Gangadharan 2012).

2.3 Green IT adoption models

A number of Green IT adoption models have been developed based on the existing literature on IT adoption. Nazari et al. (2009) combine the TOE framework and DOI model in order to identify factors influencing the adoption of Green IT at an organizational level. This framework highlights three sets of factors that may influence the adoption of Green IT: Innovation, Organizational and Environmental Factors.

Another Green IT adoption framework, posited by Schmidt & Ereik (2010) hypothesis that the extent of Green IT planning and implementation is influenced positively by the perceived importance but negatively by uncertainty around Green IT. The framework suggests a number of first level predictors which can either

positively or negatively influence the importance of IT (corporate management, environmental engagement, experience) and uncertainty surrounding Green IT (experience, measurement, standards, hype and IT staff initiative) (Schmidt & Ereik 2010).

Molla (2008) poses a new theory relating to the adoption of Green IT based on existing innovation and adoption models. His Green IT Adoption Model (GITAM) (Figure 1) poses that an organizations intention to adopt Green IT and the adoption of Green IT, is influenced by factors such as Green IT Readiness, Green IT Context and Green IT Drivers. The Green IT context assesses the existing characteristics of the available technology adoption models. Based on the TOE model, the GITAM framework divides these contexts into a technological, an organisational and an environmental context. The Green IT Readiness is an assessment of an organizations readiness to adopt Green IT (Molla 2008). Based on the PERM model (Molla & Licker 2005), Green IT Readiness is categorized into the perceived organization Green IT Readiness, the perceived value network Green IT Readiness and the perceived Institutional Green IT Readiness. Molla (2008) identifies three drivers of Green IT: economic, regulatory and ethical. Molla and Abarreshi (2011) pose an additional driver that may influence the adoption of Green IT: the eco-responsiveness driver which refers to other external pressures such as social, cultural and political pressures, industry pressure and new market opportunities.

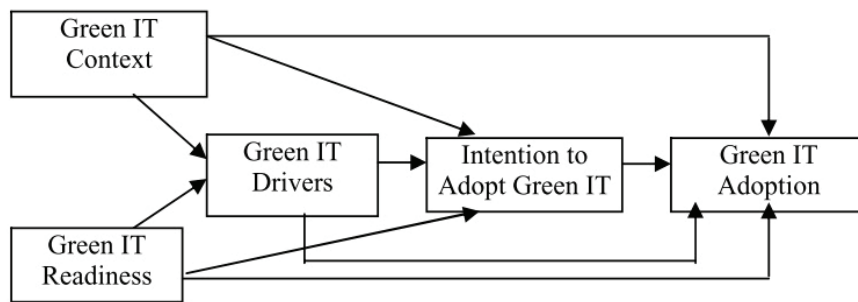


Figure 1: GITAM: The basic model (Molla 2008)

3. Research methodology

The purpose of this research is descriptive as well as exploratory. A positivist stance and deductive approach were adopted. The theoretical framework for this research is based on the GITAM model developed by Molla (2008), although the intention to adopt was not measured explicitly. Figure 2 below shows the final research model, with each of the arrows representing a proposed impact for which a corresponding hypothesis was formulated.

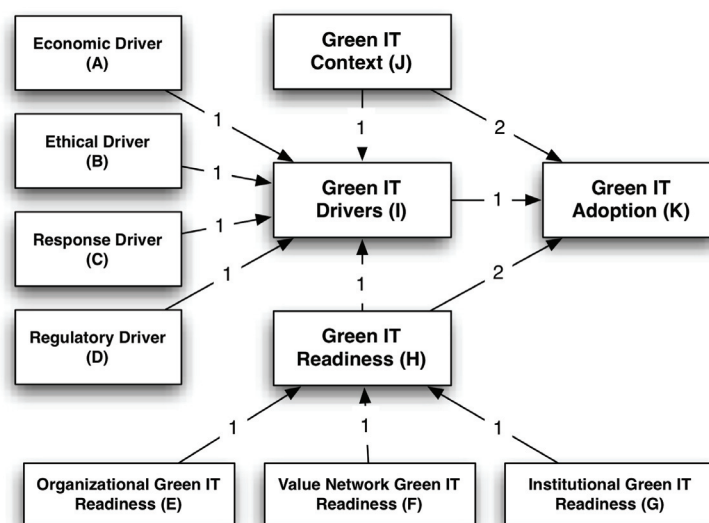


Figure 2: Logical mapping of hypotheses against the proposed model

The survey questionnaire instrument that was used for this research accommodates questions for each of the factors that may influence the adoption of Green IT. The Green IT driver section of the survey questionnaire

was adapted from an existing instrument developed by Molla & Abareshi (2011) on the adoption of Green IT from a motivational perspective as well as one self-developed question. The Green IT Readiness section of the survey questionnaire was predominantly adapted from an existing instrument developed by Molla & Licker (2005) on the adoption of ecommerce in developing countries, together with other instruments developed by Schmidt & Ereik (2010) and Molla & Cooper (2010). Green IT adoption was operationalized as the use of server virtualization, storage virtualization, storage consolidation, having an environment-friendly IT procurement policy, having a policy on managing electronic waste and measuring the environmental impact of IT. Most questions were re-phrased for a higher-education context. Where pre-developed questions were not available for the construct that was being measured, the questions were self-developed. The final questionnaire is available from the authors on request. The research was targeted at the information technology staff in two to three IT departments at each of South Africa's 23 public higher education institutions. The survey was launched end-July 2013 and follow-ups were done via email and telephone to encourage responses.

4. Data analysis and results

All data analysis was completed using the statistical tool R. Of the 48 responses that were received, 28 incomplete responses and 1 erroneous response were discarded and a total of 19 complete responses remained.

4.1 Sample description

Out of the 23 higher education institutions that were contacted, only 9 institutions provided valid responses to the survey. However, six of the seven South African provinces that have HEIs are represented, with no province having more than two HEIs. Thus the sample is geographically very representative. The distribution of individual responses from institutions (most HEIs had two individual responses) was similar, apart from the Western Cape Province, which had averaged 3 individual responses per university.

4.2 Instrument validity

As the research instrument consists of multi-point questions and summated scales and as some of the questions were self-developed, it was necessary to validate the reliability of the instrument before proceeding with data analysis (Cronbach 1951). Cronbach's alpha was used to measure the internal consistency reliability of items within the instrument. In order to get an accurate representation of the instruments reliability an additional three measures were analysed, including Guttman's lambda 6 (Guttman 1945; Kadijevich 2003), standardized alpha based on correlations (Schmitt 1996) and the average inter-item correlation (Kuder & Richardson 1937; Gulliksen 1945). Using George and Mallory's (2003) rule of thumb for the assessment of the results, any item with a Cronbach's alpha below 0.7 was reassessed and as a result three items (ETH3, RES2 and COM4) were dropped from the instrument. Once these items had been dropped, the Cronbach alpha of the remaining items was above 0.7 (Table 1).

Table 1: Instrument validity

Instrument validity for instrument variables				
Variable	Cronbach's alpha	Standardized alpha	Guttman's Lambda 6	Average inter-item correlation
Economic Drivers	0.9159	0.9167	0.8911	0.7857
Ethical Drivers	0.7326	0.7326	0.5780	0.5780
Response Drivers	0.7340	0.7145	0.7400	0.4548
Regulatory Drivers	0.7236	0.7386	0.7490	0.4140
Commitment	0.7340	0.7145	0.7400	0.4548
Awareness	0.8364	0.8408	0.8251	0.5691
Resources	0.9044	0.9109	0.9285	0.6717
Suppliers	0.9345	0.9406	0.9207	0.8407
Competitors	0.8597	0.8608	0.8689	0.6073
Investors	0.9224	0.9281	0.9229	0.8114
Government	0.8564	0.8572	0.8040	0.6668
ADOPTION	0.7174	0.7544	0.8190	0.3385

Unfortunately, the sample size was too small to do validity analysis by means of exploratory factor analysis.

4.3 Exploratory data analysis

Tukey’s (1977) exploratory data approach was used to present the data. A diverged stacked bar chart was produced; this chart is preferred to pie or normal bar charts which make the data difficult to interpret without a common baseline (Robbins & Heiberger 2011). Figure 3 shows that responders seem to agree to a greater percentage with Green IT Drivers, which is weighted to the right of the plot, shown in blue. In contrast, responders generally tend to disagree to a greater percentage with the Green IT readiness constructs and the adoption construct, shown to the left of the plot, in red (Figure 13). This may possibly indicate a low level of Green IT readiness as well as Green IT adoption as the questions for both readiness and adoption are phrased around the state to which institutions have implemented the construct (Figure 3).

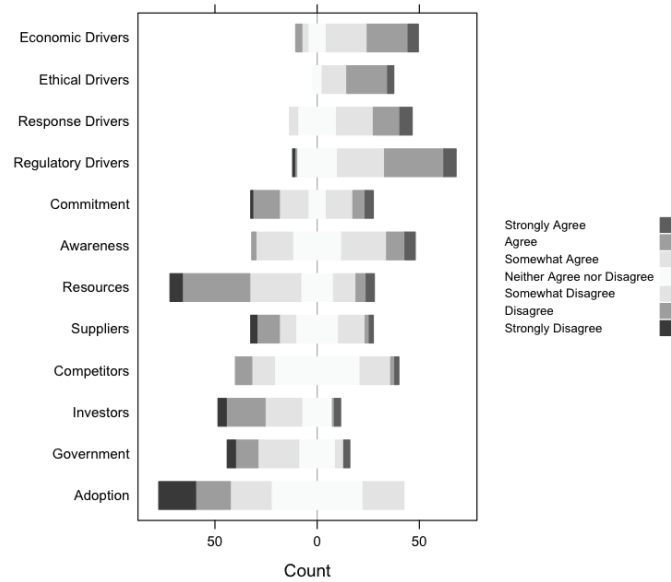


Figure 3: Diverged and stacked bar chart of the responses to the instrument constructs

4.4 Correlation analysis

Correlation matrices between individual items and between constructs were created using Pearson’s correlation coefficients to identify any relationships (Sedgwick 2012). Figure 4 shows the correlations between constructs and a graphic representation. The left matrix gives the actual correlation coefficients below the diagonal and the corresponding p-values above the diagonal; the right matrix gives a visual interpretation with blue for positive and red for negative correlations; size and intensity of the cell block indicate magnitude.

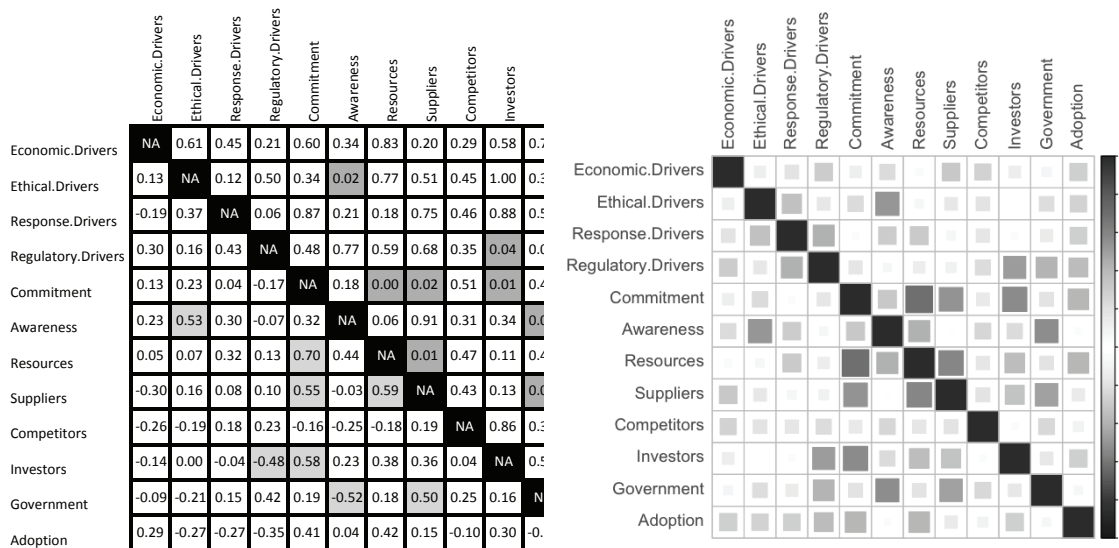


Figure 4: Pearson’s correlation matrix for constructs

Figure 4 shows significant positive and negative correlations between constructs. There are some strongly significant positive correlations within Green IT Readiness between constructs Organizational Green IT Readiness, Value Network Green IT Readiness and Institutional Green IT Readiness. A significant positive correlation is also evident between Commitment and Resources, between Commitment and Suppliers and between Resources and Suppliers. Additionally, within Green IT readiness, a significantly positive relationship exists between Commitment and Investors and a significant negative correlation exists between Government and Awareness.

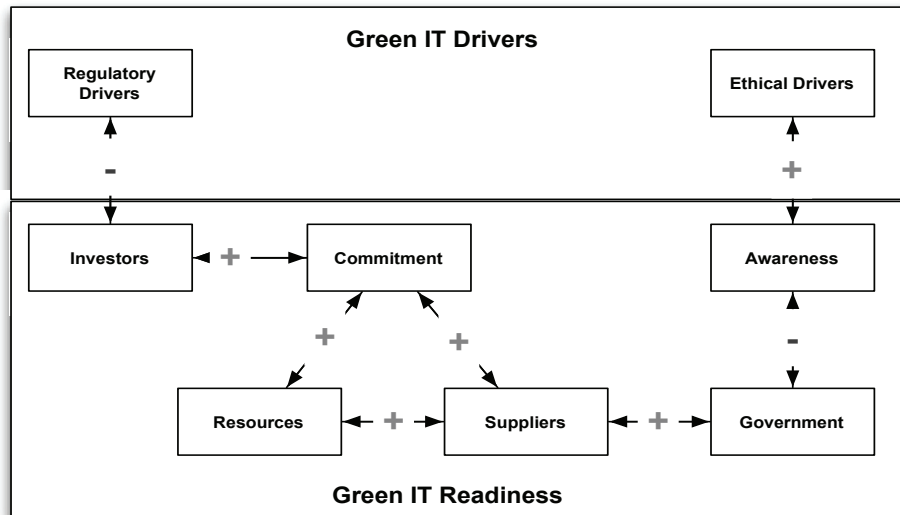


Figure 5: Significant correlations within green IT drivers

Correlation results show that there are no significant correlations between any of the constructs within Green IT Drivers (Figure 5). There are however two significant correlations between Green IT Drivers and Green IT Readiness, namely a significant positive correlation between Ethical Drivers and Awareness and the significant negative correlation between Regulatory Drivers and Investors. Once the relationships between constructs had been investigated, the hypotheses were tested.

4.5 Hypothesis testing

Given the relatively small sample size of this study, a Fishers exact test was used in addition to the Chi-squared test as a non-parametric approach for hypothesis testing (Lancaster & Seneta 1969; Routledge 1998). Although both Chi-squared and Fishers Exact tests were provided for comparison, final deductions were based on the results of the Fisher’s exact test alone. The results from the Fishers exact test showed that for the hypotheses, shown in Table 1, all but two of the hypotheses of this study were significant (Table 2). Note that the hypotheses refer to Figure 2 i.e. H2 is the hypothesis that Green IT Readiness (H) impacts on Green IT Adoption (Arrow 2).

Table 2: Results for chi-squared test and Fishers exact test for hypothesis testing

Chi-Squared and Fishers Exact Test			
Hypothesis	Fishers Exact p-value	Chi-square	Chi-square p-value
A1*	< 0.05	76.98	< 0.05
B1*	< 0.05	93.54	< 0.05
C1*	< 0.05	60.45	< 0.05
D1*	< 0.05	88.16	< 0.05
E1*	< 0.05	26.77	< 0.05
F1	> 0.05	NA	> 0.05
G1	> 0.05	NA	> 0.05
H1*	< 0.05	43.66	< 0.05
H2*	< 0.05	NA	> 0.05
I1*	< 0.05	77.74	< 0.05

* significant at p = 5%

According to the hypotheses, these results suggested that the adoption of Green IT in higher education institutions in South Africa is significantly ($p < 0.05$) affected by economic benefits, overall perception and

beliefs of an institution, external pressures, government and professional bodies and by the perception of an institutions Green IT readiness. Green IT Drivers as a whole plays a significant role in affecting adoption of Green IT in higher education institutions in South Africa (Figure 6).

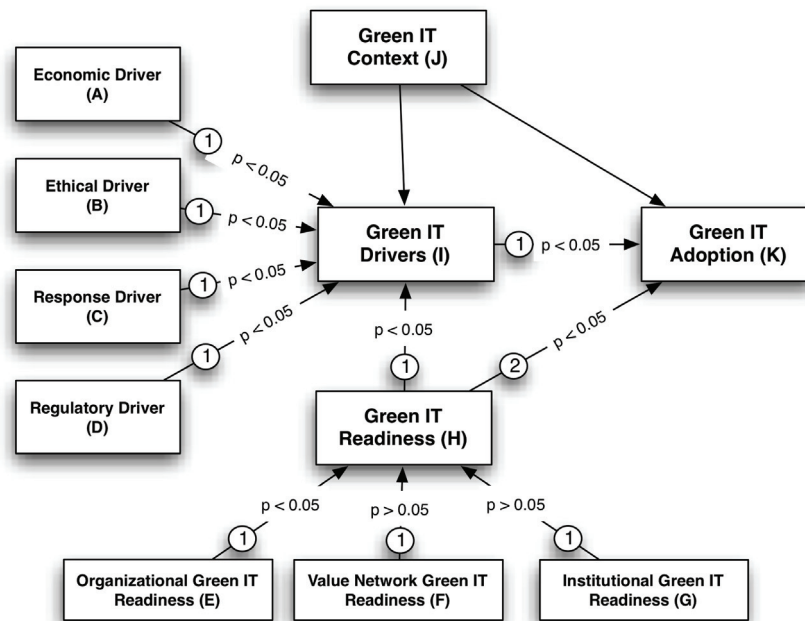


Figure 6: Proposed model indicating p-values for hypotheses testing using Fishers exact test

In contrast, the adoption of Green IT in higher education institutions in South Africa is not significantly ($p > 0.05$) affected by the perception of an institution's value network Green IT readiness or by the perception of an institutions institutional Green IT readiness. Nonetheless, results indicate that Green IT Readiness overall affects the adoption of Green IT in higher education institutions in South Africa (Figure 6). Furthermore, the perception of Green IT readiness has a significant ($p < 0.05$) effect on Green IT Drivers. Regardless of the small sample size, the results of the Chi-squared give nearly identical results to the Fishers Exact test, with the exception being that H2 is found to be not significant (Table 2).

5. Conclusion, limitations and future research

The adoption of Green IT in higher education institutions in South Africa has not been investigated to date and results from this study will contribute towards understanding what factors that influence this adoption. This will enable future movements towards implementing Green IT solution in higher education institutions in South Africa, thereby promoting the sustained practice and usage of IT infrastructure and support. As a result of small sample size, the results of this study should be viewed as an explorative study into some of the perceptions of IT staff and managers on the factors driving the adoption of Green IT in higher education institutions in South Africa.

The theoretical framework for this research is based on the GITAM model developed by Molla (2008). An empirical research instrument was developed and tested for reliability. In spite of the small sample size, some very strong correlations between factors were revealed. Strong, highly significant positive correlations within Green IT Readiness exist between the constructs Organizational Green IT Readiness, Value Network Green IT Readiness and Institutional Green IT Readiness. The significant positive correlation between Commitment and Resources, between Commitment and Suppliers and between Resources and Suppliers seem to suggest that institutions that are committed to Green IT, may have the necessary resources for Green IT and as well the necessary supplier relationships.

In addition to the strong correlative trends which were found, all but one of the hypotheses put forward were accepted. Results indicated that all constructs of the perception of Green IT Drivers have a statistically significant influence on the adoption of Green IT in higher education institutions in South Africa. The perception of an institution's value network Green IT readiness and the perception of an institutions institutional Green IT readiness did not appear to affect the adoption of Green IT. Therefore, suppliers,

investors, competitors and government does not appear to play an important role in influencing the adoption of Green IT within higher education in South Africa. Unfortunately, currently the actual level of Green IT Adoption and Readiness within higher education institutions in South Africa appeared to be fairly low. In the absence of normative pressure, a significant acceleration of Green IT implementation beyond cost-driven rationales may require a legislative or financial incentive.

These findings need to be confirmed through further studies with a larger sample size and possibly with more of a qualitative approach. Additionally, it will be interesting to have an international comparison to see which factors and relationships are dependent on country, regional and developing economy contexts. Hopefully comparisons can also be made with regions where Green IT adoption is higher as different drivers and pressures may exhibit themselves at different levels of sustainability maturity. These studies would also lead to further empirical validation and possible refinement of the research instrument proposed here.

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A Case Study on Web-Based Information System Evaluation

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Abstract: A new framework is proposed to assess web-based information systems (WISs) which is domain-independent, that is, can be applied for profit seeking as well as service oriented or non-profit seeking organizations. Assessment starts from an identification of the critical success factors (CSF) that outline organizational strategies, and proceeds to determine the measures of three categories of relationships: User-WIS, Other systems-WIS, Organization-WIS. These measures and CSF's are evaluated collectively to arrive at an effectiveness measure. A case study illustrating the applicability of the assessment framework in the e-business domain is presented.

Keywords: web-based information systems, effectiveness, assessment

1. Introduction

With the progress achieved in Internet and information technologies, many Information Systems (ISs) turned into web-based information systems (WIS), enabling access through multiple channels. Naturally, this new dynamic environment has generated the necessity to look into IS assessment from a new perspective. While assessment of web-based systems usually emphasizes ease of use and flexibility, current approaches for measuring IS effectiveness do not consider the Internet as a characteristic system and rather view it as an add-on property. Effectiveness, especially regarding achievement of organizational goals is, if at all, considered an indirect achievement. Therefore, a broad model assessment is needed for measuring the effectiveness of WISs, applicable to whichever domain they run in, such as e-commerce, e-government, or e-health. This model should take into account the added value that the WIS provides to the organization in light of its targets. In this study, a comprehensive and generic framework for the assessment of WIS effectiveness SEWISS is introduced. This framework is based on exploring WIS relationships and organizational strategy.

The concept of effectiveness concerns the influence or results caused by a system on the environment, and thus has an external focus (Myers et al., 1997). Similarly, success is considered as the achievement of an intended or expected effect (Webster's dictionary). In this study, success and effectiveness are used interchangeably.

IS assessment studies literature can be grouped into two main categories: studies about traditional ISs, and studies on WIS after the emergence of the Internet. In the former studies, IS researchers have considered different aspects of the ISs under assessment such as product, process, service dimension, stakeholders, and user satisfaction. In their classical work, DeLone and McLean (1992) proposed a comprehensive framework (hereafter referred to as the D&M Model) for IS success measurement. They specified six different dimensions of IS success: System Quality, Information Quality, Use, User Satisfaction, Individual Impact, and Organizational Impact. Other assessment models have been proposed by other researchers based on different dimensions of the system being evaluated like product, process, service, stakeholders, and user satisfaction (Pitt et al., 1995) (Seddon et al, 1999), (Özkan, 2006), (Kanungo et al., 1999).

Traditional ISs were closed systems, having a single access channel, where only staff running the IS had access to the system (Taniar and Rahayu, 2004). For WIS assessment, the initial trend was to apply traditional IS conceptual models like the D&M Model to the web-based domain. Researchers tried to modify the D&M Model to include effects of the Internet by adapting the same model specifically to e-business and e-government environments (DeLone and McLean, 2004), (Hu et al, 2005). However, it was observed that the Internet generates a wide communication medium with many users from different cultures with diverse expectations which makes the business environment more complex (Jarvenpaa and Tiller, 1999), (Jones et al, 2000). Therefore, the assessment of WISs should account for this complexity, considering the system and its interactions with its environment as a whole.

Other studies (Lai, 2006), (Torkzadeh et al., 2003), (Gil-Garcia and Pardo, 2005), (Becker et al, 2004), (Elpez and Fink, 2006) on WIS evaluation consider domain specific issues. For example, studies on the evaluation of e-government or e-business WISs mainly concentrate on one of the following dimensions: consumer satisfaction (Torkzadeh, Chang, and Dhillon, 2003), firm strategy (Gil-Garcia and Pardo, 2005), risk (Evangelidis et al, 2002), service quality (Lai, 2006) or web-site assessment (Liu and Arnett, 2000). In general, these studies are far from providing a broad, comprehensive framework for the evaluation of WISs independent of the specific application domain. Furthermore, they ignore the organizational targets and the effect of the WIS on those targets.

Effective use of Internet technologies can provide competitive advantage, market penetration, innovation, technology transfer and even management competency (Torkzadeh and Dhillon, 2002). The unique characteristics of the WIS may require new metrics or at least careful evaluation of existing ones (Straub et al, 2002) in its assessment. WISs are social systems, so their assessment is not an easy task; there are many different aspects to be considered in the assessment process. These systems have several interactions with different stakeholders having different expectations from those systems. Through the Internet, users can access a broad information base quickly, compare product prices, shop through fast transactions, exchange views about products and services easily, which creates a complex environment with security being an important issue. In such a competitive and complex environment, WIS success becomes vital for the survival of an organization. Therefore, assessment of the effectiveness of a WIS should take into account its contribution to the achievement of the organizational goals.

As a result, there is a need for a novel approach to evaluate WISs, considering Internet accessibility as a system characteristic rather than an add-on property. In this study, SEWISS is introduced; a comprehensive and generic framework for WIS effectiveness assessment based on WIS relationships and organizational strategy, and its application to the e-commerce environment is illustrated.

2. Strategy-based evaluation of the WIS success assessment framework

IS success is a multi-dimensional issue (DeLone and McLean, 1992). To decide whether an IS is effective or not, or to what degree, several dimensions of WIS should be considered in the assessment process (Malik, 2001), (Smith and McKeen, 1996), (DeLone and McLean, 1992), (Pitt et al., 1995), (Seddon et al, 1999), (Iivari, 2005), (Sabherwal et al., 2006), (Lu et al., 2005). Since the goal of this study is to assess the WIS effectiveness of an organization, the model focuses on the controllable dimensions that can be improved upon through organizational effort. In this regard, at the basic level, a comprehensive assessment framework for WIS effectiveness will be the result of interaction between the WIS and the organization in the business environment.

In this study, the organizational aspect influencing WIS effectiveness will be represented by organizational strategy and the WIS-related aspects, the relationships of WIS with its environmental entities, will be considered as illustrated in Figure 1.

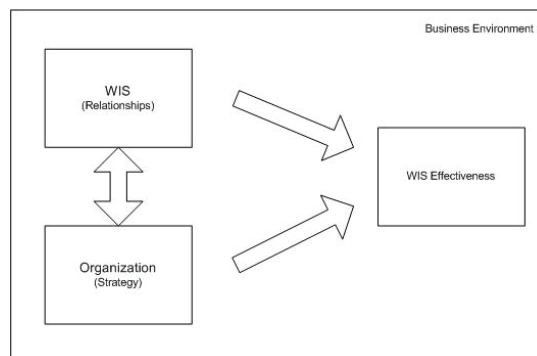


Figure 1: WIS effectiveness aspects

A. WIS Relationships

A WIS interacts with various entities. In this study, the proposed SEWISS framework considers the interactions of WIS with users, with other ISs (web-based or non web-based) in the domain, and with the organization's

entities. These interactions should be considered in effectiveness assessment and are represented by WIS relationships which form one of the SEWISS framework dimensions. In this dimension, the following categories exist, each having various measures effecting assessment. (Measures of any specific relationship, obviously, must be determined through interviews with the particular organization under assessment.)

User-WIS relationship (WIS Relationship 1): includes the interaction between system users, both internal and external, and the system itself, and takes into account the perspectives of different stakeholders using the WIS (related measures: user friendliness, ease of use, understandability, etc.).

Other Systems-WIS relationship (WIS Relationship 2): consists of the interaction of the organization's WIS with ISs in the external environment and covers the effect of other systems in the environment like compatibility between systems (related measures: security, compatibility, timeliness, etc.).

Organization-WIS relationship (WIS Relationship 3): consists of the interaction of organizational units and WIS such as culture, structure, standards, processes, possibly other non-WISs in the organization, turnover, communication factors by which the organization is influenced (related measures: privacy, scalability, standards, etc.).

It can be concluded that the WIS relationships dimension takes into account the stakeholders' views, environmental factors and also the organizational characteristics under the above-listed relationship categories.

B. Strategy

Strategy is an action plan that directs an organization in its environment, affects its processes and characteristics, and thus its performance (Hambrick, 1980). IT/IS planning and implementation is influenced by strategic decisions in the long-term. Similarly, IT/IS involvement has an effect on organizational performance; therefore, there should be a relation between organizational strategy and IT/IS selections and actions [29, p13]. Any change in organizational strategy means changes in the IS to provide new products or services (Sobczak and Berry, 2006). Thus, IS characteristics should be related to the organizational strategy (Sobczak and Berry, 2006), similarly the WIS is expected to serve organizational strategy. A strong connection exists between IT/IS investment and business goals. In that respect, IT investment requirements are shaped by the business goals and so the evaluation process should measure the level of their achievement as well (Serafeimidis and Smithson, 2003).

Web-based organizations can be classified as non-profit web-based organizations and profit-oriented web-based organizations. Non-profit organizations (e-government, e-health and charity organizations) provide services and products in order to enhance the transactions; on the other hand, profit-oriented organizations (e-business organizations) provide services and products in order to make profit, earn market share. A commonly accepted form of specifying organizational strategy is through critical success factors (CSF) (Rockart, 1982). CSFs are the important areas of action that must be accomplished effectively to achieve the mission, objectives, quality and high performance (Alazmi and Zairi, 2003). Rockhart and Bullen (1986) defined five specific sources or types of CSFs for the organization as follows:

- the industry in which the organization competes or exists
- an understanding of the organization's peers
- the general business climate or organizational environment
- problems, barriers, or challenges to the organization
- layers of management

In this study, WIS effectiveness is defined as how much success in WIS relationships contributes to the organizational CSFs, as illustrated in Figure 2.

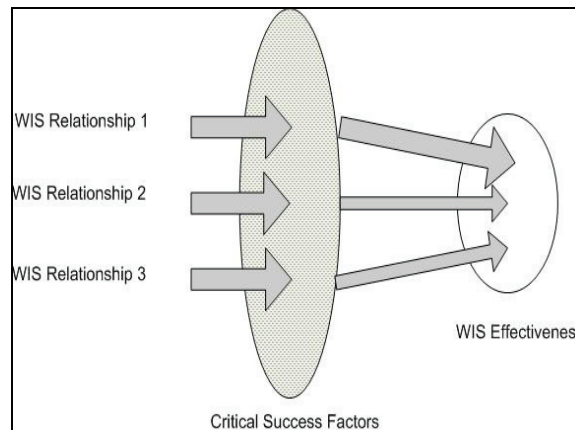


Figure2: WIS effectiveness assessment framework

3. SEWISS framework

WISs are systems actualized by stakeholders and external systems, so their success largely depends on their interaction with the environment. For example, an e-commerce system can exist as long as the customers stick to the system and use it. Such organizations should have a customer-centered view in designing, improving and modifying their WISs to keep user loyalty. A WIS in the consumer electronics market, for instance, where success is achieved by customer's motivation to use it (Chen et al., 2008), must be assessed by taking customers' subjective perceptions into account. Different stakeholders may have different perceptions for a particular WIS. An experienced stakeholder may have higher expectations from a WIS and may not find particular characteristics successful and may switch to an alternative system that satisfies his/her expectations better.

The first step in the assessment process is measuring the success of each WIS relationship which eventually adds up to WIS success. For this purpose, WIS relationships, their importance for the organization and their stakeholders, are identified. In order to determine the measures that will be used in the success assessment of WIS relationships, a method based on the Goal-Question-Metric method (GQM) is applied. The GQM builds a connection between software goals; questions to be answered for each goal and metrics as answers to the questions (Mendonça and Basili, 2000). In order to check whether and how much the goals of the WIS relationship are satisfied, the level of the existence of the measures that are related to the goals of that WIS relationship are rated by system stakeholders through an interview with an IS specialist. Since the effect of WIS is experienced by the interacting parties in its environment, whether they are human or non-human, in order to determine if a WIS relationship satisfies its goals, the stakeholders interacting with that specific WIS relationship are asked to determine how much they think that relationship provides its expected influence based on the determined measures of the relationship. For this purpose, a questionnaire is prepared by converting each chosen measure into statements. Then stakeholders are asked the extent to which they agree with those statements based on 5-point Likert scale, 1 representing strongly disagree and 5 representing strongly agree. By converting stakeholder judgments into their corresponding ordinal value based on the Likert scale, which is then averaged over all respondent stakeholders with respect to the measure number for each WIS relationship, the questionnaire results are calculated as a numerical success value for each relationship. In this study, convenience sampling was used to decide on the participants. The questionnaires were posted on a website and the link was sent to the volunteers who were available for the study. Sample of respondents for the interview was selected according their dignity of IT and the company experiences. They were decision makers in their units and work at least five years in the company.

Since cases are selected from the same sector (financial sector) in the same market (Turkish markets), it is assumed that 1, 3 and 4 types of CSFs in Rockhart and Bullen's list are the same. Because of that, for the sake of simplicity, all necessary information is collected via interviews with managers at the same levels. Organizational CSFs are weighted by their importance for organization and used in calculation of total success of the organization. It means that a relation has more effect on the WIS success if it contributes to a more important CSF. Because of that, all relationship success values are needed to be calculated by their effects on each CSF. So, a WIS relationship calculation matrix is created. It contains all the elements representing how much each relationship affects an organization's CSFs. Thus, success of the WIS relationship can be

represented through its weighted importance values. Thus, success of the WIS relationship can contribute to organizational strategies through the importance of each weighted value. The total of those contributions from WIS relationships results in a success value for organization as shown in the following section. The assessment process follows the steps explained below (Figure 3).

- WIS Relationships are identified and measures are gathered for each WIS relationship
- Questionnaire is prepared
- Stakeholder responses are collected
- Organizational CSF's and related weights are collected
- WIS success is calculated using the data gathered

Assessment process is depicted in the Figure 3 below.

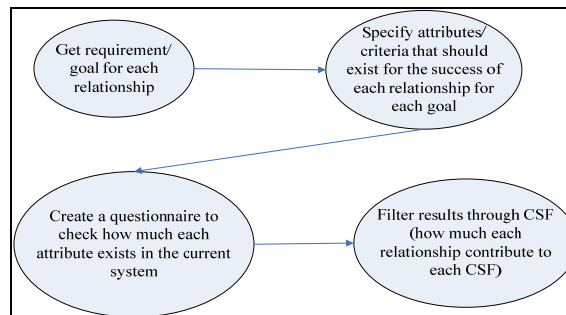


Figure 3: WIS success calculation process

The WIS assessment model based on organizational CSFs and WIS relationships will be called Strategy-based Evaluation of WIS Success-SEWISS framework.

Table 1: SEWISS success value calculation

			CSF1	CSF2	CSF3	CSF4	CSF5
CSF Importance			5	4	3	2	1
j	Relationships	R _j					
1	Rel1 (User-WIS)	4,1	4	9	9	10	7
2	Rel2 (Other Systems- WIS)	3,8	10	10	10	8	4
3	Rel3 (Organization - WIS)	3,7	10	10	10	4	4
Success for each CSF			91	112	112	86	59
Success for each CSF with priority			457	447	335	172	59
Total success for each CSF			1468				
Normalized SEWISS value			65%				

4. Application of SEWISS framework into the e-business environment

In this section, a case study is presented to illustrate the proposed framework. Organization A used in this case study is a leading e-commerce company selling various consumer products such as electronics, clothing, cosmetics, books, DVDs. They have been in business for almost 10 years. They have been awarded the best IT Company in the B2C category, among 500 IT companies in Turkey. Organization A has 156 employees, 10 of which work for the IT department and are responsible for development and maintenance of the B2C system. An interview was conducted with the Sales Manager who is also one of the three shareholders of the company. Three WIS relationships proposed by our framework exist in Organization A's WIS. Their related objectives are given in Table 2.

For each goal, attributes are collected in the interview which should exist in the relationship for the satisfaction of its goals. For Organization A, factors like delivery speed, problem solving speed, revenue target, daily visitors to new customer ratio, customer satisfaction, and product return rate are constantly monitored to check the problems of the WIS system which are kept confidential. The interview revealed that company

has five critical success factors as listed below according to their priority, which have different importance values for the company which supports the proposed model.

- CSF1. Correct Delivery
- CSF2. Increased Customer Satisfaction
- CSF3. Increased Revenue
- CSF4. Increased number of sold products
- CSF5. High revenue per bill ratio

Table 2: WIS relationship goals

Relationships	Goals
User-WIS	-easy to use -fast operations -understandable
Other Systems-WIS	-secure data exchange -fast
Organization-WIS	-easy reporting -correct financial reporting

The importance of CSFs and also the CSF rankings with respect to each relationship were gathered, which resulted in differences among them as shown in Table 1.

A questionnaire was prepared using attributes obtained from the interview, which was then sent to system users by email. 64% of the respondents were older than 30 years, 68% of which were males. 84% of them were at least university graduates. 73% of the respondents use the Internet continuously during the day, 40% of which use Internet shopping several times a year, 33% of them use online shopping several times a month. 65% of the respondents used online shopping within 1 month. 52% use the system to perform active transactions and 36% just to get information. 31% of the respondents use organization A Internet shopping several times a year, 27% accesses it several times every month and 21% connect continuously. For each questionnaire answer by the respondents, judgments were converted into a numerical value between 1 and 5 based on the Likert scale. WIS relationship success values (R_j) were obtained by considering each respondent's answers. These values were then filtered through CSFs using the WIS relationship weight matrix. Calculation details are given in Table 1. Considering different respondent profiles, SEWISS values were calculated as in Table 3 for Organization A.

Table 2: SEWISS values for organization A

Respondent Profile	SEWISS
all respondents	65%
Using Internet shopping several times a year	65%
Using Internet shopping several times a month	66%
Using Internet shopping continuously	61%
Using Internet continuously	66%
Using Organization A WIS several times a year	62%
Using Organization A WIS several times a month	69%

Similar approach has been applied to Organisation B, which is an e-commerce company selling various types of consumer goods. It has total of 50 employees, 15 of who work for the B2C WIS. Table 3 illustrates WIS Relationship Goals.

Table 3: WIS relationship goals

Relationship	Goals
User-WIS	-fast shopping -easy to search -no technical problems -user-friendly
Other systems-WIS	-fast data exchange -correct operations -easy to detect errors
Organization-WIS	-available functions -fast promotion definition -display correct customer information -enabling information update -deciding new products to be sold

Organization B has several CSFs, which were stated as “tightly connected” to each other, described below.

- CSF1. Increase sales
- CSF2. Increase customer quantity
- CSF3. Cheap product prices
- CSF4. Increase Product variety
- CSF5. Increase payment options

The questionnaire was prepared by using the measures obtained in the interview, which was rated by system users. 56% of the respondents were older than 30 years. 87% of them were at least university graduates. 81% of the respondents used Internet continuously during the day, 38% of whom used Internet shopping several times a year, 31% of them used online shopping several times a month. 63% of the respondents used online shopping within 1 month. 63% used the e-commerce system to perform active transactions and 38% just to get information. 50% of the respondents used Organization B’s Internet shopping several times a year, 19% accessed it several times every month and 7% connected continuously. Considering CSF weights, SEWISS value calculation is performed for Organization B (Table 4).

Table 4: SEWISS value calculation

		CSF1	CSF2	CSF3	CSF4	CSF5	
CSF Importance rankings(ri)		5	4	3	2	1	
j	Relationships	Rj					
1	Rel1 (User-WIS)	3,6	6	8	4	2	8
2	Rel2 (Other WIS- WIS)	3,4	8	6	2	8	1
3	Rel3 (Organization - WIS)	3,9	8	6	3	9	3
Success for each CSF (wij*Rj)		80	73	33	70	44	
Success for each CSF with priority(wij*Rj*ri)		401	291	99	139	44	
Total success for each CSF		974					
Normalized SEWISS value		43%					

Considering different respondent profiles, SEWISS values were calculated as in Table 5 for Organization B.

Table 5: SEWISS values for organization B

Respondent Profile	SEWISS
all respondents	43%
Using Internet shopping several times a year	44%
Using Internet shopping several times a month	44%
Using Internet shopping continuously	43%
Using Internet continuously	44%
Using Organization B WIS several times a year	46%
Using Organization B WIS several times a month	47%

In order to check the validity of the SEWISS success results, the concurrent validity approach has been employed which explores correlation between the instrument developed and other factors which could be related to the subject (Muijs, 2004). It allows comparisons of the instrument measurement items and known or accepted standard measures or criteria. For concurrent validity, some organizational characteristics were compared with the SEWISS results as shown in Table 6 below.

Table 6: Organization A and B properties

FACTORS	Organization A	Organization B
Age of the Organization	10	2
Number of employees	156	50
Revenue	\$150 million	\$10 million
SEWISS	65%	43%

Furthermore, Organization A was placed as 58th in the first 500 IT companies in a research conducted by Interpromedya in 2007 in Turkey. They were also awarded as the best IT Company in B2C category, in 500 IT companies in Turkey, which also supports the SEWISS results.

5. Conclusion

The proposed SEWISS framework encompasses both WIS and organization related aspects of the assessment. In this regard, the relationships of the WIS with its environment are taken into account as the first dimension of the assessment framework. The WIS success is evaluated in terms of its relationships with its users, other ISs, and the organization. As the second dimension, organizational CSFs are considered. The starting point is that if a WIS relationship measure interacts with a CSF, it adds value to the accomplishment of the specific CSF and therefore contributes to WIS success.

The proposed framework, SEWISS, is proposed as a generic framework for any type of WIS, for any organizational domain, whether it is in an e-business, e-government, e-learning or e-health system. The framework also allows organization specific assessment based on organizational CSFs and WIS Relationship measures for different domains.

Application of the framework has been illustrated in an e-commerce environment. The proposed framework dimensions, namely WIS relationships and CSFs, existed in the e-commerce system. Similarly, CSFs differed in their levels of importance to the organization; some were more important and crucial than the others, which supports the proposed framework. Validity of the proposed assessment framework has been shown with multiple case studies in different domains (Tokdemir, 2009). The present work aims to introduce the framework and to provide an illustration for its applicability. As a future study, the assessment framework can be applied to a higher number of e-commerce organizations to develop a domain-specific list of measures. Through the organizational life span, strategy and CSFs change. Therefore, organizations, with their own motivation, can apply the framework at different stages of their organizational life span, and observe improvement in their WISs at different organizational ages. Further applications and evaluation of the assessment framework are expected to enhance it, especially in popular WIS domains such as e-government as the subject of future research.

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Reflective Frameworks for Change Management

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Abstract: Financial Information Management Systems (FIMS) is a multidisciplinary field that includes contribution from computing and accounting disciplines. As computing has become ubiquitous, there is a greater demand for information from FIMS. To meet the increase in demand, the role of FIMS has changed significantly. To bring about changes, at the top level, strategies to set objectives and articulate institutional ambitions are formulated; next policies and processes to support strategies and staff development activities are devised; then at a practical and pragmatic level, individuals devise and utilise tactics that bring about or support change. In order to deliver quality professional development courses, instructors must actively update their knowledge of accounting systems and information technology as well as reflect on teaching techniques. Reflective capacity is regarded by many as an essential characteristic for professional competence. Yet little has been written about how experienced instructors reflect on their practices and how they apply their reflections to develop staff and support management in implementing change. In this paper, through a case study at a research-intensive Australian university, we discuss (1) strategies for change, reflective practices and action-research, Constructivist theory, Cognitive Load theory, Bloom's Revised Taxonomy, and their relevance to staff training (2) the 9-C Model of change management: *Capacity building, Champions of change, Collaboration, Communication, Coherence-making, Communities, Culture for learning and evaluation, Curriculum development and Continuous improvement*, (3) a framework for reflective practices, the Five-dimensional Reflective Cycle Framework (5DRCF): *Describe, Analyse, Transform, Act and Evaluate*, (4) the application of the 9-C Model and the 5DRCF in assisting managers to work through the complexity of leading and managing the change in FIMS and (5) reflection on our strategies in applying the 9-C Model and the 5DRCF. Our case study demonstrates how we employ the Bloom's Revised Taxonomy, the Cognitive Load theory and the 5DRCF to design and deliver FIMS courses that can assist instructors to teach FIMS in a way that enhances participant's abilities to make meaning of the change and to build staff capabilities. Our paper provides evidences that the 9-C Model and the 5DRCF is an effective reflective framework for change management.

Keywords: reflective practices, reflective frameworks, change management, staff development activities, organisational learning

1. Introduction

Financial Information Management Systems (FIMS) or Accounting Information Systems (AIS) is a multidisciplinary field that includes contribution from computing and accounting disciplines (Grabski, Leech and Schmidt, 2011). As computing has become ubiquitous, there is a greater demand for information from FIMS/AIS (Belfo and Trigo, 2013). To meet the increase in demand, the role of FIMS/AIS has changed significantly (Daoud and Triki, 2013; Grabski et al., 2011). In order to deliver quality professional development courses, instructors must actively update their knowledge of accounting systems and information technology as well as reflect on teaching techniques. Reflective capacity is regarded by many as an essential characteristic for professional competence (Schön, 1983; Balzert, Fettke and Loos, 2012). In this paper we explore the questions: how experienced instructors reflect on their practices and how they apply their reflections to develop staff and support management in implementing changes?

The rest of the paper is organised as follows. After a literature review, we discuss the 9-C Model of change management: *Capacity building, Champions of change, Collaboration, Communication, Coherence-making, Communities, Culture for learning and evaluation, Curriculum development and Continuous improvement*. We introduce a framework for reflective practices, the Five-dimensional Reflective Cycle Framework (5DRCF): *Describe, Analyse, Transform, Act and Evaluate*. We present our application of the 9-C Model and the 5DRCF in assisting managers to work through the complexity of leading and managing the change in FIMS and reflection on our case study.

2. Literature review

To bring about change, at the top level, strategies to set objectives and articulate institutional ambitions are formulated; next policies and processes to support strategies and staff development activities are devised; then at a practical and pragmatic level, individuals devise and utilise tactics that bring about or support change (White, 2007). To choose strategies for change, Kotter and Schlesinger (2008) advise managers to conduct an

organisational analysis to identify problems such as who might resist the change and why; based on the analysis, managers can then decide on the speed of change, the degree of plan and involvement required. Grabski et al., (2011) reviewed major accounting-related themes across Enterprise Resource Planning (ERP) topics and noted that '*Change management practice has long incorporated the need for education because it addresses both knowledge acquisition and behavioural change*'. Knowledge acquisition that leads to behavioural changes requires reflection (Gray, 2007). Balzert et al. (2012) present a case for the need of continuous professional development and real-time learning; they combine reflection and Business Process Management (BPM) to present a five-phase cycle framework: Strategy development, Design, Implementation, Execution and Monitoring, and Controlling and Improvement. For each of these five phases, Balzert et al. (2012) discuss possibilities and potentials for reflection, and provide brief comments on the purpose of reflection, reflective process, outcome of reflection, reflection level, time dimension and an indication of the approach.

The importance of reflection is noted in the literature (Schön, 1983; Cowan, 2014). The reflective professional '*may reflect on the tacit norms and appreciations which underlie a judgment, or on the strategies and theories implicit in a pattern of behaviour*' (Schön, 1983, p. 62). Schön (1983) introduced the terms 'reflection-in-action' and 'reflection-on-action'. He describes reflection-in-action as 'thinking on our feet', the thinking and reflecting that happens in the midst of activity and, reflection-on-action as the thinking and reflecting that occurs after an event. There are different levels of depth in reflections. Van-Manen (1991) distinguishes four levels of reflection: 1- reflection on everyday thinking and acting in ordinary life; 2- specific reflection on incidents or events; 3- systematic reflection on own experience and 4- reflection about the way a person reflects. Balzert et al. (2012) discuss time dimensions of reflection: anticipatory, contemporaneous and retrospective reflection and distinguish two types of approach to BPM: a top-down approach through management directives and a bottom-up approach through self-development of the individual employee's learning process. Reflective journals are widely used as a tool to assist critical reflection and unearth tacit knowledge; matters that are worthy of attention to reflective journal writers are: 1- selectively describing, 2- examining from multiple perspectives; 3- self-challenging and openness to new insights; 4- forward planning and 5- meta-cognitive self-review (Cowan, 2014).

Reflective practice requires creating awareness and understanding in order to improve a certain practice (Mahani and Molki, 2012). Action-research is when instructors perform research on themselves and their participants for the purpose of improving teaching and learning (Carlo, Hinkhouse and Isbell, 2010). Action-research involves changing the teaching practice using whatever on-the-ground evidences that the teacher can obtain and can be put into the right action (Biggs and Tang 2011, p.51). Constructivist learning theory states that learning is an active process of creating meaning from experiences based on the learner's current or past knowledge (Denton, 2012). Active learning with technology and real-world applications enhances students' learning abilities (Ragan et al., 2006). Learners interpret concepts and principles in terms of the 'schemata' that they have already developed (Biggs et al. 2011, p.22). The interpretation of concepts adds to learners' cognitive load. The cognitive load can be high when students are doing a task in a new domain as they have to learn new skills while performing the task. Cognitive Load Theory (CLT) states that human memory consists of sensory memory, working memory, where schemas are generated during learning, and long-term memory where knowledge is stored in the form of schemas (Sweller, Merrienboer and Paas 1998). To overcome the limitations of working memory, schemas which help to systematically store and access information are created during the learning process (Sweller et al., 1998). A well designed instructional material presents the new information such that the schema generation is within the working memory of a learner (Sweller et al., 1998). Bloom's Revised Taxonomy incorporates the Knowledge Dimension and the Cognitive Process Dimension; the Knowledge dimension consists of *Factual, Conceptual, Procedural* and *Meta-cognitive* knowledge. The Cognitive Process Dimension, which refers to learning processes, is grouped into six categories: *Remember, Understanding, Apply, Analyse, Evaluate* and *Create*; with *Remember* being the least complex and *Create* being the highest rung of the Cognitive Process (Anderson and Krathwol 2001).

3. The 9-C model of change management

Drawing on the literature and our experiences, we propose a 9-C Model to assist managers and leaders in leading and managing change. The 9-C Model consists of nine interrelated factors: *Capacity building, Champions of change, Collaboration, Communication, Coherence-making, Communities, Culture for learning and evaluation, Curriculum development* and *Continuous improvement*.

Capacity building: Capacity building provides the 'conditions, opportunities and experiences for collaboration and mutual learning' (Harris, 2001). To build capacity, policies, strategies, resources and actions must be designed to increase people's collective power to '*accomplish greater achievement through new knowledge, skills and dispositions, enhanced resources, and increased motivation and commitment*' (Chapman and Fullan, 2007). An example of capacity building is to build staff capabilities.

Champions of change: Champions of change are people who actively promote the innovation, build support, overcome resistance and ensure that the innovation is implemented (Howell and Higgins, 1990). At Macquarie University, Breakfast of Champions was held to welcome early adopters and to provide networking opportunities for them and, to encourage them to spread the good word about their discoveries of the new system (McNeil et al. 2012).

Collaboration: Collaboration occurs when a group of people have a shared goal that cannot be reached by any group member alone (Stohl and Walker, 2002). Collaboration is critically important for capacity building (Harris, 2001).

Communication: Communicating the need for and the logic of a change is an effective way of dealing with resistance when there is a good relationship between initiators and resisters (Kotter et al., 2008). Communication during implementation is far more important than communication prior to implementation because communication in the abstract, in the absence of action, means almost nothing (Fullan, 2011a).

Coherence-making: Coherence-making helps groups gain shared clarity and shared commitment (Fullan, 2011a). Increasing collective capacity is a coherence-maker; when people become better at something they become clearer and more committed (Chapman and Fullan, 2007). Good leadership requires the process of making meaning out of the change; once people start to make meaning of the change and it has coherence, new patterns may emerge (Fullan, 2011b).

Communities: One of the powerful drivers of change involves learning from peers (Fullan, Cuttress and Kilcher, 2005). Community builds and preserves new knowledge; at Oxford Brookes University, a community of practice of learning technologies emerged; they were '*effective brokers of e-learning practice and agents of change*' (Sharpe, Benfield and Francis, 2006). The more employees gain understandings and skills in embracing the change, the less they resist it (Kotter et al., 2008).

Culture for learning and evaluation: '*A culture for learning involves a set of strategies designed for people to learn from each other and become collectively committed to improvement*' (Fullan et al., 2005). Evaluation helps leaders to monitor the implementation processes, to gauge their success and, to identify and resolve issues in a timely fashion. '*When schools increase their collective capacity to engage in ongoing assessment for learning they achieve major improvements*' (Fullan et al. 2005).

Curriculum development: Constructivism's perspectives on the role of the individual, on the importance of meaning-making, and on the active role of the learner have had great impact on instruction and curriculum design (Jones and Brader-Araje, 2002).

Continuous improvement: Continuous improvement is the key to create effective and lasting change; it helps people to understand the change process (Fullan et al. 2005).

4. The five-dimensional reflective cycle framework

Drawing on the literature and our experiences, we have developed the 5DRCF to facilitate reflective practice (Tran and Anvari, 2013, p.248). The reflective cycle consists of five dimensions: *Describe, Analyse, Transform, Act, and Evaluate*. The five dimensions are independent as illustrated in the star. Any dimension can provide the initial catalyst for reflective cycle to start and some issues may not involve all dimensions. However in most cases they start at the *Describe* dimension and are followed in a cycle as illustrated in figure 1.

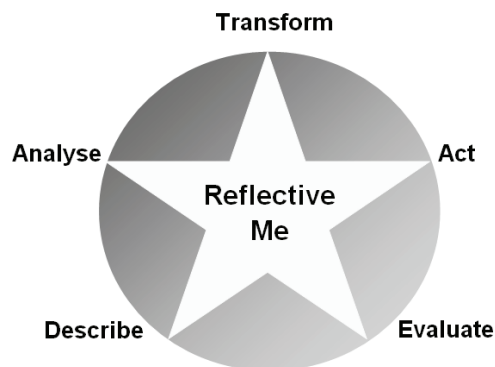


Figure 1: The five-dimensional reflective cycle framework

Describe the process or the issue requiring reflection. Issues are selectively described, including feelings at the time (Cowan, 2014).

Analyse the process or the issue. Moon (1999) defines this dimension as ‘a mental process with purpose and/or outcome in which manipulation of meaning is applied to relatively complicated or unstructured ideas in learning or to problems for which there is no obvious solution’ (p. 155).

Transform: It is important to examine the issues from multiple perspectives and be open to new insights (Cowan, 2014). This dimension requires action-research (Mahani and Molki, 2012), reflect-on-action (Schön, 1983) and forward planning (Cowan, 2014).

Act on issues.

Evaluate whether the instructors’ actions indeed enhances learning experiences of the participants and, to monitor the instructors’ actions to gauge their success (Tran et al., 2013, p.248).

To improve processes and find solution to issues, each of the above five-dimensional processes is repeated.

5. The application of the 9-C model and the 5DRCF

At a research-intensive Australian University, the lead author has been responsible for designing FIMS courses for professional staff since 2007. FIMS has changed significantly and the lead author has been assisting managers to work through the complexity of leading and managing changes in FIMS. She has been keeping reflective diaries, journals and notes in which she analyses theories and methodologies, records action-research findings and reflection.

5.1 Describe

Instructors should selectively describe processes as irrelevant materials can clutter up subsequent stages in the reflection (Cowan, 2014). Reflective questions are used to guide reflection (Cowan, 2014; Moon, 1999). The lead author has developed the following reflective questions against each of the 9-C factors:

- *Capacity building:* What are the resources and processes to support staff development activities and organisational learning?
- *Champions of Change:* Who are the champions of change? How do they learn best? What topics should be covered for them?
- *Collaboration:* What strategies have been formulated to collaborate with others?
- *Communication:* How can FIMS courses convey the purposes of change?
- *Coherence-making:* How can FIMS courses assist staff to make meaning of the change and how can course materials have coherence?
- *Communities:* What are the needs of the communities? What are the differential scenarios for various communities?

- *Culture for learning and evaluation*: What are the resources to encourage a culture for learning and evaluation of FIMS?
- *Curriculum development*: How can FIMS courses promote critical thinking among staff and to enhance their abilities to make meaning of the change?
- *Continuous improvement*: What actions are required to encourage continuous improvement?

5.2 Analyse

Examples of the 9-C factors in the *Analyse* dimension are:

- *Capacity building*: Analyse and formulate a method to increase staff capabilities in FIMS.
- *Champions of Change*: Survey champions of change's needs and prior-knowledge.
- *Collaboration*: Research and analyse lessons learnt from past experiences and draft a plan to resolve potential issues.
- *Communication*: Investigate, select and classify materials to include in FIMS workshops to convey the purposes of change and use real-life scenarios to demonstrate how new processes work.
- *Coherence-making*: Analyse and update coherent procedures and integrate them with FIMS courses.
- *Communities*: Analyse and differentiate the needs of a diverse group of communities.
- *Culture for learning and evaluation*: Research and recommend procedures and policies to promote a culture for learning and evaluation of FIMS.
- *Curriculum development*: Analyse Bloom's revised Taxonomy (Anderson et al., 2001), the Cognitive Load Theory (Sweller et al., 1998) and the reflective concepts and, employ them to design course materials that encourage critical thinking from participants.
- *Continuous improvement*: Formulate continuous improvement strategies and resources. Prepare an action plan.

5.3 Transform

Examples of the 9-C factors in the *Transform* dimension are:

- *Capacity building*: Conduct literature review and attend seminars and courses on how to increase staff and organisation learning capabilities.
- *Champions of Change*: Create worked-examples to evaluate the various processes needed by champions of change in the context of change.
- *Collaboration*: Reflect on working relationships with Informatics and other staff to manage technological changes and develop an action plan.
- *Communication*: Research on how to communicate change to participants via FIMS Courses.
- *Coherence-making*: Design FIMS courses that have coherence and forward planning.
- *Communities*: Reflect-on-action and reflect-for-action alternative scenarios that meet the needs of various communities.
- *Culture for learning and evaluation*: Develop the Learning Outcomes based on Bloom's revised Taxonomy. Examine the PEER Review of Learning and Teaching model which consists of reflective questions Why; What; Who; How; Reporting; and Follow up. Design survey questions under five headings: Planning and organisation; Documentations and contents; Training strategies and resources; Presentation and management; Feedback and follow up of participants (Tran et al., 2013). Users of computing system wish to achieve higher goals than just interact with the system (Cronholm and Bruno, 2009). Based on the literature and action-research we have developed the E-USABLE framework. E-USABLE has 'seven categories: *Effective to use (effectiveness)* e.g. *how effective the application documents can convey the business processes to the users; have good Utility (utility)* e.g. *do FIMS documents contain worked-examples that assist users to achieve business goals; Safe to use/prevent possible errors (safety); can the data entries be Audited (audit-ability); do User Interfaces provide feedBack (feedback); is the application easy to Learn (learn-ability) and Efficient to use (efficiency)*' (Anvari and Tran, 2013, p.39).

- *Curriculum development:* Develop curriculum to ‘*promote cognition, computation, problem solving, analysis, critical thinking, and decision making skills*’ (Robles, 2012). The cognitive load on participants are considered, in particular the participants’ expectations and prior knowledge; worked-examples and scenarios as the modelling technique are developed; training documents are illustrated with pictures and descriptions of real-world scenarios.
- *Continuous improvement:* Reflective instructors continuously learn about themselves to improve their teaching techniques. In our experiences, continuous improvement nurtures innovativeness and helps staff to deal with the demands of evolving change. Action plans are developed and reflected upon.

5.4 Act

Examples of the 9-C factors in the *act* dimension are:

- *Capacity building:* FIMS courses are designed with worked-examples that help a diverse group of staff to make meaning out of the change and identify new patterns. Active learning approach is used to teach procedural and meta-cognitive knowledge.
- *Champions of Change:* Advanced and specialised FIMS workshops are conducted for champions of change.
- *Collaboration:* Informatics staff and external vendors are collaborated with finance staff.
- *Communication:* Scenarios as worked-examples are used to illustrate new processes and assist staff in making meaning out of the change.
- *Coherence-making:* FIMS workshops build staff confidence and help participants gain shared clarity and shared commitment.
- *Communities:* Communities’ various needs are addressed. Multiple perspectives are covered.
- *Culture for learning and evaluation:* Based on the analysis of the Bloom’s revised Taxonomy and the E-USABLE framework, we have devised the three-dimensional framework to self-evaluate whether FIMS courses effectively taking a diverse group of users into considerations; the three dimensions are Knowledge, Cognitive Process and E-USABLE (Anvari et al., 2013).
- *Curriculum development:* Participants learn at the higher rung of the cognitive process dimension when they apply, analyse and evaluate business processes and create new ones to suit their own work environment. All participants have access to the university financial system to practice; they actively learn during workshops then independently practise worked-examples documented in the course materials; by solving real-life problems they gain procedural and meta-cognitive knowledge. (Tran et al., 2013).
- *Continuous improvement:* FIMS courses have been running fortnightly since 2007 and have been continuously improved to meet objectives at the business processes levels and to increase staff capabilities.

5.5 Evaluate

Examples of the 9-C factors in the *evaluate* dimension are:

- *Capacity building:* Participants confidently use the university’s FIMS after attending FIMS courses.
- *Champions of Change:* Champions of change provide positive feedbacks.
- *Collaboration:* The lead author works collaboratively and collegially with professional staff in Informatics office as well as academic staff at the Learning and Teaching Centre.
- *Communication:* Survey results show that scenarios and worked-examples communicate new processes and assist staff in making meaning out of the change.
- *Coherence-making:* Participants praise FIMS documents.
- *Communities:* FIMS users have almost tripled over the past two years.
- *Culture for learning and evaluation:* Managers send new staff to FIMS courses. Participants’ feedback and surveys confirm the benefits listed by Falchikov and Thompson (2008): empowering learners; encouraging attention; creating partnerships; fostering proactive strategies in instructors and participants; reflection; enhancement of learning; performance; personal development/autonomy (Tran et al., 2013).

- *Curriculum development:* We employ the three-dimensional framework (Knowledge, Cognitive Process and E-USABLE) for self-evaluation of the effectiveness of course materials to meet the objectives at the business processes levels and increase collective capacity.
- *Continuous improvement:* We are committed to continuous improvement to enhance our experiences.

We repeat the five-dimensional processes continuously to improve FIMS courses. In our case we reflect more often on *Coherence-making, Culture for learning and evaluation* and *Curriculum development* factors than the other C factors.

6. Reflection on our case study

We have presented the application of the reflective frameworks, the 9-C Model and the 5DRCF, to assist managers to lead and manage change in FIMS through staff developments. However, the proposed reflective frameworks can be applied to other domains. The 5DRCF can assist software engineers in designing new applications and in documenting the reflective processes (Anvari and Tran, 2014). We speculate that the reflective frameworks can be used to facilitate reflection among managers and staff when major organisational and technological changes are taking place e.g. BPM, ERP, e-learning implementation. For example in BPM where *'efforts are focused on the continuous transformation and improvement of business processes'* (Balzert et al., 2012, p.3645), each of the five dimensions is acted on using the 9-C factors for every identified business process (figure 2).

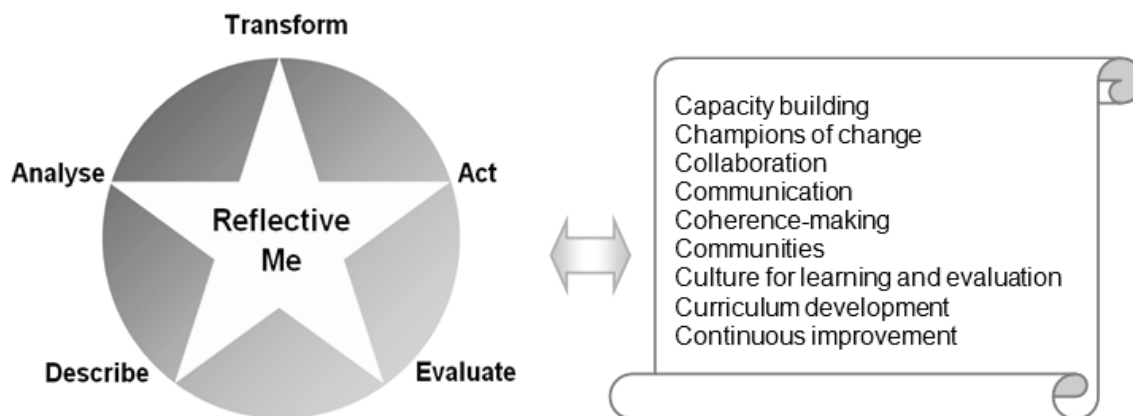


Figure 2: The five-dimensional reflective framework for change management

Describe: Reflection *'should entail sustained questioning and especially self-questioning'* (Cowan, 2014, p.64). The 9-C factors can assist instructors to frame sustaining questions that can guide reflection on BPM, ERP and e-learning implementation. These questions keep instructors focus on business processes that are important to the organisation.

Analyse: Sustaining questions provide a structure for reflective practitioners to analyse multiple perspectives (Cowan, 2014) and to determine levels of reflection e.g. specific reflection on events or systematic reflection on own experience (Van-Manen, 1991). The 9-C factors can provide a framework for instructors to analyse multiple perspectives e.g. how to collaborate with others to improve business processes that are support by the champions of changes and are acceptable by various communities.

Transform: An instructor reflects *'on the way in which he has framed the problem he is trying to solve, or on the role he has constructed for himself within a larger institutional context'* (Schön, 1983, p. 62). The 9-C factors provide a framework for instructors to conduct action-research on areas that are important to the organisation and are subject to change. Based on the 9-C factors and the requirements for change, instructors decide on top-down or bottom-up approach and reflect on how to carry them forward.

Act: When instructors act on issues that have been framed, analysed and transformed by specific reflective questions related to business processes, participants gain procedural and meta-cognitive knowledge that are applicable in the new environment, hence they are encouraged to embrace the change. The design of training courses must have coherence and forward planning. Worked-examples, that consider the needs of champions

of change and the various communities, help a diverse group of staff to make meaning out of the change and identify new patterns.

Evaluate: Evaluation helps leaders to monitor the implementation processes, to gauge their success and, to identify and resolve issues in a timely fashion. The instructor '*may reflect on the feeling for a situation which has led him to adopt a particular course of action*' (Schön, 1983, p. 62). The 9-C factors provide a framework for instructors to develop an internal voice that can enable them to evaluate the quality and nature of their business processes.

Reflective practitioners improve their professional skills based on their on-going reflection with respect to their performance during and after the accomplishment of a process of creation (Schön, 1983) and by reflecting about the way they reflect (Van-Manen, 1991).

7. Conclusions

Our case study provides insight into the application of constructivist theory, action-research and reflective practice strategies in managing change. It highlights the importance of reflection in staff development activities and in supporting management to implement change. To assist managers to work through the complexity of leading and managing the changing technological landscape of FIMS, we have used the 9-C Model which consists of nine interrelated factors: *Capacity building, Champions of change, Collaboration, Communication, Coherence-making, Communities, Culture for learning and evaluation, Curriculum development and Continuous improvement*. We provided evidence that the 9-C Model and the 5DRCF are effective reflective frameworks for change management. The E-USABLE framework, the Peer model and reflective questions are tools that can assist instructors to reflect. The CLT and the Bloom's Revised Taxonomy can help instructors to design course materials that assist learners to absorb new information. We argued that the proposed reflective frameworks can assist instructors to design ERP, BPM and e-learning courses that enhance participants' abilities to make meaning of the change and to build staff capabilities.

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Questioning the Questionnaire: Expediency of Reviewing and Publication Versus Adequate Description and Methodological Justification

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Abstract: The questionnaire is one of the fundamental research instruments in the field of Information Technology and Information Systems research. The survey as data capturing method with the questionnaire as data capturing tool is used in various research designs. The wide-ranging application field of the questionnaire as research instrument has led to varied practices in conducting and reporting questionnaire driven research. Standards of quality vary along with the assumptions underlying different philosophical traditions. Considering the ontological and methodological differences between paradigms the transfer of methods and tools between paradigms can introduce deviations in accepted practices. This raises questions about the critical constraints on using the questionnaire as research tool. The present study investigates issues related to the rigor of survey based research reporting. Precisely, it evaluates questionnaire-driven research reporting and then seeks to determine the reasons for deviating from accepted reporting practices such as providing access to the questionnaire. To fulfil this objective, the research design entails document analysis of papers presented at a leading South African Computer Science and Information Systems conference over a six-year period (2008 to 2013). The analyses sought to identify trends in the reporting of the questionnaire design. The survey-driven studies were identified from the proceedings and the reporting practice was analyzed. The specific conference was selected since it is a reputable annual conference in the South African IT/IS field. The analysis revealed that the questionnaire was made available in less than one third of the survey-based articles on average. Having found a definite trend towards omitting the questionnaire, an short survey was conducted with 12 well-published researchers to get their opinion on including the questionnaire and also to uncover the underlying reasons for the omission practice. Reporting practices impact the rigor of any research since rigorous research needs to be done and rigorous research needs to be seen to be done. The non-reporting practice affects the quality of the findings measured in terms of reliability and validity for quantitative research and in terms of trustworthiness, confirmability, and consistency for qualitative research; therefore it is important to question why this practice prevails. The contribution of the study is to highlight a practice of not providing the questionnaire as research instrument and provides some reasons why the practice prevails. This investigation is meant to open a larger debate on the governance of reporting practices. The paper should be of interest to researchers that use surveys and consume survey based findings as well as reviewers, editors and academic conference chairpersons.

Keywords: questionnaire, rigor, repeatability, trustworthiness, survey

1. Introduction

Surveys are one of the most commonly used research methods across all fields of research (Lazar and Feng 2010). Survey research provides a quantitative description of trends, attitudes and opinions of a population by studying a sample of that population (Creswell 2009). The terms ‘surveys’ and ‘questionnaires’ are sometimes used interchangeably, but to be more concise the term survey refers to the technique or method used (Creswell 2009) whereas the term questionnaire relates to the actual list of questions (Oates 2006). This study was triggered when the author was interested in repeating a specific study and could not find the questionnaire or any of the questionnaires relating to that strain of information systems research in the papers. The questionnaire may be obtained by asking the author but since reviews are normally double-blind the reviewers do not have that option. Therefore the omission of the questionnaire implies that the findings were judged without having considered the research tool – and that impacts the rigor of the findings.

Research should be rigorous and relevant (Golafshani 2003 ; Oates 2006; Creswell 2009). In Information Systems and Computer science rigor encompasses both systematic conduct and validity where validity means that ‘an appropriate process has been used, the findings do indeed come from the data and they do answer the research question(s) (Oates 2006) :10. Therefore vagueness and obfuscation does not support the rigor expected of Information Systems and Computer science research. The aim of this study was to find how prevalent the non-reporting of questionnaires were, and if there was indeed such a trend, to investigate the reasons behind it. To fulfil this objective, a leading South African Computer Science and Information Systems conferences was chosen as the unit of analysis and the data was captured over a six-year period (2008 to 2013). The standard is evident from the fact that the SAICSIT proceedings is published in the ACM’s International Conference Proceedings Series (ICPS), and is available online in the ACM Digital Library. The

analysis of the articles in the six proceedings showed a trend towards non-reporting of questionnaires. To gain some insight into the reasons for this practice a follow-up investigation was done with 12 well-published academics of whom seven had published in the specific conference. The research design therefore includes document analysis and a survey. The findings from the document analysis confirm a trend of non-reporting of the questionnaire as research tool and the survey provides some insights into this behavior despite the fact that none of the participants in the survey condoned the omission of the questionnaire.

2. Literature

The literature background for this research is the questionnaire as research instrument as briefly discussed in section 2.1 to make the argument that questionnaire design is not trivial and needs to be evaluated as integral part of the research design. Questionnaire adoption and use display similarities with technology adoption, the similarities and the implications thereof are discussed in section 2.2.

2.1 Questionnaire as research instrument

A questionnaire is a purposely defined, structured and well-written set of questions to which an individual is asked to respond. Surveys using questionnaires as data-capturing instruments may look easy, but inferior data, erroneous conclusions and costly mistakes are the results of underestimating the complexity of surveys (Mouton 2001). Olivier (2004) identifies three aspects of surveys that often contain pitfalls: sampling the data, designing the questionnaire and applying the results. Oates (2006) supports the importance of questionnaire design by stating that the quality of the information obtained by a questionnaire is directly proportional to the quality of the questionnaire design. Leung (Leung 2001) highlights the importance of clarifying the dependent, independent and confounding variables in order to ensure that the right questions are asked. Furthermore, the questions should be asked right, that means appropriate wording of the individual questions where he identifies various pitfalls (Leung 2001). Research on questionnaire design is mature and many guidelines are available for regulating content, organisation, clarity, conciseness and style (Mouton 2001). Therefore further discussion of questionnaire design guidelines is beyond the scope of this study but the complexities relating to questionnaire design are mentioned to make the argument that questionnaire design is not trivial and therefore questionnaire should be evaluated as part of the quality assurance on survey based research.

Quality in *quantitative* research is evaluated from the perspective of *explaining* something while *qualitative* findings are aimed at *understanding* (Golafshani 2003) and that has implications for the research methodology. Quantitative researchers seek causal determination, prediction, and generalization of findings while qualitative researchers seek illumination, understanding, and extrapolation to similar situations (Golafshani 2003). Therefore the purpose, methodologies and the role of the researchers in quantitative research is different from that in qualitative research. A previous study into questionnaire reporting (Van Biljon 2011) investigated whether the fundamental differences between the positivist and interpretivist paradigms could be the reason behind the varying reporting practices. Besides importance, quantitative findings are judged in terms of reliability (potential replicability) and validity (Golafshani 2003; Field and Hole 2005) while qualitative findings are judged in terms of credibility, transferability, and trustworthiness (Golafshani 2003). However, despite the philosophical differences scientific progress is guided by peer evaluation and therefore research practices should be transparent and clearly described, regardless of the paradigm (Van Biljon 2011). This paper aims to extend van Biljon's (2011) study by establishing if the questionnaire non-reporting practice is still prevalent and if so, investigate what the reasons could be.

2.2 Factors that influence technology adoption

Human behavior is goal-seeking and actions are directly controlled by intentions. Behavior prediction studies lie at the center of technology adoption research; the theory of reasoned action (TRA) (Ajzen 1985) and the Technology Adoption model (TAM) (Davis 1989; Davis 1993) which is based on the TRA represent some of the theorizations in technology adoption research. TAM is a behavioral model that represents how users come to accept and use a technology (Davis 1989). The model suggests that when users are presented with a new technology, a number of factors influence their decision about how and when they will use it as depicted in Figure 1, in particular:

- Perceived usefulness - this was defined by Davis as 'the degree to which a person believes that using a particular system would enhance his or her job performance'.

- Perceived ease-of-use - this was defined by Davis as 'the degree to which a person believes that using a particular system would be free from effort' [8].

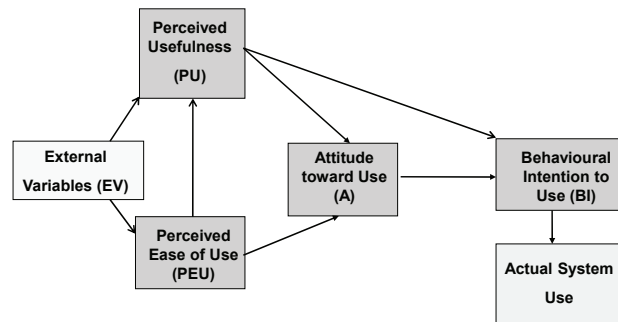


Figure 1: Technology adoption model (Davis 1989)

A review of technology adoption models is beyond the scope of this paper but Visser (2011) provides a useful comparison on the origin and contributions of the most important models. Similar to technology, the adoption of the questionnaire as research tool is influenced by perceived usefulness and other variables. Technology adoption is also described in terms of phases where people move through various adoption phases. The questionnaire is a tool that is used in a specific way, like other and therefore there are similarities in the process of adopting it partially, fully or not at all. Besides the decision to adopt a tool there is also the diffusion of the innovation for which Rogers (2003) proposed the following stages:

- the knowledge phase where the person gets to know about the product;
- the persuasion phase where he or she becomes persuaded of a need for the product;
- the decision phase which leads to a purchase;
- the implementation phase where the item is used; and,
- the confirmation phase where the individual seeks to confirm that he or she made the right decision in purchasing the product (Rogers 2003).

To use a questionnaire as tool in survey based research, the researcher needs to become convinced of the need for doing a survey and this is followed by the need to find an appropriate questionnaire. If an appropriate questionnaire cannot be found then the researcher may consider designing a questionnaire. Whichever way, the implementation and confirmation phases remain relevant to the adoption process. Silverstone and Haddon (1996) proposed the domestication of technology as a concept used to describe and analyze the processes of acceptance, rejection and use. Users are seen as social entities and the model aims to provide a framework for understanding how technology innovations change, and are changed, by their social contexts. The domestication of technology model consists of the following phases (Silverstone and Haddon 1996):

- Appropriation: the process of possession or ownership of the artefact.
- Objectification: the process of determining roles product will play.
- Incorporation: the process of interacting with a product.
- Conversion: the process of converting to intended future use or interaction.

Again considering the questionnaire as tool in survey based research, the researcher goes through the phases of appropriation, objectification, incorporation and possibly conversion when a questionnaire needs to be changed to suit the objectives of the study. The similarities in the process of technology adoption and questionnaire choice and application are clear. Therefore these technology adoption models are considered useful in understanding and interpreting the findings on the researchers' behavior in using questionnaires as discussed in section 4.2.

3. Research design

The investigation now looks at questionnaire design reporting in the field of Computing. Computing refers to any goal-oriented activity requiring, benefiting from, or creating computers (ACM/IEEE 2005). Computer Science and Information Systems are both classified under the umbrella definition computing but can be differentiated as follows:

- Computer science is the study of the theoretical foundations of information and computation and of practical techniques for their implementation and application in computer systems (Denning and Comer 1989). Computer Scientists invent algorithmic processes that create, describe, and transform information and formulate suitable abstractions to design and model complex systems.
- Information Systems developed out of the need to bridge the gap between business management and Computer Science towards an evolving new scientific area of study (Hoganson 2001). Information systems are implemented within an organization for the purpose of improving the effectiveness and efficiency of that organization (Silver and Markus 1995). The capabilities of the information system and characteristics of the organization, the work systems, people, and development and implementation methodologies together determine the extent to which that purpose will be achieved.

The conference proceedings of the South African Institute for Computer Scientists and Information Technologists (SAICSIT) was chosen for the document analysis as it is a reputable conference that attracts a wide audience of Computer Scientists and Information Technologists from across South Africa, Africa and even internationally. Section 3.1 provides more detail about the context and the research published at SAICSIT and Section 3.2 explains the document analysis procedure followed.

3.1 Context

Given the combination of Computer Science and Information Systems research the research approaches include qualitative, quantitative and mixed-methods research. The conference is held annually and the proceedings of six consecutive years (2008 to 2013) were analysed. SAICSIT uses a diversity of reviewers to ensure the stated aim of being internationally competitive as well as relevant to South African and African needs (Co-Chairs 2010). On average the accepted papers received between 3 and 4 reviews each (Co-Chairs 2010); this standard of a rigorous doubleblind reviewing process has been consistently followed as evident from the message from the Programme Chairs for SAICSIT proceedings 2013 (Co-Chairs 2013) and the acceptance rates depicted in Table 1.

Table 1: SAICSIT conference acceptance rates 2008 - 2013

Year	Number of papers accepted	Acceptance rate
2008	33	41%
2009	23	45%
2010	37	37%
2011	49	33%
2012	42	35%
2013	48	54%

Over the six year period the paper acceptance rate varied between 33% and 54% with an average of 40.8%. This acceptance rate attests to the popularity and high standard of the conference. The following universities and institutions were represented in the SAICSIT proceedings analyzed: Council for Scientific and Industrial Research; Nelson Mandela Metropolitan University; University of Cape Town; University of the Western Cape; Rhodes University; University of Fort Hare; University of the Witwatersrand; Tshwane University of Technology; University of South Africa; North-West University, University of the Free State and the University of Pretoria. The wide coverage of South African research institutions bears evidence that SAICSIT is a representative conference of the South African research landscape in Computer Science and Information Systems research. The research philosophies include positivist, interpretive and critical approaches, using quantitative, qualitative and mixed methods research with the associated range of data-collection methods. The data-capturing methods include observation, recordings, interviews, surveys and the use of secondary data. Evaluation attributes or criteria considered in the present review focus on, the number of questionnaire driven studies reported, the number of standardized questionnaires used and the questionnaire reporting practice.

3.2 Analysis procedure

To investigate the reporting of questionnaire-related information, document analysis was done on the SAICSIT proceedings of 2008 to 2013. The proceedings were analyzed by electronically searching the full research papers for the words *survey* and *questionnaire*. The analyses were done independently by two researchers and the results were compared and consolidated after checking the differences. A paper could include the term *questionnaire* without involving questionnaires in data-capturing so only the papers on research that used a

questionnaire as data capturing tool were selected. The studies where questionnaires were used were then reviewed for providing information that made it possible to evaluate the questionnaire. This meant providing the actual questionnaire, an electronic link to the questionnaire or the name of the questionnaire in the case of standardized questionnaires. To preserve anonymity the actual titles of the articles cannot be published but most studies involve the testing of an information system in a specific context with a specific user group. A possible limitation is that different kinds of questionnaires were involved, comprehensive questionnaires that formed the basis of the study, post-test questionnaires administered after usability testing and one case of a questionnaire used in an interview. However, since the questionnaire was used as data-capturing tool in all these studies there is no obvious reason why the reporting should not comply with the requirements for good governance in questionnaire usage. The results of the analysis are presented and discussed in Section 4.1.

Given the surprisingly high percentage of questionnaire omissions a follow-up investigations was done where 12 published researchers, 7 of which had published in the conference proceeding were surveyed with a short questionnaire. The results of the analysis are presented and discussed in Section 4.2.

4. Results and discussion

Evaluation attributes or criteria considered in the present review focus on, the number of questionnaire driven studies reported, the number of standardized questionnaires used and the reporting rigor.

4.1 Results

The analysis of the SAICSIT full-papers for survey driven research produced is depicted in Table 2, with the following information provided in the nine columns:

- Column 1: Conference date
- Column 2: The number of questionnaires provided in the paper.
- Column 3: The number of papers where standard questionnaires were used and referenced.
- Column 4: The number of papers where the questionnaire was accessible i.e. a reference to the questionnaire was provided or it was based on a referenced standard questionnaire.
- Column 5: The number of papers where parts of the questionnaire was described
- Column 6: The number of institutions involved
- Column 7: The total access (based on the number of papers where the questionnaire was provided, a standard questionnaire was used or access to the questionnaire was provided.
- Column 8: The number of papers analyzed
- Column 9: The percentage of questionnaires made available per papers analyzed

Table 2: Questionnaire (Q) provision in survey-based papers (2008-2013)

1	2	3	4	5	6	7	8	9
Date	Q provided	Standard Q	Q access	Q Description	Institutions	Total Q access	Q Papers analyzed	Access Q %
2008	4	0	0	6	7	4	14	28.6
2009	1	0	0	2	4	1	4	25
2010	5	1	1	3	5	7	15	46.7
2011	3	0	2	5	5	5	8	62.5
2012	2	0	2	0	5	4	8	50
2013	3	2	1	0	6	6	11	54.5
Total	16	3		21		19	60	AVG 31.7

The analysis found that in total 60 papers used questionnaires but the provision of the questionnaires varied. In only 27% (16 of the 60 papers) was the questionnaire included in the paper. Columns 3 and 4 refer to papers where a standard questionnaire was used or the questionnaire was based on a standard questionnaire. The

latter could be problematic since a questionnaire is a balanced instruments and using selected sections only could detract from the rigor. Considering questionnaire availability (not only direct provision) those papers were included and then the average is 31.7(19 of 60 papers).

The cases where only sections of the questionnaire was provided (column 5) was not included since it is essential to be able to evaluate the entire questionnaire. This practice also introduces subjectivity since the selection was made by the authors. The availability of the questionnaires ranged from 25% to 54.5% with an average of 31.7%. If the values from column 4 are ignored (there is a strong argument for using a questionnaire as a unit) then the questionnaire access drops to a range of 25% to 45.5% with the average remaining at 31.7%. Note, the difference between the papers in columns 4 and 5 is that the former made selections from a standardized questionnaire and then made all the questionnaire items from the sections selected available while the papers counted in column 5 selected provided only the questionnaire items that produced interesting results. Either way the evidence indicates a trend to omit the questionnaire. The practice of non-reporting was not limited to specific institutions but researchers from the Nelson Mandela Metropolitan University showed a trend towards using standardized questionnaires. This paper argues that the findings from a survey cannot be evaluated without access to the questionnaire and omitting the questionnaire can cause reasonable doubt about the validity of the findings. Therefore the identified tendency to omit the questionnaire, despite the possible negative effects on validity, prompted further investigation. A short survey (four questions) was conducted with 12 well-published researchers, 7 of which had published in the SAICSIT conference proceedings. Some of these researchers had provided access to the questionnaire in their SAICSIT articles, some had not done so and some had done so in some of their articles. The questions and a summary of the responses are depicted in Table 3.

Table 3: Questionnaire on questionnaire access put to researchers

Consider a piece of research where a questionnaire was used as data capturing tool. Please indicate which of the following apply to the provision of the questionnaire and motivate your response.				
		Always	Sometimes	Never
1	The questionnaire should be provided	10	2	0
2	Access to the questionnaire should be provided i.e. URL.	6	3	3
3	Only the relevant sections need to be provided.	1	4	7
4	The questions items need to be provided for the important findings only.	3	1	7

From the responses depicted in Table 3 for question 1 it can be inferred that the majority of the interviewees (10 of the 12) would always expect the questionnaire to be provided. Two would be satisfied with sometimes. Note that none of them indicated 'never' as an option.

The idea of an URL, as mentioned in question 2 was new to some respondents, one expressed concern about the anonymity but 6 of the 12 selected always as option. The last two questions had to be clarified where the question 3 referred to selection based on the questionnaire items and question 4 referred to selection based on findings. Looking at the wording of the questions, that confusion is understandable and this underscores the argument of this paper, namely that the questionnaire items should be provided. However, both questions refer to the practice of allowing the researchers decide on what part of the questionnaire to provide. The majority (7 in both cases) responded with Never. Thus the results show that most participants found it unacceptable to provide only parts of the questionnaire. The reason given was that the researchers sacrificed objectivity in deciding what to omit and could be accused of 'cherry-picking', the fallacy of incomplete evidence based on the act of pointing to individual cases or data that seem to confirm a particular position, while ignoring related cases or data that contradict that position .

When asked to give reasons for not providing a questionnaire the following responses were obtained on why it should be included:

- "I personally like a data trail."
- "One needs to see what the respondents see."
- "Results can be affected by the wording of the questions. Thus the research must report the words used."

- “No – it is important otherwise a researcher could have made the results up and results have to be linked to the different questions. Evidence of this is thus necessary.”
- “All questions should be provided to prevent bias/selective inclusion of results that fit purpose of research.”

The following responses were obtained on why the questionnaire would be omitted:

- “Because of space restrictions and because a paper often focusses on only part of the work.”
- “When you have done 'creative' interpreting or plan to market an instrument (IP).”

In Figure 2 the advantages and disadvantages of providing the questionnaire is depicted based on the interviewee comments provided in reply to the request to motivate their responses.

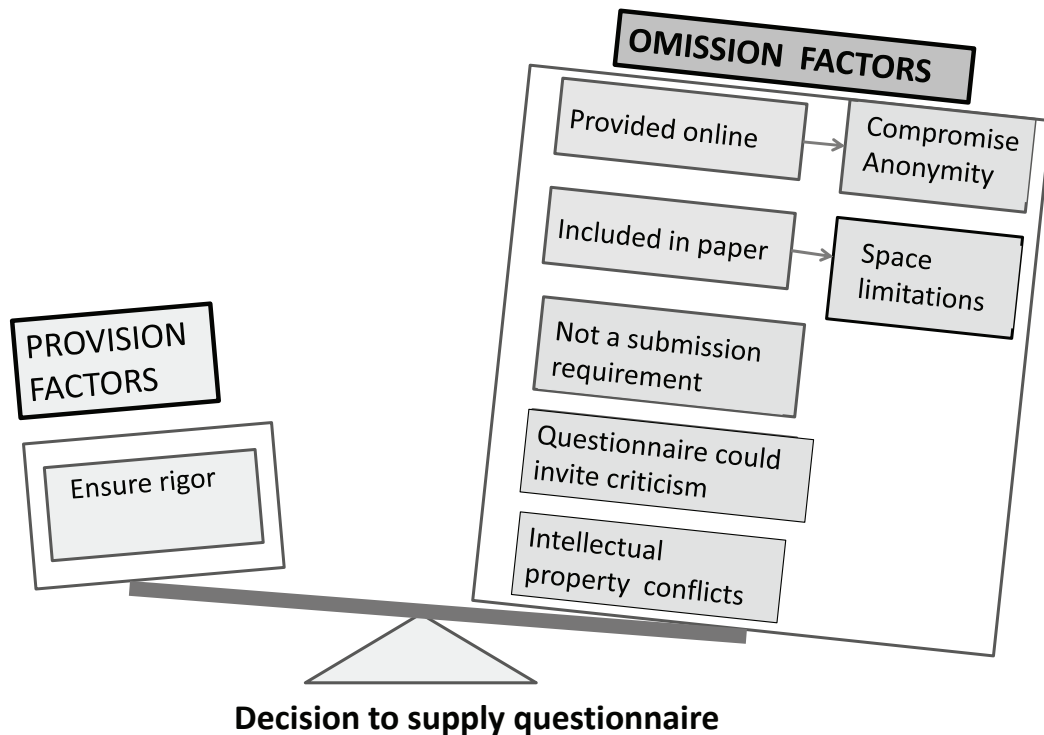


Figure 2: Factors impacting on the decision to provide the questionnaire

4.2 Discussion

Considering the results from section 4.1 it can be deduced that in the SAICSIT conference proceedings from 2008 to 2013 there was a definite trend towards omitting the questionnaire. This is based on the fact that it was included in less than a third of the papers on average.

In section 4.2, the results of a short survey conducted with researchers indicated that researchers found it necessary to provide access to the questionnaire. Over time there had been calls for the Computing community to raise the bar on what can be expected from reporting research. Louridas and Gousios (2005) recommend that published papers include the following:

- All measurement data.
- All interviews, questionnaire, research protocols, and other related data derived from subjects, anonymized if necessary.
- Full details on the statistical methods used. These should include scripts and programs, so that it is easy for other researchers to run them. If statistical frameworks are used (e.g., r or spss), full details on the versions and libraries should be provided as well.
- Any other code that has been used in the publication's re-search.
- Documentation for all of the above.

Decision making can be biased in different ways but Dobelli (2013) calls the confirmation bias the mother of all misconceptions. The confirmation bias is ‘the tendency to interpret new information so that it becomes compatible with our existing theories, beliefs and conviction (Dobelli 2013): 23. Therefore researchers have to follow procedures carefully and transparently to produce evidence of their confirmability, reliability, and credibility to minimize opportunities for bias. This begs the questions why the questionnaire is not routinely provided. The factors that influence human behavior in adopting and using a technology may provide some insight. Looking at the difference between best practices and the way people behave from an Information security angle, Renaud and Goucher (2014) investigated the difference between the intention to behave in a specific way and the actual execution of the behavior. They distinguished the *Gulf of Evaluation* from the *Gulf of Execution* as depicted in Figure 3.

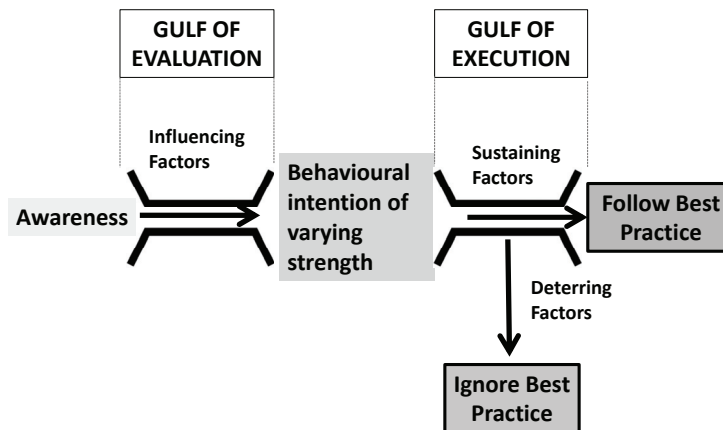


Figure 3: Antecedents of actual use adapted from Renaud and Goucher (2014)

Considering the many factors against providing the questionnaire (as depicted in Figure 2) it becomes clear why the more abstract concept of rigor does not outweigh the many practical factors that drive the practice of omitting the questionnaire.

5. Conclusion

This paper reported a study on the use and reporting of questionnaires. Based on the findings it is concluded that questionnaires were not routinely provided as it was done so on average in less than a third of the conference papers analyzed over a six year period for the selected conference. Given the fact that this is a reputable South African conference with an acceptance rate of 40.8% on average a follow-up investigation was conducted to probe why this trend prevailed - despite the adverse consequences for the rigor of the research. In the short survey the majority of the researchers thought it necessary to provide the questionnaire as research tool – even if they had omitted it in some papers themselves. The reasons for non-reporting relate to intellectual property, practical issues and governance issues. The specific reason mentioned were intellectual property, space consideration and the fact that it is not required by most conferences. Requiring the questionnaire in some format, i.e. as a separate file in the review process could address some of the problems mentioned. The findings are based on one conference only therefore more research is needed to investigate the trend and the reasons for not routinely providing the questionnaire. Research needs to be done rigorously, but it also needs to be seen to be done rigorously. Conference chairmen, journal editors and reviewers have a responsibility to ensure that expediency of reviewing and publication does not come at the expense of adequate description and methodological justification. This is in line with Louridas and Gousios’s (2005) call for specifying reporting requirements and it is hoped that this paper will revitalize the debate on reporting practices for ensuring reporting rigor.

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Building a Green Archiving Model: Archival Retention Levels, Information Value Chain and Green Computing

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Abstract: Information and Communication Technologies (ICTs) affect the environment in various ways. Their energy consumption is growing exponentially, with and without the use of 'green' energy. Increasing environmental awareness within information science has led to discussions on sustainable development. 'Green Computing' has been introduced: the study and practice of environmentally sustainable computing. This can be defined as 'designing, manufacturing, using, and disposing of computers, servers, and associated subsystems - such as monitors, printers, storage devices, and networking and communications systems - efficiently and effectively with minimal or no impact on the environment'. Nevertheless, the data deluge makes it not only necessary to pay attention to the hard- and software dimensions of ICTs but also to the value of the data stored. We explore the possibilities to use information and archival science to reduce the amount of stored data. In reducing this amount of stored data, it's possible to curb unnecessary power consumption. The objectives of this paper are to develop a model (and test its viability) to [1] increase awareness in organizations for the environmental aspects of data storage, [2] reduce the amount of stored data, and [3] reduce power consumption for data storage. This model integrates the theories of Green Computing, Information Value Chain (IVC) and Archival Retention Levels (ARLs). We call this combination 'Green Archiving'. Our exploratory research was a combination of desk research, qualitative interviews with information technology and information management experts, a focus group, and two exploratory case studies. This paper is the result of the first stage of a research project that is aimed at developing low power ICTs that will automatically appraise, select, preserve or permanently delete data based on their value. Such an ICT will automatically reduce storage capacity and curb power consumption used for data storage. At the same time, data disposal will reduce overload caused by storing the same data in different formats, it will lower costs and it reduces the potential for liability.

Keywords: archival retention levels, information value chain, digital archiving, green archiving, green computing

1. Introduction

The origins of an environmental approach to Information and Communication Technologies (ICTs) can be traced back to the beginning of the 1990s, when the reduction of the use of hazardous materials, the maximization of energy efficiency, and the recyclability or biodegradability of defunct products and factory waste became hot items in computing (Jacob & K.G 2012). The development of the World Wide Web, the emergence of social media and Big Data have led to a rising amount of data (Armitage & Roberts 2002; Segaran, Hammerbacher 2009; Manyika 2011). The infinite opportunities to process and publish data, global electronic communications, an explosion in devices located at the periphery of the network, including embedded sensors, smartphones, and tablet computers, aerial sensory technologies, software logs, cameras, microphones, radio-frequency identification readers, wireless sensor networks, a large-scale digitization of cultural heritage such as film, music, art, images, maps, and text, cause [1] the data storage capacity to double every 40 months (Hilbert & López 2011) and [2] an annual growth rate of 40 % in the amount of data, creating a 'data deluge' (Gantz & Reinsel 2012). This data creates new opportunities for analytics in human genomics, healthcare, oil and gas, search, surveillance, finance, and many other areas (Golden 2010). This data deluge is putting great pressure on the infrastructures of ICTs (Van Bussel & Henseler 2013).

ICTs affect the environment in various ways. Its production requires electricity, raw materials, chemical materials and large amounts of water, and supplies (often toxic) waste (Robinson 2009). Computers and peripherals are changed two or three years after purchase (Murugesan 2008). In 2006, global production of E-waste was estimated at 20-50 million tonnes per year (UNEP 2006). In rich countries, E-waste represents some 8 percent of municipal waste (Widmer, et al. 2005). It is the fastest growing municipal waste stream (EPA 2011). Most of this E-waste is not recycled, because those items tend to go out with the normal household waste and do not receive special treatment (Ladou & Lovegrove 2008). Some 80 percent of collected E-waste is exported to poor countries and ends up in landfills and informal dumps (Schmidt 2006). These dumping sites are poisoned and groundwater is polluted (Murugesan 2008). Green Computing has been introduced to

minimize environmental effects of ICTs, to save costs and for corporate social responsibility (CSR) (Harmon & Auseklis, 2009; Subburaj, et al. 2014).

The energy consumption of ICTs is growing exponentially as a result of the data deluge, just like energy costs. From 2000 to 2005 power consumption of data centers doubled, while power consumption worldwide grew by 16.7 percent per year (Kooimey 2008). From 2005 to 2010, power consumption of data centers alone jumped with 56 percent (Kooimey 2011; Cook 2012). This increase in energy consumption results in increased greenhouse gas emissions. According to Dubey & Hefley (2011), each PC or laptop in use generates about four tons, each server about eight tons of carbon dioxide every year, although there are many possibilities to lower those emissions (Boccaletti, et al. 2008). In 2008, storage networks were responsible for 15 percent of total ICT energy costs (HP 2008). This percentage has, in our estimate, doubled in 2011, given the increasing need for data storage as a result of multiplication of data, social media, and fear of not being compliant (Van Bussel 2012a). Studies have shown that power costs can approach 50 percent of the overall energy costs for an organization (Harmon & Auseklis 2009). In January 2013, an average in-house server in the USA costs \$ 731,94 in electricity (Hammond 2013).

2. Research questions, objectives, and methodology

The data deluge threatens to drown all positive effects of Green Computing. It becomes necessary to curb data storage. We need to pay attention to data value (over time), to implement data value appraising methods and tools, and to completely and permanently delete data that has lost its economic, social, cultural, financial, administrative, fiscal and/or legal value.

2.1 Questions

We have defined two research questions for this paper:

- [1] Can a Green Archiving model be constructed when combining Green Computing, information and archival science?
- [2] Does this Green Archiving model [a] increase awareness for the environmental aspects of data storage; [b] reduce the amount of stored data, and [c] reduce power consumption for data storage?

2.2 Objectives

The first objective of this paper is to develop a Green Archiving model to [1] increase awareness in organizations for the environmental aspects of data storage, [2] reduce the amount of stored data, and [3] reduce power consumption for data storage. The second objective is to test the viability of this model in two exploratory case studies to see if reducing the amount of data reduces power consumption for data storage. The Green Archiving model integrates Green Computing with theories of information and archival science: Information Value Chain (IVC) and Archival Retention Levels (ARLs). Green Archiving does not yet have the aim to directly reduce environmental impact, but intends to raise awareness of the environmental effects of ICTs (like increased greenhouse gas emissions) and to define solutions for the rising amount of data and the constantly rising costs of energy. Operationalizing the Green Archiving model, organizations curb power consumption, lower needs for storage capacity and develop 'low power' ICTs (Forrest, Kaplan & Kindler 2008). That way, Green Archiving reduces the environmental impact of ICTs and contributes to energy efficiency and cost effectiveness (Barosso & Hölzle 2007; Schwarz & Elffers 2010; Orgerie, et al. 2014). In new research, we are designing case studies to measure the environmental effects of the Green Archiving model. Green Archiving is a new subject and is not extensively studied within the context of information and archival science.

2.3 Methodology

Our exploratory research was a combination of desk research, qualitative interviews with information technology and information management experts, a focus group and two exploratory case studies. We researched scientific literature with an IT, information management and archival science perspective. We collected literature with a key word search in Google Scholar and in the Digital Library of the University of Amsterdam (indexes on IT, information science / management, archival science / management). The key words used in this search were: 'Green Computing', 'Green IT', 'IT power use', 'IT power costs', 'information value', 'archival appraisal', 'archival disposal' and 'environmental awareness'. The findings of this desk research were used, complemented and criticized in: [1] individual, semi-structured interviews with ten IT,

information management and archival science experts (three scientists, two consultants, three CTO's, and two storage industry specialists); [2] a focus group, consisted of six (different) experts (two Green Computing consultants, two information managers and two storage managers). We used the information acquired through desk research, interviews and focus group to develop a provisional Green Archiving model. This model was then tested for validity in two small exploratory case studies.

3. Theoretical discussion

3.1 Green computing

Green Computing (Brooks, et al. 2012) is defined by Murugesan (2008, p. 25-26) as 'the study and practice of designing, manufacturing, using, and disposing of computers, servers, and associated subsystems - such as monitors, printers, storage devices, and networking and communications systems - efficiently and effectively with minimal or no impact on the environment'. There are four paths along which the environmental effects of computing should be addressed: green use, green disposal, green design, and green manufacturing (Murugesan 2008). Green Computing can also develop, according to Donnellan, Sheridan and Curry (2011), solutions that align IT processes with the principles of sustainability and stimulate innovative technologies to deliver green benefits across an organization. In that way, end user satisfaction, management restructuring, regulatory compliance, fiscal benefits, and return on investment (ROI) can be addressed. In the opinion of Visalakshi, et al. (2013, p 64), Green Computing may be 'simple, plain, common sense'. Analyzing literature, interviews and focus group discussion, we discern six components of Green Computing research: [1] product longevity (Visalakshi, et al. 2013; Agarwal & Nath 2011), [2] software and deployment optimization (Ahmad & Ravikanth 2012), [3] power management (Murugesan 2008; Visalakshi, et al. 2013), [4] materials recycling (Visalakshi, et al. 2013; Kwon, et al. 2006), [5] telecommuting (Thompson 2009), [6] low power IT (Ahmad & Ranka 2012; Lee, et al. 2013). The components [2], [3] and [6] are important for reducing power consumption for data storage.

3.2 Archival retention levels en information value chain

Information and Archival science are interdisciplinary fields concerned with the analysis, collection, classification, storage, retrieval, dissemination, appraisal, disposal and preservation of data. They use methods and techniques to appraise and select organizational data for long-term (or indefinite) preservation or to permanently delete appraised data (Shepherd & Yeo 2003; Xie 2013; Smallwood 2013). This appraisal is based on the 'value' of organizational data over time, be it economic, social, cultural, financial, administrative, fiscal and/or legal value (Cook 2013). Appraisal results in retention schedules, which assure that all data is retained and disposed according to their quantified 'value': the time (in years) that data should be retained, according to considerations of organizational risks and assigned economic, social, cultural, financial, administrative, fiscal and/or legal value. Minimizing risks (especially those of litigation) also means systematic disposal immediately after the expiration of the assigned retention period (Shepherd & Yeo 2003; Robek, et al. 1995). Two theories of archival science offer tools for appraising data: the theories of Archival Retention Levels (ARLs) (Den Teuling 2001) and Information Value Chain (IVC) (Van Bussel 2012ab). The first theory concerns itself with designating ARLs in organizations to store and retain data that is unique, authentic, relevant and contextual. ARLs define detailed functional (organizational) responsibilities for the retention, storage and archiving of unique and authentic data (Smit 2012). Data value is appraised according to the organizational level that is responsible for the collection, analysis, processing and storage of that specific data. This organizational level is the designated ARL. At the ARL the data are retained as long as the retention schedule permits. This schedule makes the economic, social, cultural, financial, administrative, fiscal and/or legal value of the data (retained at every ARL) explicit and defines its archival value: a time (in years) after which the data should be disposed of. Identical data retained elsewhere within the organization and without a new business objective (duplicates) can be deleted permanently and immediately. In digital environments, duplicates are stored in different forms and places and in various business processes (Paul & Baron (2007)), not being the designated ARL. In hospitals, an average organization's duplicate rate in 2009 was typically between 5-10% (McClellan 2009). It is (non-scientifically) estimated that in 2013 in most organizations 30% of all files are duplicates, without a new business objective or value (Proofpoint 2013). Using ARL checklists can seriously reduce the amount of data stored, which has direct effects on costs and needed storage capacity. The organizational use of ARLs can be seen as contextual data deduplication. The IVC theory defines the utilization of the informational and evidential value of data in business processes to improve the management of trusted data and the performance

of business processes (Van Bussel 2012ab). The IVC includes all processes of information management and manages data generation, data identification, data capture, data storage, data processing, data distribution, data structuring, data publication, data (re-) use, data appraisal, data selection, data disposal, data retention, data security, data auditing and data preservation. For the purpose of this paper, only the processes of data appraisal, data selection and data disposal are important. In the data appraisal process the short- and long-term (or indefinite) data value is defined in order to retain and preserve data for later (re-)use. As stated above, this data appraisal defines the archival value and results in a retention schedule. In the data selection process, data is collected and set aside according to its retention schedule. In the data disposal process, this set aside data is completely and permanently deleted (Shepherd & Yeo 2003). Organizational retention schedules are used to operate those processes. Almost 75 percent of all data in an organization can be permanently deleted over time (Archieflandsverordening 2007).

4. A 'green archiving' model

The theoretical discussion allows us to combine the components of Green Computing, with the data reducing components of the two archival theories. We were able to develop a Green Archiving model that can be used [1] to reduce the amount of stored data, [2] to reduce power consumption for data storage and, ultimately, [3] to reduce greenhouse gas emissions and E-waste in realizing all components of Green Computing. This paper concentrates on the aspects [1] and [2] of the model. Aspect [3] of the model will be part of further research. Participants of the interviews and the focus group remarked that the model could be used to increase awareness in organizations for the environmental effects of the use of ICTs. In their professional experience, they encountered an extremely low organizational awareness of the environmental effects of ICTs. We tend to agree with this remark: we could not use the results of an online questionnaire because the response was extremely low. The lagging participation in that survey could be a result of very low awareness of the problem, but we could not confirm this. In the case studies, we also tried to confirm if the model could be used to increase organizational awareness of the environmental effects of ICTs. The model of Green Archiving we developed is shown in figure 1.

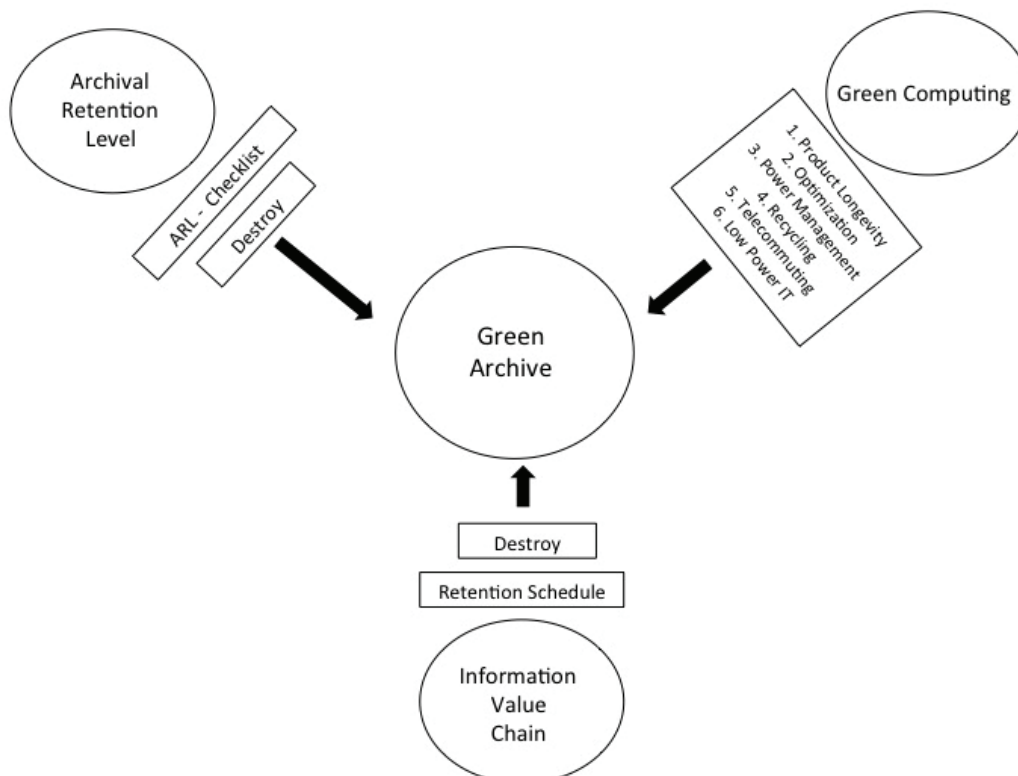


Figure 1: Green archiving model: combination of green computing, ARL and IVC

5. Exploratory case studies

5.1 Purpose

The purpose of the case studies was to ascertain that the model was viable and that it could be used in organizations to [1] increase awareness of the environmental effects of ICTs, [2] reduce the amount of data, and [3] curb power use for data storage. These exploratory cases only provide us with provisional results, that need to be confirmed in further research.

5.2 Dutch Music Institute (Nederlands Muziek Instituut)

We organized our first case study in the Nederlands Muziek Instituut (Dutch Music Institute), a small organization that operates as national heritage centre for musicians and composers. We ascertained that environmental awareness was extremely low and that all components of the model were unknown. The information managers had never heard of Green Computing. The management of the organization was not informed about the environmental effects of ICTs. That may be a result of the fact that the Institute used the ICT infrastructure of the Koninklijke Bibliotheek/National Library of the Netherlands (The Hague) for its storage network. The Institute never discussed energy use and power costs for their two terabytes (TB) of data storage capacity with their hosting partner. Within the Institute, ARL Checklists were not in use, but it was acknowledged (after being instructed about their purpose) that its use would reduce the amount of duplicates within office automation. Because the storage capacity for office automation was not known, it was not possible to quantify this effect. In addition, the Institute didn't use retention schedules for its digital collection and its business processes. All data was retained. We could only confirm that the Green Archiving model was a viable model to check and increase environmental awareness. We could not estimate the effects of the model for the reduction of the amount of data or the reduction of power consumption.

5.3 Dutch international trade organization

The second case study was in a small international trade corporation in Maastricht (The Netherlands), working with subsidiaries in Europe, Asia and South America. The case study data were collected in [1] a scan of the ICT infrastructure of the corporation using the model, and [2] a pilot study by the corporation's IT department on the effects of ARL Schedules. In [1] the Green Archiving model was enthusiastically received. Green Computing was well known within the IT department, but only the components Optimization and Power Management were implemented. The results of this implementation of these components were comparable to those described by Dubey & Hefley (2011). The IT department admitted that it should be more aware of other Green Computing components. CSR was extremely important for the corporation and implementing other components of Green Computing would be a significant contribution to CSR. The IT department planned to look into the possibilities of Telecommuting and Product Longevity. When we did the exploratory scan, the organization didn't use ARL checklists, but (for this case study) agreed to experiment with them in its corporate headquarters. After a scan of the company's file systems, the IT department estimated that almost 35 % of their IT storage capacity of 18 TB was used for duplicate files. It acknowledged that the use of ARL checklists would have a significant effect on the IT storage capacity. Retention Schedules were used only for the data stored in their document and records management applications, but the IT department acknowledged that both applications were not yet generally in use. Rigorous use of those schedules would certainly have an effect on the IT storage capacity, but the IT department could not quantify those effects yet. In [2] the IT department concluded that the use of ARL checklists would diminish global data storage capacity with 30 percent. 37 percent of the company's data storage capacity was used for duplicate files. Reducing the amount of data resulted in less power consumption for data storage. Energy costs for data storage diminished with 25%. The company planned a pilot for 2014 to measure the global effects of rigorous use of retention schedules. We concluded that the Green Archiving model seemed to be a viable model for organizational use.

6. Conclusions and future work

In this paper, we have developed a model for Green Archiving by combining Green Computing with the theories of ARLs and IVC (research question 1). Both cases confirm that the model can be used for increasing environmental awareness (research question 2 [a]). The second case study showed that the model could be used to reduce the amount of data (30 percent, using ARLs only) (research question 2 [b]) and to reduce the power consumption for data storage (resulting in a cost reduction of 25 percent). It seems that the Green Ar-

chiving model is a viable model to study possibilities to create environmental awareness, to reduce the amount of stored data and to curb power consumption in organizations. These exploratory case studies only provide us with provisional results. They need to be confirmed in further research. We are planning extensive case studies to research the environmental effects of Green Archiving and the scientific viability of our model. The ultimate goal of this research project is the development of a low power ICT that will automatically appraise, select and preserve or permanently delete data. Such an ICT will automatically reduce storage capacity and curb power consumption used for data storage. At the same time, data disposal will reduce overload caused by storing the same data in different formats, it will lower costs and it reduces the potential for liability.

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‘Privacy Lost - and Found?’ Some Aspects of Regaining Citizens’ Privacy by Means of PET in the age of ‘big Data’

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Abstract: In a world where rapid development of ubiquitous computing and ‘the internet of things’ are quickly leading to Big Data and Smart Cities, we are witnessing the emergence of Cyberspace as a transforming force in society. This transforming power may be seen perhaps nowhere more profoundly than in the field of citizens’ privacy. At a conceptual level privacy is easily understandable. Privacy regulations state that privacy-sensitive information may be captured by organizations, provided 1] that the person the information is gathered about consents to the information being gathered and 2] the information is only used for the express purpose the information was gathered for. Any other use of this personal information without consent is prohibited by law; notwithstanding legal exceptions. When laws must be applied in Cyberspace, the rules and regulations need to be embedded in the code of used information and communication technologies (ICTs). Writing code involves information modelling. Compliance to laws depends on proper modelling of privacy laws and regulation in the development process of ICTs. If these are properly translated in written code, they will be part of the outcomes of the end product – the information system will therefore be privacy compliant. We are reporting the results of our exploratory desk research as an introduction to a more extensive research project on Privacy, Big Data and the Smart City. In this paper we attempt to take stock of the question whether privacy enhancing technologies (PETs) may be an answer to challenges posed by extended use of ICTs by both citizens and commercial companies in the age of Big Data.

Keywords: privacy, privacy enhancing technology, digital archiving, information value chain, big data, information management

1. Introduction: Privacy and ICT

In this paper we will be exploring some interactions between information and communication technologies (ICTs) and Privacy. It is an issue that manifested itself prominently with the emergence of the ‘Internet of Things’ and ‘Big Data’. Within the next few years, according to Mayer-Schönberger & Cukier (2013), we will be witnessing the final breakthrough of Big Data as a transforming force in our society. The Internet of Things will provide our environment ‘with eyes and ears’. Information harvesting systems, fed by the upcoming abundance of all kinds of sensory systems that continuously capture information regarding human-environment interaction in the Smart City, lead to new challenges in the area of the privacy of citizens. For the purpose of this paper, we consider individuals as ‘individuals-as-citizen’, bestowed with citizens’ rights that are to be respected by government institutions by law, among them the right to privacy (Rezgui, et al. 2003). Data, traditionally captured in ICTs by organizations, are breaking loose from the constraints imposed by separate information systems and are absorbed into a ‘cloud’. All data in that ‘cloud’ are stored, analysed, transmitted and reprocessed in a continuous cycle of information management processes and algorithmic processing. The challenge of facilitating ICTs with proper and fail-proof systems to guarantee citizens’ privacy during information processing is by no means new (Flaherty, 1989; Solove, et al. 2006; Etzioni, 2007; Kosinski, et al. 2013). Incidents involving privacy infringement are, likewise, not a new phenomenon, especially not in a time of ever more intrusive surveillance technologies and data analysis techniques (Wang & Petrison 1993; Lahlou, et al. 2005; Leese 2013). Attempts are made, however, to ameliorate the situation. Privacy infringement may be portrayed as ‘natural’ to the implementation of ICTs, but as Morozov (2013, p 20) points out organizations developing information systems make *choices*. There are therefore no ‘inherent’ properties of information systems. Organizations processing data choose to add or subtract functionalities in their software. That means, that they may decide to implement Privacy Enhancing Technologies (PETs), thereby respecting citizens’ privacy during their operations. There is a major problem however. Privacy is a legal concept from the real world, ruled by institutions manned by people. ICTs are also part of cyberspace, ruled by technology. Although some aspects overlap, at the same time it must be acknowledged that each environment comes with their own sets of rules and limitations. Laws ‘work’ best in the real world. And as can be witnessed on a daily basis: real-

world laws may not necessarily apply the same way in global cyberspace. The rule of law therefore cannot be translated directly from the one to the other, and the other way around (e.g., Solove 2004).

2. Purpose and research method: an inventory of thought on privacy-aware cyberspace

This paper explores the current state of affairs on the feasibility of a privacy-aware Big Data environment. As Big Data is fed by ICTs, our goal is to find out what current research has to say, if anything, on the concept of ICTs that are respectful towards citizens' privacy. While privacy and ICTs (and in its wake Big Data) are often portrayed as opposites (Pogue 2011; Morozov 2013), we intend to investigate whether citizens' privacy might still be upheld, while at the same time the benefits of Big Data analysis may be reaped by citizens and information processing organizations alike. We will do that by means of an inventory of a reasoned selection of recent literature on the development of technologies and procedures that may provide the means to create a privacy-sensitive ICT environment. Privacy laws and regulations intend to provide citizens with the right to privacy. In theory the working sphere of these laws extends to the real world and cyberspace alike. The way this may be put into practice in ICTs is explored in a PhD on the use of PETs by Borking (2010). He discusses problems of transforming and methods and techniques available to transform real-world law through 'programming code' into cyberspace. Another, more technological perspective is elaborated by Van Heerde (2010). This PhD provides an overview of available technological solutions to make information systems privacy-aware by looking at ways ICTs may be configured to yield data processing to the privacy laws and regulations from the real world. Besides these two fundamental publications, we collected literature with a key word search in Google Scholar and in the Digital Library of the University of Amsterdam (indexes on IT an information science / management) on the subject of PETs. Very important for our research were papers that allowed us a glimpse into technological solutions that might help solve ICT-induced privacy problems (e.g., Zeng, et al. 2013, Martínez-Ballesté, et al. 2013; Thierer, 2013; Kwecka, et al. 2014).

We will pay attention to some basic assumptions that underlie privacy regulations. These regulations intervene in the processing of information by prescribing the rules any organization has to adhere to while processing citizens' information. A closer look at the way information is processed by organizations, using the theory of the information value chain (IVC) (Van Bussel & Ector 2009; Van Bussel 2012), will allow for a structured way to implement privacy regulations within the organizational ICTs. It is during processing of citizens' privacy-sensitive information that violations of privacy (and henceforth of privacy regulations) may ensue. We will take a look at research that has been done towards making information processing systems compliant to privacy regulations. This leads to an inventory of PETs, that strive to make information systems privacy-aware. The feasibility of implementation of privacy regulations into ICTs should be put to the test by confronting PETs with a privacy-audit, as proposed by Mayer-Schönberger & Cukier (2013).

3. Privacy – an evasive concept

Privacy regulations are abundant, just like literature on the subject. The European Union privacy guideline 95/46/EC (1995), which protects individuals with regard to the processing and transmitting of personal data, has been in place since the closing years of the 20th century. It was amended by Directive 97/66/LC (EU 1997), expanding the scope to electronic services, and ultimately replaced by the Directive on Privacy and Electronic Communications (EU 2002). Although local and national legislation is also in place, all EU member states should adhere to these regulations. Lessig (2006, p 5) wrote that 'In real space, we recognize how laws regulate - through constitutions, statutes, and other legal codes. In cyberspace we must understand how a different 'code' regulates - how the software and hardware (i.e., the 'code' of cyberspace) that make cyberspace what it is also regulate cyberspace as it is. [...] this code is cyberspace's 'law'.' In cyberspace, in other words, 'code is law (Lessig 2006, p 5). The analysis of this phrase by Borking (2010, p 11) is based on the perspective of a real-world privacy authority, and explores ways in which Law, upheld by legal systems in the real world, may translate into *code* in cyberspace. He explores the way data service providers may make their hard- and software compliant to privacy guidelines and regulations. Van Heerde's (2010) information management approach concentrates on the implementation of those legal guidelines and regulations. Although focused on the technological possibilities of privacy-compliant ICTs, Van Heerde (2010) shares Borking's (2010) concerns when discussing the data analysis technologies of Google, Apple, Facebook, Twitter and Amazon, the largest data aggregators worldwide, and the fact that the price citizens pay for 'free' services is privacy-sensitive information about themselves. 'The market needs urgently to be regulated and, most importantly, to get transparent. [...] Transparency is one of the key foundations of privacy; it must be clear for the user how his or her data is being handled, stored, and to whom it will be disclosed. Asymmetry of power between users and service pro-

viders leads to privacy risks for the users, because service providers are in a better position to serve their interests' (Van Heerde 2010, p 6). Service providers, by their actions, shape privacy in the real world as much as real-world law is trying to shape privacy compliance in cyberspace (Tsiavos, et al. 2003). Ultimately, both actions are inherent to the way information systems are built. System developers building the data collection and analysis systems making Big Data possible determine what users can and cannot do with those ICTs. The 'rule of the code' leads to 'laws' being enforced by ICTs (Lessig 2006). This puts law enforcement powers in the hands of the code-writing system developer. In cyberspace, the system developer holds both legislative and executive power, which is undesirable because the code-making process defies proper democratic controls, deemed essential in a constitutional state (Borking 2010, p v).

4. Privacy in organizational information systems

There existed a relative sense of control on the aspect of privacy in organizational ICTs. Until a few years ago, information retention was deemed a matter of organizations that exploited their own ICTs. Organizations captured their business process information into a digital infrastructure, which didn't cross the borders of the organization's structure. Organizations controlled the information that was collected and retained within their ICTs. If privacy issues arose, a single point of interaction could be contacted by a citizen or privacy authority (Davenport & Prusak 1997). That 'point of control' became diffused with 1] the ongoing integration of processes between different organizations, stimulated by the sharing of information through (for instance) social media (McAfee 2006), and 2] the breakthrough of supply chain and ERP systems, causing information integration (Srinivasan & Dey 2014). As it became common practice to share data between different parties, it could become quite difficult to ascertain which of the integrated process-owners was responsible for a breach of privacy, if and when that occurred. A model of the information flow in and between organizations can be drawn using both interorganizational business process analysis and information flow analysis. Van Bussel and Ector (2009) introduced an innovative concept of the information value chain (IVC). The IVC is a process model that includes all processes within the information flow: generation or receipt, identify, capture, storage, processing, distribution, structuring, publication, (re-) use, appraisal, selection, disposal, retention, security, auditing and preservation (Van Bussel & Ector 2009; Van Bussel 2012). The IVC (see Figure 1) is instrumental in providing proper control on the performance of business processes, the provision of trusted information and the protection of privacy-sensitive data. Privacy issues in the information processing process must be assessed, to identify possible risks for the organization and take proper actions if breaches of privacy regulations may take place (Haller 2012).

Organizations need to take proper care of the information they are entrusted with by citizens, because any failure to do so leads to loss of trust, economic value or public support. Most organizations consider compliance with privacy guidelines primarily relevant at the point where information enters the ICTs of the organization ('generation/receipt' in the IVC, the first 'open circle' in Figure 1). Looking at the IVC from a privacy risk perspective, risks of privacy infringement appear most explicitly at 6 moments, emphasized in Figure 1 as 'open circles': generation/receipt of information within the organization, processing, (re-)use, appraisal, disposal and preservation of information.

5. Privacy and information security

Most organizations have implemented information security procedures in order to protect data integrity and to prevent unauthorized access to the information contained in their ICTs. Borking (2010) discusses these measures extensively, referring to the EU funded PISA research project (Privacy Incorporated Software Agent) (EU 2004). In PISA, researchers investigated the applicability of information security measures on privacy compliance. Table 1 shows the conclusions of that research: information security measures do not lead to compliance to privacy regulations that would render ICTs privacy-aware. Borking (2010, p 68) states it is not surprising that privacy is not met by the information security policy of an organization, due to the fact that 'information security and confidentiality surpass lawfulness completely'. Whether the information contained in the information system is put there lawfully is *not* subject of the information security policies. The conclusion is unavoidable that privacy compliance is not guaranteed by applying information security policies. It is quite clear *why* organizations have problems with developing their systems to be compliant to privacy law and regulations. Where information security may be controlled sufficiently, privacy proves to be too elusive and conceptual to implement in an automated system 'because of its subjective nature' (Van Heerde 2010, p 55).

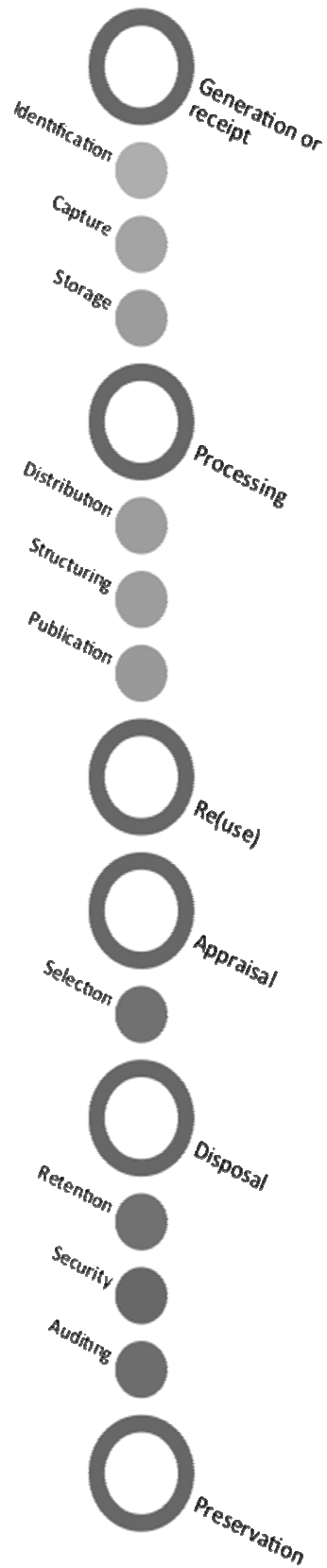


Figure 1: The information value chain (IVC) (Van Bussel & Ector, 2009, p. 13) (Open circles: Start of stage, privacy-audit necessary)

Table 1: PISA information security vs privacy (Borking 2010, p 68)

		Privacy Criterion								
		Reporting of processing	Transparent processing	'As required' processing	Lawful basis for data	Data quality conservation	Rights of the parties in-	Data traffic with coun-	Processing personal data	Protection against loss
Information Security	Availability									
	Confidentiality									
	Integrity									
		Very strongly related				Weakly related				
		Strongly related				Not related				
		Moderately related								

6. Building privacy-sensitive ICT systems

Defining the problem ‘out of scope’ is not a solution. An organization (when confronted with the risks of privacy breaches) has to accept the possibility of privacy issues arising from the use of citizens’ information in ICTs, and needs to embed privacy compliance in its requirements analysis (in the case of new, to be developed ICTs) or in its auditing cycle (within existing ICTs). An organization has to embed privacy enhancement measures in its business processes. That means that organizations have to take ample precautions that privacy-sensitive information is being processed in such a way that risks of privacy-infringement are minimized and that privacy guidelines and regulations are respected within ICTs. They can use PETs: technologies that try to implement privacy-compliance in ICTs. PETs have been studied extensively in the last decades (Wolfe 1997; Seničar, et al. 2003; Phillips 2004; Borking 2010; Van Heerde 2010; Zeng, et al. 2013; Kwecka, et al. 2014).

Van Heerde (2010) shows the possibilities of privacy aware data management. The focus of this research is on limiting the potential damage caused by a breach of data security by meticulously managing the data stored in ICTs. A technological solution is conceived to the technology-induced problem of data retention by owners of ICTs. According to this research it is ‘possible to reason about retention periods so that not only service providers, but also users of those services will be satisfied’ (Van Heerde 2010, p 152). The proposed solution is that after primary use of information, data precision is decreased automatically in different stages. Information may therefore be decreased automatically by automatic adjustment of data elements that provide precision in queries. The object is to degrade the data in an irreversible way (Van Heerde 2010, p 150). After an extensive analysis of scientific literature, Van Heerde (2010, pp 133-146) points towards five different possible ways of implementing data degradation techniques: service-oriented, ability-oriented and user-oriented data degradation, upgradable data degradation and external data degradation. Only user-oriented data degradation puts the citizen (not the service provider, as in the other data degradation techniques) in charge of the process of data retention. All other options imply some form of built-in system functionality. This means that (with the exception of external data degradation) these techniques rely on a single point of interaction with data retention (like in a classical database management system). The techniques of data degradation may be a solution to privacy issues in these ‘monolithic’, ‘one point of interaction’ ICTs, because the entire life cycle of information is managed within the system itself.

7. Providing privacy in an era of ‘cloud’ and ‘big data’

In a networked environment the problem of privacy compliance gets more complicated. The previous data degradation technologies do not work properly in a networked environment. As the majority of data in a mobile world is transported between different ICTs in which different sets of information are stored and processed, no ‘single point of entry’ to the management and retention of data exists. For those purposes Van Heerde (2010, p 144) puts external data degradation forward, but does not elaborate on this solution. In his opinion, external data degradation is binding the degradation policy to the data while the data is traveling through the network, and make network components degradation-aware. Network switches and routers can check the policy attached to each data item, and block (or remove) the data item from the stream if it does not comply with the degradation policy. Zeng et al. (2013) have tested a working proof-of-concept prototype of

this kind of PET on user data in ‘the cloud’. Their Self Destructing Data System (SeDas) protects data privacy from attackers who retroactively obtain, through legal or other means, a user’s stored data and private decryption keys. The prototype irreversibly destroys sensitive information, such as account numbers, passwords and notes, without any action on the user’s part.

Martinez-Ballesté (et al. 2013) add a holistic approach to the issue of privacy enhancement in networked environments. ICTs help governments to improve the management of operations of cities in a variety of areas: transportation, energy, sustainability, e-governance, economy, communications, etc. They analyze all available PETs that might mitigate the privacy-corroding effects of these developments: pseudonymizers, RFID privacy techniques, privacy-aware video surveillance, private information retrieval techniques, location masking, cloaking, anonymization, statistical disclosure control and privacy-preserving data mining (Martinez-Ballesté, et al. 2013, p 140). An interesting concept has been developed in Van Blarckom, Borking and Olk (2003, pp 33-49). In this concept, seven principles of PET are defined: [1] Limitation in the collection of personal data; [2] Identification, authentication, authorisation; [3] Standard techniques used for privacy protection; [4] Pseudo-identity; [5] Encryption; [6] Biometrics; and [7] Audit ability. These principles can be associated with the Common Criteria (CC) for Information Technology Security Evaluation (ISO/IEC 15408, 2009). We combined both PET principles and CC with the technologies mentioned in Martinez-Ballesté (et al. 2013) in Table 2 to generate an overview of PET solutions. This table shows that, although the technologies are in place, ‘there is still a lot of work to be done to materialize the notion of privacy in smart cities’ (Martinez-Ballesté, et al. 2013, p 136). In other words: many of those technologies are not used yet by organizations to protect the privacy of citizens. That there are no PETs in use for automatic security/privacy audits and for security management is a cause for concern.

Table 2: PET principles, CC and technological solutions

CC	PET Principles	Technological Solutions
Security / Privacy Audit	Audit Ability	
Communication	Encryption	RFID privacy techniques
Cryptographic Support	Encryption	RFID privacy techniques
User Data Protection	Limitation in the collection Identification, authentication, authorization Standard Techniques	anonymization cloaking location masking private information retrieval techniques privacy-aware video surveillance privacy-preserving data mining statistical disclosure control
Identification and Authentication	Identification, authentication, authorization Biometrics	anonymization cloaking location masking privacy-preserving data mining private information retrieval techniques statistical disclosure control
Security Management		
Privacy		
Anonymity	Standard Techniques	anonymization privacy-aware video surveillance privacy-preserving data mining private information retrieval techniques statistical disclosure control
Pseudonimity	Pseudo-identity	pseudonymizers
Unlinkability	Standard Techniques	anonymization cloaking location masking statistical disclosure control
Unobservability	Standard Techniques	privacy-preserving data mining private information retrieval techniques

8. IDP: Privacy protection embedded in ICTs

A method to protect users' privacy is a trusted third party, operating as an 'identity protector' (IDP). This IDP allows for privacy-aware fulfilment of the IVC. Borking (2010, pp 179, 201-202) shows the workings of this IDP in the technological environment of an ICT, realizing an overall view into the technology of privacy-aware processing of data. According to Mayer-Schönberger and Cukier (2013, p 173) providing proper privacy to citizens in an age of ubiquitous computing and Big Data remains to be a mind-bending problem. Traditional methods for privacy-safeguarding are no longer feasible. They propose privacy assessments, backed up by real authority (a sort of IDP?) that may impose the rule of privacy law on the organizations reaping the (huge) benefits of Big Data analysis. A formal assessment offers tangible benefits to data users: they will be free to pursue secondary uses of personal data in many instances without having to go back to individuals to get their explicit consent. By data users, to make matters clear, they mean the organization that exploits privacy-sensitive data, not the citizen-as-user. Implementing these assessments based on the IVC and the six steps therein to be audited could minimize privacy breaches. Table 2 indicates that this proposal for privacy assessments is correct.

9. Conclusion and further research

Electronic information retention, ubiquitous computing, and Big Data make issues of use of privacy-sensitive information major problems for both citizens and information processing organizations. With the movement from 'ownership-oriented' ICTs to service-oriented 'cloud' determination *who* needs to solve a privacy issue once it arises has become almost impossible. It is widely acknowledged that some of the most beneficial aspects of Big Data also give rise to the most influential and invasive breaches of citizens' privacy. NSA, GAFTA and citizens benefit from Big Data, but the citizens do not have the power of NSA and GAFTA. Rules and regulations are available. There are data authorities bestowed with ample powers to enforce privacy compliance. Rules can be translated into code that makes ICTs privacy-aware (or not). Technologies exist to implement privacy regulations, and even empower citizens by providing self-destructing data, embedded in the networking environment. As an answer to our research question: it is possible to make the Big Data information environment privacy-aware, providing citizens with the privacy they are entitled to by rights. At a conceptual level there is nothing preventing privacy-aware data. We are then, however, left with a puzzling problem. If no real legal and technological barriers for proper implementation of PETs seem to exist, why are they not being implemented? If there seem to be no legal or technological barriers preventing wide scale implementation of PETs, logic dictates that there might be other factors at play. The power distribution is in our view a likely candidate that might be responsible for putting up that blockade. We think this 'power aspect' might constitute a hitherto underexposed spot in the debate on PETs implementation. We deem it highly relevant to explore this line of investigation, as privacy infringements eat away at trust levels in society at large, with detrimental effects on society. In our view, chances are that the Key to Privacy in the era of Big Data might just be found there. Providing proper privacy to citizens is no matter of small concern.

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PhD Research Papers

Implementing ERP in a Challenging Environment: The Case of a Palestinian Telecom Company

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Abstract: This paper explores how a company in the Palestinian territories managed to realise substantial benefits from an ERP system. The Palestinian context is quite challenging, with uncertainty and frequent changes in regulations. This study investigates what the company achieved from the system and what the company did to ensure such successful benefits realisation. Six areas were important to secure the potential benefits from the system. First, the company's management was technology proficient and was able to understand the obstacles to realising the potential benefits. Second, the implementation proceeded with well-managed changes. Third, the company established a long-term business partnership with the implementation company. Fourth, the company surveyed similar companies' experiences implementing ERP in several countries in the Middle East. Fifth, the company allocated significant time and resources for motivating employees. Sixth, the company allocated ample time for end user training.

Keywords: enterprise resource planning (ERP), successful implementation, benefits realisation, palestinian territories, post-implementation

1. Introduction

Organisations are increasingly implementing enterprise resource planning (ERP) systems. Many organisations consider such systems more than just information technology solutions to facilitate and automate the existing work; rather, such systems have comprehensive implications for organisational practices regarding how they organise, regulate, control and develop the business processes. While many organisations are satisfied and have gained substantial benefits from the implemented systems, many other organisations face considerable obstacles in realising the potential benefits from these systems (Staehr et al. 2012; Peng and Nunes 2009). An ample body of research has been conducted to investigate what makes such implementations more successful and what makes organisations fail in their ERP implementations (Somers and Nelson 2001; Finney and Corbett 2007). There is also an increasing body of research focused on understanding how organisations can gain the maximum benefits from ERP systems (Schubert and Williams 2011; Seddon et al. 2010; Staehr et al. 2012).

However, it has been argued that existing literature about ERP success factors provides lists of success factors that are most likely focused on ensuring the success of the system via its implementation, but these studies do not focus particularly on the post-implementation stage (Peng and Nunes 2009; Doherty et al. 2012). It is in this stage that organisations realise the benefits of the system; further, this is the phase that enables the company to create the return on the invested amount. The successful implementation of a system alone does not guarantee its successful use and benefits achievement, especially in the long run (De Loo et al. 2013; Doherty et al. 2012; Gattiker and Goodhue 2005; Ha and Ahn 2013). Doherty et al. (2012) argue that the literature on success factors concentrates on the delivery of a technical system, but it falls short after that. Many system benefits are obtained when the system is integrated with other systems – the benefits are not exclusively from a particular system that is isolated from the rest of the technological infrastructure (Ibid.).

The success of ERP implementation is highly dependent on context (De Loo et al. 2013; Robey et al. 2002; Schubert and Williams 2011). Doherty et al. (2012) argue that the success factors of IT projects ignore the dynamics of the social, organisational and political contexts. The success factors cannot be implemented as independent variables to enhance the success of an information systems project, and not all factors have a genuine impact on every kind of system and in different organisational contexts (Ibid.). Against this backdrop, this study was undertaken to investigate the different success aspects that enabled a company to realise the potential advantages of an ERP system after implementation in a non-typical and challenging context. Thus, the research question that this study aims to answer is 'How can ERP implementation successfully realise the benefits in a challenging environment?'

This study investigates a Palestinian telecom company that implemented an ERP system and is highly satisfied with the realised benefits. The company started its implementation in the beginning of 2007. The system implementation took nine months and was ready for use in September 2007.

The rest of the paper is structured as follows: Section 2 reviews a number of relevant studies. Section 3 explains the methodological choices we applied. Section 4 reports the study's results. Section 5 discusses the results.

2. Theoretical background

ERP systems are widely adopted and implemented in organisations. It has been assumed that such systems can have a huge impact on the organisations and on their performance. Davenport (1998, p. 121) said that 'For managers who have struggled at great expense and with great frustration with incompatible information systems and inconsistent operating practices, the promise of an off-the-shelf solution to the problem of business integration is enticing'. Furthermore, many studies showed that such systems can generate operational, organisational, managerial, technological and strategic benefits for organisations (Shang and Seddon 2000; Staehr et al. 2012). On the other hand, when organisations implement these systems, they are confronted with a wide range of challenges, especially because these systems differ from traditional information systems in a number of areas including scope, scale, complexity, the organisational changes that are implied and the consequences for business process reengineering that could result from implementing such systems (Davenport 1998; Somers and Nelson 2001).

Many studies have been conducted to help organisations deal with these challenges and to enable them to achieve their expectations from these enterprise systems (Robey et al. 2002; Finney and Corbett 2007; Gargeya and Brady 2005; Somers and Nelson 2001). Somers and Nelson (2001) identified a set of critical aspects that can help organisations in each stage of the implementation process. For example, factors like top management support was critical in most of the implementation stages. They found that the most critical part of an ERP implementation occurs early on, particularly in the selection of the software package itself and in preparing to make that selection. They also paid attention to the training, communication and vendor support, among other things. Finney and Corbett (2007) argued that the success of ERP should include the key stakeholders.

It has been argued that many challenges become more persistent after ERP implementation (Peng and Nunes 2009). These challenges can threaten potential benefits, despite success in the initial implementation stages. The real challenges show up after the implementation, especially when different staff members from different business units start using a central and a comprehensive system serving the whole organisation (Robey et al. 2002). Therefore, different studies have focused on the dialectics that can be encountered when organisations that already have existing systems and working practices encounter new requirements, which in turn create cultural and dialectical challenges. Many authors (e.g. Robey et al. 2002; Soh et al. 2003) argue that an ERP implementation as a dialectic perspective occurs between the old knowledge embedded in business processes and practices associated with legacy systems and the new business processes and practices implicit in the ERP. Drawing on dialectics as a theoretical base, Robey et al. (2002, p. 21) found two categories of knowledge barriers: configuration and assimilation. A dedicated core team that is carefully selected, motivated with incentives and empowered to act, as well as effectively managed consulting relationships, are critical for responding to configuration challenges. Intensive employee education and an incremental pace of implementation are important for succeeding in assimilation challenges (Robey et al. 2002).

Recently, Doherty et al. (2012) argued that the real success of an information system project should not be about the delivery of the project on time, on budget and to specification; rather, it should focus on the time when the information system becomes able to achieve the expected benefits and when the benefits exceed the costs. They suggested that one should focus on the context, which is usually influenced by political and social dynamics, because the suggested list of success factors is not necessarily applicable or does not have high relevance in every project's context. For example, user participation is highly dependent on a number of contextual variables like leadership style or participation climate. Accordingly, implementing an ERP system in an emerging country influenced by various political and social forces may not necessarily be similar to implementing an ERP in a company working in a more stable environment. The same can be said about implementing an ERP system in a governmental organisation – it may be quite different from implementing an

ERP in a telecom company. Furthermore, such success factor lists ignore the interrelationships between factors. For example, successful change management and introducing organisational changes requires management support and engagement. However, Doherty et al. (2012) suggested that one should focus on the context and pay attention to issues like business environment and leadership, management of transformation and ongoing benefits review, among others.

3. Research method

3.1 Research overview

This study is qualitative, which helps articulate a clear understanding of the role of the ERP system within the company. There is a need to describe the company's context to understand how this company was able to deal with various situations. The study investigated a telecom company working in the Palestinian territories. The investigations focused on the process of system implementation, the benefits that were realized after the system was implemented and the aspects that were critical for the success of the system during and after implementation. The study adopted the case study method, which is recommended when the research objective is to explain, explore and describe and when the study aims to generate answers to questions like why, what and how (Yin 2009). The case study method allows investigators to maintain the holistic and meaningful characteristics of real-life events, such as the specific life cycle of organisational and managerial processes (Yin 2009). The investigation was based on 11 interviews, including junior staff, senior staff and people who participated in the implementations, like consultants.

3.2 Case description

This study investigates a Palestinian company called 'Jawwal Mobile'. The company is the first provider of mobile telecom service in Palestine and started its business operations in 1999. Despite continuing political and economic instability, Jawwal succeeded in consistently growing its customer base from one million subscribers in 2007 to two million subscribers in 2010. By the end of 2012, the company had 2.5 million subscribers in the West Bank and the Gaza Strip. The company has an extensive network of 29 stores, more than 1,000 primary distributors and 10,000 outlets in the West Bank and the Gaza Strip. By the end of 2012, the company had 950 employees working in different locations in the Palestinian territories. The company began implementing an ERP system in early 2007, and the system was ready to be used in September 2007. This system was viewed as essential for managing the company's expanding administrative tasks. Without an ERP, it became increasingly difficult to deal with the huge amount of work generated by the large number of external parties such as customers, suppliers and distributors. The data collection was conducted in 2013/2014, and we targeted different interviewees working on different business functions to represent different voices. It was also important to recruit interviewees who had participated in the implementation process.

Table 1: List of interviewees, their roles and the duration of their interviews

Interviewee code	Role	Interview duration in minutes
B1	Financial director and internal project manager	70
B2	Head of reconciliation and accounts receivable	90
B3	Head of fixed assets and inventory	90
B4	Accounts payable supervisor	80
B5	Head of general accounting	60
B6	Payroll accountant and HR coordinator	70
B7	Functional consultant	60
B8	Finance coordinator	25
B9	Technical team leader	70
B10	ERP implementer	50
B11	E-Business suite manager	80

4. Findings

4.1 Challenging context

Palestine is an emerging state and therefore lacks many national pillars; this has ample consequences for the political, economic and social forces in the business environment in Palestine. This context is quite challenging for organisations undergoing any kind of development. Implementing an ERP system is not an exception, and we uncovered several challenges. The country is facing frequent changes in the business rules because of the high level of uncertainty. The country is an emergent nation, so it does not have a national currency. Individual movement between the West Bank and the Gaza Strip is restricted and could create difficulties in the system configuration and training. Also, access to international implementation experts is limited due to travel restrictions to the Palestinian territories.

4.2 Achieved benefits

The ERP system implementation started in the beginning of 2007 and took nine months to complete. In September 2007, the staff started using the system in parallel with the existent systems for a couple of months during a transition period. However, the first period the system was in use was hectic due to problems in data migration, a great number of errors generated by novice users and the many bugs that appeared. The finance coordinator (B8) stated, 'the system was very difficult to use in the beginning, and we faced a lot of trouble'. This unsettled period continued until 2009, when the company perceived that the system had reached stability. The functional consultant (B7) stated, 'we had work pressure in the first two years doing bugs fixing, correcting business transactions, investigating the reasons for varied balances and convincing the business users to provide the appropriate details of the business transactions because this would be helpful for them later'. The general accounting section head (B5) said, 'Initially, there was a system and it was successfully implemented within the specified time, but we were not fully relying on the system. We were using some work manually, but now we are using the system for most of our work, and the manual work is very limited'. Despite the implementation challenges, the company was satisfied with the system operations after two years of implementation; they acknowledged they had realised many benefits.

Most importantly, the company was growing, so it needed the system to deal with the increasing volume and complexity of the business. The fixed assets and inventory section head (B3) said, 'Before the system implementation, I wondered how big companies manage their huge volume of work because we were not able to do all the business work regularly, so we assigned specific dates to receive invoices, but now everything is done in a timely manner'. Further, the system helped the company to deal with the external forces that influenced the business world in Palestine. Most notably, the system configuration was flexible, which helped the company deal with frequent changes, especially in regulations, and the multi-currency problem that had frustrated the company staff before the implementation.

4.3 Key motives facilitated the benefits realization

Although the system implementation led to many challenges, the implementation was seen as successful and the company was able to achieve various benefits, which made the company management and staff highly satisfied. The high level of satisfaction and success can be attributed to several key motives. We illustrate these aspects in more detail below.

4.3.1 Technology proficiency

The management understood the importance of the enterprise system for the company's processes and for the company's future development. They therefore allocated an appropriate budget for the implementation and assigned a senior manager as the implementation project manager before starting the implementation. The management gave him the required responsibilities and power to lead the implementation process. He involved the management in resolving conflict and resistance among users, and in turn, users were encouraged to adopt the system logic. Furthermore, the company's industry, telecom, is technology intensive. The company invested extensively in the ERP system implementation because the management considered this technology crucial to its business success. The company project manager, who is now the head of the finance department (B1), noted that 'the company's capital is its systems. As a telecom company, what we have is many systems doing our work'. Accordingly, the company's management believed in the system and its

capabilities and wanted to implement the system logic. At the same time, the management had a clear picture about the consequences of implementing an information system. This awareness about the technology was a key factor in the system's success. This view facilitated the adoption of the system before the implementation, and facilitated the changes that the system logic required; it encouraged all staff to use the system to achieve the system's benefits. Furthermore, the management requested a weekly status report and a monthly presentation to the steering committee of the project throughout the implementation process. This committee consists of the top management, the key staff members and representatives from the implementing company. This meeting was important to keep the project progressing according to the plan.

4.3.2 Managing the changes

There were well-managed changes in the two sides, organization and the system. There was some customisation in the system along with some organizational changes. The core system and its workflow structure were not changed, but some changes were made to deal with the challenges of the working context. The system introduced new changes to the business and imposed new business rules. Examples of these changes include changes in the structure (moving staff from one department to another), revoking privileges (the budget department no longer was responsible for approval, but every department had its own allocation, and the system, through approval channels within the purchasing department, could secure the purchase order), creating some new rules (e.g. not possible to pay in a currency different from the invoice currency, which was acceptable before the ERP; not possible to enter an invoice if it does not have a reference in the purchasing module). These changes were successfully implemented and became new business rules because the management fully supported the system, including the consequent changes. At the same time, the system was customised to deal with multiple currencies and to create automatic adjustments in an effective way. Also, the system was changed to accept multiple tax rules at the same time to reflect the varied treatment of tax rules according to the work location.

4.3.3 Partnership with the implementation company

There are a limited number of companies that implement ERPs in Palestine, which makes the implementing company interested in the success of the system; it considers it important to its future success. The implementation consultants have the time to stay with the customer through the implementation and afterward. We found that close and friendly relations between the implementer and the organisation were a key aspect that helped the company extract the maximum benefit from the system. The implementing company was selected based on its experience. The project managers from both the company (B1) and the implementer (B11) emphasised that the implementation company had ample experience from five previous ERP implementation projects. Most of the informants agreed that one key factor was the professionalism of the system implementers. They were always available, were loyal to the project and all of them were highly determined to succeed. The implementer consultant (B10) said, 'we shared the risk of the implementation, so the system success was important for us also'. Further, the implementation team, whether from the implementer company or from the company itself (Jawwal), has not changed. The same team members followed the project from inception until the end of the implementation; most of them followed the project after its implementation was complete.

4.3.4 Learning from other companies

Before the system implementation started, representatives from the company visited many peer telecom companies in the region to learn from their experiences and to understand how the ERP system could help in handling the increasing volume and complexity of a business. The company representatives also raised some problems that they had faced in earlier systems to envisage how the ERP system could solve these issues. The project manager (B1) commented that 'The site visits helped us also to determine which modules from the suite to implement first and which modules are most valuable in the telecom industry'. To exemplify, he added that 'the project management module is an important module, but when we asked other operators, they suggested that we should focus on such a module in later stages, not from the beginning, as the inputs to this module will not be ready in early stages. It would be more appropriate in industries that depend more on projects than the telecom industry'.

4.3.5 Motivating employees

We found that the company staff was highly motivated; they were concerned about performing their work in an effective and productive way. They were interested on the system even before it was implemented. They were motivated to learn, and learning was seen as important for their professional development. The company introduced incentives to further motivate them. The staff perceived that expertise in the ERP system would be important for their career development and that it might create new opportunities for them. Another issue is the age of the staff. When we walked through the company buildings, we could see that most of the staff were quite young. This is due to the company's growth in recent years. Young people are generally more motivated to embrace new technology; they are usually more willing to learn new things because this knowledge may provide attractive opportunities in the future. The payroll accountant (B6) stated, 'When I stayed to work with the system until late, my manager stayed with me, and when I saw that he appreciated my extra hours, I certainly became more motivated'. Most of the informants (e.g. B2, B3, B4, B5 and B6) acknowledged that they were motivated to make the system a success story. They confirmed that they were working late into the night; further, they worked on the system on the weekends, especially in the first year after its implementation. The accounts payable supervisor (B4) noted that 'The management was confident and motivated to implement the system, and they were motivating us all the time, helping us, staying with us and supporting us, especially when there was a problem or if we faced a situation we did not know how to deal with. That means the top management and the project manager did not make us feel that we were alone'.

4.3.6 End user training

In the initial stages of the system implementation, and particularly after the configuration, key staff members visited the regional office, Oracle, in Jordan, to do what was called a 'health check'. This was done to ensure that the company and the implementer shared the same understanding of the company's needs and expectations and to ensure the implementation would be carried out in the right way. The first 'health check' was in the early stages of the implementation to give introductory details about the project, the important features that could help them through the implementation and a high level of training. The second 'health check' was after the implementation and gave more details about the system use. When the staff members started using the system, the company created an image for the working environment that was refreshed frequently. This gave the staff a testing environment to do experiments, to track the transactions in the system and to better understand how a transaction would influence other business sections. This practice expedited the learning process of the system. The company was also committed to using an up-to-date version of the system; therefore, as the post-implementation phase lasted for several years, a new version was launched by Oracle. The company then adopted the new version and sent many staff members for training courses to learn about the new features in the new version and how they could help the company's business. Furthermore, most of the interviewees (e.g. B2, B3, B4, B5 and B6) emphasised the importance of self-training. They were interested in learning the system's capabilities and they used the testing environment to do experiments on the system and to track the impact of a particular transaction in the different business functions. The training was not just about how to use the system, but also about the consequences of the entered transactions (B6).

5. Discussion and conclusion

Although the company faced many challenges both during and after the implementation, it was able to achieve many of the expected benefits. This benefits achievement explains why the system implementation was considered successful. This is consistent with studies (Doherty et al. 2012; Schubert and Williams 2011; Seddon et al. 2010) that suggested that real success materialises through actual benefits for the organisations. The company realised important benefits primarily after the system provided standard practices across different locations and became able to handle the hugely complicated system processes, among other factors.

Consistent with Somers and Nelson (2001), in the routinisation and infusion stages, which comprise the post-implementation period, the success factors were top management support, interdepartmental cooperation, vendor support, partnership with the vendor and user training. In fact, all of these factors are supported in our study; however, we argue for the active involvement of the top management, and not only management support. Furthermore, our study highlighted the importance of the staff's motivation, particularly in relation to self-training. These aspects were important because a number of systems features were not very visible and demanded efforts from the user to appreciate the advantages of the ERP system. User training and the competency of the internal ERP team was also important for on-going benefits achievement, which is supported in other studies (e.g. Ha and Ahn 2013; Ononiwu 2013). In addition, our study showed the

importance of surveying peer companies to learn from their experiences, especially companies in the same industry and the same region, despite some differences related to the Palestinian context. However, user training and staff motivation were two important aspects to make successful use of the system. These aspects were very helpful as the staff appreciated the system outcomes and they accepted the system without resistance. Many studies have found that users' resistance is a critical challenge that influences the success of the assimilation stage (Robey et al. 2002). Further, Seddon et al (2010) found that the users' acceptance and motivation can overcome the organizational inertia that reduces the ERP system benefits. Thus, the staff learning and motivation resulted in effective use of the system, which in turn lead to real benefits. Most importantly, motivated staff have the desire to learn and use the system, and this was very critical to foster the self-learning which in turn helped to overcome the effects of the movement restrictions between the main two work places.

Furthermore, dialectic aspects related to the context influenced the ERP implementation. These aspects were related to items such as the country and the business sector. Soh et al. (2003) provide some examples of such factors. Country-specific factors include national culture, regulatory environment, level of national wealth, degree of government involvement in the economy and level of education. Similarly, sector-specific factors include revenue generation and whether the sector is private or public and in service or manufacturing. Soh et al. (2003) found that country-specific structures like governmental involvement in healthcare and sector-specific structures like revenue management were found to be in opposition to the assumptions embedded in the ERP system. Our findings revealed many country-specific and sector-specific factors that influenced the system implementation and influenced the ability to reap the benefits from the system, but they were not in opposition to the system implementation. For example, the business sector, telecom, which is a technology-based sector, facilitated the management of the implementation and encouraged organisational changes and system use. The Palestinian territories are politically unstable; thus, using ERP is influenced by frequent changes that require appropriate competence and flexible configuration. Furthermore, despite the company had its old processes and old ways of working, the study findings did not show dialectic issues between the old systems and old ways of working compared with the new system and the new ways of working. We conjectured that, the staff felt the importance of the system and its potential to solve their problems, and they accepted the system and the new ways of working.

Different studies (e.g. Peng and Nunes 2010) found that having an ERP manager who is competent and empowered could improve the likelihood of success. Such a person would participate in resolving conflicts between various stakeholders, especially when the project manager became empowered to promote and facilitate the required organisational changes after the implementation. Our findings support the previous studies' findings, but it is worthy to mention that the ERP project manager was from the finance department and not from the IT department, as found in Peng and Nunes (2010). We believe that the project manager background is one of the aspects that facilitated the friendly relations with other team members in his department. He was able to understand the business changes and was able to enable these changes with a low level of resistance, perhaps lower than a project manager from the IT department.

We advocated the role of top management in realising significant benefits from the system after the implementation, especially in uncertain conditions (Peng and Nunes 2010). This is well beyond the early stages and providing adequate funding. This requires continuous active engagement from the inception through implementation and into the evaluation of the system use. It also involves supporting the efforts to enhance use of the system, promoting the benefit exploitation from the technological features of the system that may arise in later versions of the ERP system. Staehr (2010) investigated the role of management in realising business benefits of ERP systems in the post-implementation stage. She found that managerial agency was very important in delivering the system's benefits. Furthermore, Doherty et al. (2012) considered the active engagement of the top management and the leadership role throughout the project to enhance the ability to realise the maximum benefits. They conjectured that the traditional success factor, top management support, would not be enough. The management should actively engage in the project work and show its leadership role, taking on the responsibility of facilitating organisational change. In our study, the top management's leadership was very clear. Because the telecom industry is highly dependent on technology, the company had a comprehensive understanding of the role of technology, the need for advanced business systems and the impact of such systems. In fact, the active engagement of the company's management since the start of the implementation process was very critical in the success of this case. This was instrumental to ensure successful implementation of the changes requested as the study findings showed there were essential changes that

were needed. In particular those related to the regulations changed frequently. Having the management active throughout the implementation process facilitated the change management and then the successful benefits cultivation.

A number of studies on ERP implementation (e.g. Robey et al. 2002; Peng and Nunes 2010) have suggested minimising customisation as much as possible, as customisation creates a high level of errors and decreases the realised benefits (Gargeya and Brady 2005). However, customisation was reasonable in this case, and it was only done when it was necessary, because the company wanted to adopt the logic embedded in the system. Some customisations were indispensable due to the challenging environment. Customisation was needed to enable the ERP system to meet the new taxation regulations. This customisation was done after the system was implemented and used, and it was needed to restructure the taxation rules to enable the system to deal with multiple tax schemas at the same time. This was not provided for in the original system. In line with this, Aslam et al. (2012) found that customisation may be necessary to modify the information system to ensure that the system meets the functional requirements of the organisation. To illustrate this, they gave the example of the UK water industry, which has two main billing mechanisms. There is a unique billing mechanism in the UK in which the customer is billed on the basis of the rateable value of the home. Therefore, it is unlikely to be included in standard ERP billing functionality, but would need to be developed in the system to meet the needs of water companies (Aslam et al. 2012). However, having proficient people who were able to address these changes was critical as suggested by previous studies (Ononiwu 2013; Robey et al 2002). It would overcome the configuration challenge that usually influences the system benefits.

In general, this work contributed to the understanding of ERP implementation in the context of Palestine, and of key aspects for the success of these systems in the post-implementation stage in particular. The paper found six key success motives that can be better understood within the given context.

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Business Process Modelling in ERP Implementation: Literature Review

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Abstract: Business processes are the backbone of any Enterprise Resource Planning (ERP) implementation. Business process modelling (BPM) has become essential for modern, process driven enterprises due to the vibrant business environments. As a consequence enterprises are dealing with a substantial rate of organizational and business processes change. Business process modelling enables a common understanding and analysis of the business processes, which is the first step in every ERP implementation methodology (blueprint phase). In order to represent enterprise processes models in an accurate manner, it is paramount to choose a right business process modeling technique and tool. The problem of many ERP projects rated as unsuccessful is directly connected to a lack of use of business process models and notations during the blueprint phase. Also, blueprint implementation phase is crucial in order to fit planned processes in an organization with processes implemented in the solution. However, business analysts and ERP implementation professionals have substantial difficulties to navigate through a large number of theoretical models and representational notations that have been proposed for business process modeling (BPM). As the availability of different business process modeling references is huge, it is time consuming to make review and classification of all modeling techniques. Therefore, in reality majority of ERP implementations blueprint documents have no business process modeling included in generating blueprint documents. Choosing the right model comprise the purpose of the analysis and acquaintance of the available process modelling techniques and tools. The number of references on business modelling is quit large, so it is very hard to make a decision which modeling notation or technique to use. The main purpose of this paper is to make a review of business process modelling literature and describe the key process modelling techniques. The focus will be on all business process modeling that could be used in ERP implementations, specifically during the blueprint phase of the implementation process. Detailed review of BPM (Business process modeling) theoretical models and representational notations, should assist decision makers and ERP integrators in comparatively evaluating and selecting suitable modeling approaches.

Keywords: BPM, enterprise modelling, ERP implementation, ERP blueprints, modelling tools, modelling techniques

1. Introduction

From the beginning of the 1990s, the attention on business processes has increasingly grown regarding scientific literature and managerial practice. Value-adding processes have become more and more the principle of organizing the business, rather than a functional hierarchy perspective. Business process models have been established as an important tool to document the workflows of companies and administrations (Dalal et al. 2004; Davenport and Short 1990; Körnmeier 1995; Pietsch and Steinbauer 1994). Lots of business processes application examples can be found in Swanson (2003), Artiba (2001), Guinet (2001), Martinez et al. (2001), Al-Mubarak (2003) and Chan (2002), and numbers of other authors. Overall, modelling of business processes is becoming increasingly popular. It is obvious, and both experts in the field of Information Technology and Business Engineering have concluded that successful systems start with an understanding of the business processes of an organization. Additionally, business processes are a key factor when integrating an enterprise (Aguilar-Saven and Olhager, 2002). Conceptual modelling of business processes is deployed on a large scale to facilitate the development of software that supports the business processes, and to permit the analysis and re-engineering or improvement of them.

It was 1960 when Levitt first mentioned the importance of business processes, but it was not perceived important until the last decade when processes have acquired a real importance in enterprise design (Levitt, 1960). Authors as Harrington (1991), Davenport (1993) and Hammer (1990), among others, endorsed the new perspective to domain of business processes. The increasing popularity of business process orientation (Hammer and Champy, 1993) has foster a rapidly growing number of methodologies, modelling techniques and tools to ground base for further development. The process of selecting the right technique and the right tool has become very complex not only because of the huge range of approaches available but also due to the lack of a guide that explains and describes the concepts involved.

For example, if someone realize the need of business process modeling in her/his environment, when searching the Internet for guides on business process modelling a thousands of references may be found. Thus there is a need of assistance for practitioners and academics in filtering the huge amount of data available on business process modelling. The aim is that they do not spend excessive time and effort in undertaking repetitive searches. Instead, they can dedicate themselves to reviewing, understanding and applying many of the associated concepts and vocabulary. In this paper, authors conducted a literature search on the topic of business process modelling techniques and tools using as research sources scholarly and trade literature both in scientific journals and material on the web. Internet is great source, but huge number of materials and articles where hard to filter. Web sources are useful for further detailed and specific information on certain techniques or tools and especially in recognizing tool availability and potential vendors. With the help of a number of databases, more than 500 scientific journals and conference proceedings were reviewed. During the search, the key words that were used are; business process modelling and/or review or framework. As we notices, the most of the papers found are published in journals or proceedings related to Information Systems or Computer Sciences. The focus of the present review is on available techniques and tools explicitly aimed at modelling business processes. The oldest paper used in this paper is published in 1993 by "Information and Software Technology" (Macintosh, 1993).

2. Business processes vs. business process management vs. business process modeling

A business process (BP) is a set of one or more linked procedures or activities executed following a predefined order which collectively realize a business objective or policy goal, normally within the context of an organizational structure defining functional roles or relationships. A process can be entirely contained within a single organizational unit as well as it can span several different organizations (WFMC-TC-1011, Workflow Management Coalition). Business process collaboration across enterprise is a complex mission due to the absence of a unique semantics for the terminology of BP models and to the use of various standards in BP modeling and execution.

Business process management (BPM) provides governance of a business's process environment to improve agility and operational performance. It is a systematic approach to improve any organization's business processes. BPM is not a technology and it is not related to diagrams creation or systems architecture. Business Process Modeling, instead, is defined as the time period when manual and/or automated (workflow) descriptions of a process are defined and/or modified electronically ((WFMC-TC-1011, Workflow Management Coalition). Often it is ambiguous to what we refer since both Business Process Modeling and Business Process Management have the same acronym (BPM), so these activities are every so often confused with each other. Business Process Modeling is the activity of representing processes of an enterprise, so that the current ("as is") process may be analyzed and improved in future ("to be") (Zur Muehlen, 2008).

Typically, Business Process Modeling is performed by business analysts and managers who are trying to improve process efficiency and quality. The term "Business Process Modeling" was invented in the 1960s in the field of systems engineering. In the 1990s companies started to substitute terms like "procedures" or "functions" with the terms "processes" and "workflows". (Zur Muehlen, 2008)

3. Proposal framework and literature survey

Consultants, practitioners and academics need a simple and clear guidelines in order to simplify the task of choosing the most appropriate technique. Important paper was published by Kettinger et al. (1997a), where author presented an important overview of methods, techniques, and tools used in Business Process Re-engineering (BPR). That study contains a list of a number related business process modelling techniques and tools that were used in that time. This list does not give detailed descriptions of the techniques, not even the tools. Nonetheless, it has been the starting point of the research presented in this paper, which gives a more thorough overview with detailed analysis of the mentioned techniques in Kettinger et al. (1997b) and others.

It is important to identify the uses or purposes of the models when undertaking modelling of any kind. It seems clear that in order to choose the right technique, the modeler must know the purpose of the model to be constructed. Different techniques are more suitable to certain purposes, e.g. one thing is a model, which describes the process, and another a model to build a system to control the process. (Aguilar-Saven, 2003)

Macintosh (1993) defines five levels of process maturity:

1. Initial - setting up of processes,
2. Repeatable - repeatable processes,
3. Defined - documented processes standardized throughout an organization,
4. Managed - measured and controlled processes,
5. Optimizing - continuous process improvement.

It is easy to imagine that for each level different models are needed. Levels 1–3 require models whose purposes are to describe the process and thus knowledge of the processes to be captured and analyzed. Levels 4 and 5 require models whose purposes are decision support in order to monitor and control processes. Macintosh (1993) proposes to define enriched representations of processes and the use of knowledge-based approaches to design new intelligent tools to model business processes.

Giaglis and Doukidis (1997) emphasize business process models use for change management which may be considered in more general terms as the need to learn, analyses, monitor and control the process and thus needing descriptive and decision support models. The most popular of these approaches include: BPR (Hammer, 1990), Continuous Process Improvement (CPI) (Harrington, 1991), Total Quality Management (TQM) (Oakland, 1993), and Organizational Transformation (OT) (Adams, 1984). Other authors such as Workman et al. (2000) claim too that many different models may be needed to analyses business processes depending on the purpose.

Some of these references aim at defining aspects for a business process model to be complete. Workman et al. (2000) present the historical development of enterprise organization and information technology distinguishing six phases:

1. The functional hierarchy,
2. The functional hierarchy with function oriented automation,
3. The functional hierarchy with shared database on mainframes,
4. The process oriented enterprise,
5. The supply chain oriented enterprise, and
6. The web-enabled agile enterprise.

For phase 4 they emphasize the need of modelling business processes and they define what they called business model architecture. Giaglis and Doukidis (1997) examine the nature of business processes in the light of modern change management approaches and propose a set of requirements for their modelling as follows:

***Technical requirements:** formal modelling, quantitative modelling, stochastic modelling, model documentation, model adaptability/reusability and objective-driven modelling.

***Political/social requirements:** Feasibility of alternative designs, communication of models and user friendliness.

All requirements identified by Giaglis et al. are basically meant as guidelines for prospective users or developers of business process simulation models. Hence, we can state that to define model requirements that enable it to be considered complete is function of the purpose of the model. In this sense, Phalp (1998) proposes that models used to analyses business processes for developing software should include expert judgments and heuristics, measurements, formality and be executable.

Hommel et al. (2000) give a more general framework to define a business process technique.

They identify on the one hand four elements that constitute any individual model: notation, meaning, concept relationship and modelling concept, which are called the way of modelling (modelling concepts). On the other hand there are three elements that constitute the way of working: procedure relationship, activity relationship and activity, which describe the procedures by which the models are constructed (modelling procedure). Hommel et al. framework is focused on describing the modelling technique. Whether the resultant model is adequate or not is another question.

Phalp (1998) uses a similar idea, which underlines that notation and method are two important considerations when modelling business processes. Both method and notation will depend on the desired model characteristics, which in turn will depend on the purpose. Hence, business processes can be described at different levels of detail depending on the abstraction put into analyzing the organization, which depends in turn on the purpose of the analysis.

As a result of the literature review, it was identified that business process models are mainly used either to learn about the process, to make decisions on the process or to develop business process software. Usually, these purposes relate to some extent to some model characteristics. That is to say, some business process models are better suited depending on the specific purpose.

4. Brief description of the process modelling techniques

First, we have to define what a business process is. According to Davenport (1993) processes are defined as “structured, measured sets of activities designed to produce a specified output for a particular customer or market”. There are a lot of other definitions but in core all are the same: processes are relationships between inputs and outputs, where inputs are transformed into outputs using a series of activities. For example, in contrast to Davenport, Hammer (1990) define businesses process as “a collection of activities that takes one or more kinds of input and creates an output that is of value to the customer”. However, an important distinction for the author of this paper is that a business process is related to enterprises, as they define the way in which the goals of the enterprise are achieved and thus they are a subset of the set of processes. According to ENV 12204 (1995) a business process is a partially ordered set of Enterprise Activities which can be executed to realize a given objective of an enterprise or a part of an enterprise to achieve some desired end-result. There are many classifications of business processes too. As an outcome of the research, and literature review the following were found as the most frequently used and therefore they are considered as the main (widely used) techniques. The key characteristics of individually technique are deliberated below.

5. Flow chart technique

A Flowchart is defined as a formalized graphic representation of a program logic sequence, work or manufacturing process, organization chart, or similar formalized structure (Lakin et al., 1996). Basically, it is a graphical representation in which symbols are used to represent such things as data, operations, flow direction, and equipment, for the definition, analysis, or solution of a problem. The Flowchart modelling method uses flowcharts to represent processes. It uses a sequential flow of actions and does not support a breakdown of the activities. The Flowchart model is possibly the first process notation. It has frequently been used over many years although there is no exact date for its origin.

The main characteristic of Flowchart is their flexibility. A process can be described in a wide variety of ways. The standard just gives the notation, but how the different building blocks are put together is up to the designer of the chart. When we look at a flowchart representation, it is easy to recognize the processes it describes. The real strength of the standard is the communication ability. The Flowchart model is very easy to use. It does not take a very long time to draw a sketch of a process. The weakness of the standard is that it is too flexible. The boundary of the process may not be clear. Flowcharts tend to be very big. Already in the evaluation model, the flowchart can be too large. There is also no difference between main and sub-activities, which makes the chart hard to read. Since there are no sub-layers, it is hard to navigate and it is difficult to find information in the chart. Of course it is easier to follow the course of events, but the risk of getting lost is high. Visualizing the process with a flowchart can quickly help identify bottlenecks or inefficiencies where the process can be streamlined or improved.

6. Data flow diagrams—Yourdon’s technique

Data flow diagrams (DFD) are diagrams that show the flow of data or information from one place to another. DFDs describe the processes showing how these processes link together through data store and how the processes relate to the users and the outside world. They are used to record the processes analyses as a part of the design documentation (<http://panoramix.univ-paris1.fr/CRINFO/dmrg/MME/misop025/info.html>) and (<http://threesl.com/data flow diagrams.htm>). A DFD can be seen as a method of organizing data from its raw state. DFDs are the backbone of structured analysis that was developed in the early sixties by Yourdon.

By using DFD, the analyst will be able to specify a process at the logical level. This means that he will be able to describe what a process will do, rather than how it will be done. They are used in discussions between analysts and users as they can be easily understood and verified, and are easy to draw. Each process can be broken down into sub-processes at a lower level to show more detail. They only show the flow of data, not materials. DFD are used in the functional model to specify the meaning of operations and constraints and show functional dependencies. It shows how information enters and leaves the process; what activities change the information; where information is stored within the process, and the organizational function to which the activity belongs. 'Action Diagrams' are a special case of DFD with simpler notation (Goldkuhl and Rostlinger, 1988) and permit a contextual analysis. In this sense, 'action diagrams' represent an exception of DFD because they introduce data concerning the performer, may show both information and material flows, and distinguish between knowledge and information

7. Role activity diagrams—RAD

Role activity diagrams (RADs) are based around a graphic view of the process from the perspective of individual roles, concentrating on the responsibility of roles and the interactions between them (Holt et al., 1983). Roles are abstract notations of behavior describing a desired behavior within the organization. They are often organizational functions. They also include software systems, customers and suppliers. RADs provide a different perspective of the process and are particularly useful in supporting communication. They are easy and intuitive to read and understand presenting a detailed view of the process and permitting activities in parallel.

With careful modelling, RADs might define the degrees of empowerment within the business and can also demonstrate how processes interact. It can even be used to describe how software systems interact RADs are, in fact, object state transition diagrams used in object-oriented models. They describe how a role object changes state as a result of the actions and interactions, which occur.

Disadvantages are that the technique explicitly excludes business objects, which are manipulated by the process, as machines or products. The process is presented as a sequence of activities not letting decomposition of the process, and thus it makes an overview difficult.

8. Role interaction diagrams—RID

Role interaction diagrams (RIDs) are a graph of a process resulting from the combination of RADs and Jacobson's object interaction diagrams (Boma, 1996). Activities are connected to roles in a type of matrix. Activities are shown vertically on the left axis and the roles are shown horizontally at the top. Text and symbols are used together in order to represent the process. Horizontal lines show human interactions (Boma, 1996). Although slightly more complex than flow diagrams, RIDs are fairly intuitive to understand,

easy to read but they tend to be messy, with many arrows pointing left and right and are therefore quite hard to build. Inputs to, and outputs from the activities are not modelled. Therefore, important information is lost. When editing an existing diagram, it can be hard to insert newest activities or roles. When a new activity or a new role is to be inserted, big parts of the diagram have to be moved to allow space. Since each activity is bound to a performer, the responsibilities are well defined and thus the connection to the organization is easy to make. RIDs are not as flexible as flowcharts, for example. They have quite rigid notation. But compared with other modelling techniques, RIDs are nevertheless flexible. Due to their notation and ability to break down activities, very complex processes can be displayed. The best use of RIDs is in workflow design. RIDs are primarily used for processes that involve co-ordination of interrelated activities.

9. Business process modelling notation (BPMN)

In 2004 Business Process Modeling Notation was released as graphical, flowchart-based Business process notation. Notation was released in order to bridge the gap between IT and business analysts. It could be perceived as a recent BP modelling language, but is already widely accepted. The BPMN elements (like activities, events, gateways, flows etc.) in Business Process Diagrams are compliant with most flow-charting notations but offer much more precise flow control semantics. Notably, BPMN is able to model private (internal) processes, public (abstract) processes (Mous et al., 2007) and collaboration (global) process at different levels of granularity. For example, roles (swimlanes in BPMN) may be modelled from either the

perspective of key stakeholders or from an inter-department perspective. Most BPMN models can be mapped to execution code (for example BPEL) which is its main strength over UML activity diagram.

BPMN enables roles to be defined at various levels of granularity through pools and swim-lanes. For example, a business analyst designing BPMN processes may choose to represent the processes across department, or across roles of different departments, or even across companies.

10. Event-driven process chain (EPC)

Aside from BPMN and UML Activity Diagrams, there is the Event-Driven Process Chain (EPC) (Scheer, 1992), which was developed by the Institute for Information Systems (Iwi) at the University of Saarland, Germany. It is a language that is widely used in the ARIS Toolset and the workflow component of the SAP ERP System.

An EPC is simple and easy for non-technical users to pick up. It works as an ordered graph of events and functions and supports parallel execution of processes. A notable feature of EPC is its logical operators (eg. OR, AND, XOR). However, the semantics and syntax of the EPC are apparently not well defined (van der Aalst, 1999, Kindler, 2004.) Because of these limitations and the absence of standardization process, the EPC will not be classified as a Graphical Standard.

11. Gantt chart

A Gantt chart (Aguilar-Saven, 2001) is a matrix that lists on the vertical axis all the tasks or activities to be performed in a process. Each row contains a single activity identification, which usually consists of a number and a name. The horizontal axis is headed by columns indicating estimated activity duration, skill level needed to perform the activity, and the name of the person assigned to the activity, followed by one column for each period in the project's duration. Gantt charts relate a list of activities to a time scale, thus they might be used to represent a process graphically and control its current situation of performance, although its use to analyse a process is limited. They are very simple graphic representations but they do not show clear dependencies between activities.

12. IDEF

The Integrated Definition for Function Modelling (IDEF) is a family of methods that supports a paradigm capable of addressing the modelling needs of an enterprise and its business areas (IDEF, 2003). IDEF's roots began when the US Air Force, in response to the identification of the need to improve manufacturing operations, established the Integrated Computer-Aided Manufacturing (ICAM) program in the mid-1970s. The IDEF family is used according to different applications. The most important parts are: IDEF0, IDEF1, IDEF1X, IDEF2, IDEF3, IDEF4 and IDEF5. However, for business process modelling, the most useful versions are IDEF0 and IDEF3 and therefore they are explained further below.

IDEF0 is a modelling technique used for developing structural graphical representations of processes or complex systems as enterprises. The processes can be further decomposed to show lower-level activities, but at some point the required view may require another notation to portray such things as branch control. These models are composed of three types of information: graphical diagrams, text and glossary. Activity sequencing can be embedded in the IDEF0 model. IDEF1 is used for information modelling, which captures conceptual views of the enterprise's information. IDEF1X is used for data modelling, which captures the logical view of the enterprise's data and is based on an entity relationship model.

It is a design method for logical database. IDEF2 Simulation Model Design method is used to represent time varying behavior of resources in a manufacturing system. Various commercial products and notations have replaced it. IDEF3 Process Description Capture method is used to capture behavioral aspects of a process. It allows different views of how things work within an organization. Unlike IDEF0, IDEF3 has been developed for explicitly describing processes.

13. Colored Petri-net—CPN

Colored Petri nets is a graphical oriented language for design, specification, simulation and verification of systems. It is particularly well suited for systems that consist of a number of processes, which communicate and synchronize (<http://www.daimi.au.uk/PetriNets/tools/quick.html>). Colored nets are extended Petri nets in which symbols are differentiated by "COLORS". A CPN model consists of a set of modules which each contain a

network of places, transitions and arcs. The graphical representation makes it easy to see the basic structure of a complex CPN model, i.e. to understand how the individual processes interact with each other. CP-nets have a formal, mathematical representation with a well-defined syntax and semantics. This representation is the foundation for the definition of the different behavioral properties and the analysis methods. The behavior of a CPN model can be analyzed, either by means of simulation (which is equivalent to program execution) or by means of more formal analysis methods (which are equivalent to program verification). Petri nets were originally developed in the 1960s and 1970s, and they were soon recognized as being one of the most adequate and sound languages for description and analysis of synchronization, communication and resource sharing between concurrent processes. However, attempts to use Petri nets in practice revealed two serious drawbacks. First of all, there were no data concepts and hence the models often became excessively large, because all data manipulation had to be represented directly in the net structure. Secondly, there were no hierarchy concepts, and thus it was not possible to build a large model via a set of separate sub models with well-defined interfaces. CP-nets incorporate both data structuring and hierarchical decomposition without compromising the qualities of the original Petri nets and thus removed these two serious problems.

14. Unified modelling language: UML

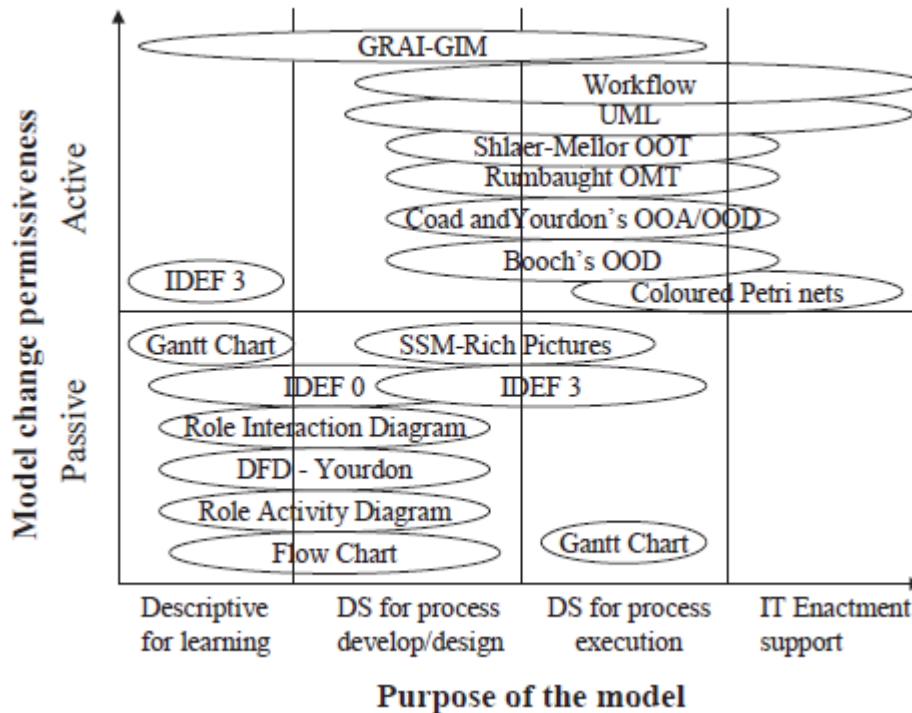
Unified Modelling Language: UML is a language for specifying, visualizing constructing and documenting the artefacts of software systems, as well as for business modelling and other non-software systems. UML uses OO methods for modelling. The UML represents a collection of engineering practices that have proven successful in the modelling of large and complex systems, see UML (2003) and Booch et al. (1999) for further information.

The UML covers conceptual things, such as business processes and system functions, as well as concrete things, such as programming-language classes, database schemas, and reusable software components. The Unified Modelling Language serves as a basis for representing most methods using a common set of modelling constructs and a common notation. It captures the concepts from the OMT, Booch, and OOSE methods, but they hope that other methodologists will adopt it also, so that users can understand models from any method without confusion. The UML can be considered as the standard of the entire object oriented community.¹ The UML consists of nine different diagrams, and each diagram shows a specific static or dynamic aspect of a system: Class diagram, describes the structure of a system. The structures are built from classes and relationships. Object diagram, expresses possible object combinations of a specific class diagram. State chart diagram, express possible states of a class (or a system). Activity diagram, describes activities and actions taking place in a system. Sequence diagram, shows one or several sequences of messages sent among a set of objects. Collaboration diagram, describes a complete collaboration among a set of objects.

15. Classification of process modelling techniques

Practitioners and academics require simple and clear guidelines in order to facilitate the task of choosing the most appropriate technique. This section proposes a classification of the techniques according to their purposes and change model permissiveness. As a result of the analysis carried out, Table 1 was built to present a summary of the above techniques. It is a summary list of the tools in alphabetic order. The table is based on information from Aguilar-Saven (2001) which in turn is based on the information presented by Kettinger et al. (1997a) and completed with information from vendor's Web-based marketing material. The idea is to provide users with a framework that helps them to decide which among the explained techniques, is the one they should apply for a specific case. Process modelling techniques might be used either to develop software that supports processes or to analyze the processes themselves. In both cases sometimes a model is required to describe the process either as a data capture or a presentation exercise. Interactive models are often of great use here. For the software development process, which supports business processes, enact able models are essential for programming. Therefore, uses or purposes of business process models might be divided into four main categories as follows:

- Descriptive models for learning;
- Descriptive and analytical models for decision support to process development and design;
- Enactable or analytical models for decision support during process execution, and control; and
- Enactment support models to Information Technology.



They will constitute the horizontal axis of our framework. Another specific model characteristic is considered important for the present proposal framework always looking to make the framework as general and simple as possible: change model permissiveness. This characteristic pays attention to the level to allow and facilitate model changes. (R.S. Aguilar-Saven (2004))

16. Conclusion and further research

We can say that business process modelling is a much-researched field but is not well-structured nor classified. First of all, there exists considerable confusion on terminology.

There is a need to clarify, classify, organize and structure this field of research.

Also, the above review of techniques used in modelling business processes and Information Systems lead to some interesting observations. Firstly, the various techniques differ significantly in the extent to which they provide the ability to model different business and system perspectives. As we mentioned at the begging of paper, the focus will be on all business process modeling that could be used in ERP implementations, specifically during the blueprint phase of the implementation process. Still it is begging of the research, and now we offer verity of business process modelling methodologies, techniques and tools. Ideally, what might be required is the development of a single, 'holistic' technique that could effectively represent all modelling perspectives in a rigorous and concise fashion, and hence be applicable in all modelling situations. However, when integrating an enterprise, business process modelling techniques and tools cannot in themselves provide 'the solution'. They are an aid to business analysts to design and manage the processes, whose understanding is an essential function of communication and consensus in an enterprise.

In this paper, as a part of PhD thesis, we tried to give a classification framework to aid selection of process modelling techniques based on the purpose and type of model. However, is obvious that further research is required (as a part of PhD thesis) in order to classify the techniques according to other which will meet specifics of ERP system. Further research is required to analyze in detail the available process modelling tools in order to give users a complete description of the purpose, scope and use of each tool. We have to develop specific requirements regarding ERP implementations. This will also provide a comparative assessment and aid in their selection.

Business process modelling techniques							
Technique	Description	Attributes	Characteristics				
				Strengths and Weakness			
		User perspective		Modeller perspective			
		Strength	Weakness	Strength	Weakness		
Flow Chart	Graphic representation	Flow of actions	Not sub-layers Great details No overview	Communication ability	Can be too large	Flexibility quick, simple	No method available Different notations
DFD	Descriptive diagrams for structured analysis	Flow of data	Explains logical level sub-layers	Easy to understand	Only flow of data is shown	Easy to verify and draw	
RAD	Graphic view object state transition diagrams	Flow of individual roles	Detailed view Degree of empowerment	Supports communication Intuitive to read	Not possible to be decomposed	Include business objects	Different notations
RID	Matrix representation of processes for co-ordination of activities	Flows of activities and roles	No overview Inputs to and outputs from are not modelled Performers are included	Intuitive to understand	Important information is not included	Rigid notation Complex processes can be displayed	Difficult to edit an existing diagram Hard to construct
Gantt Chart	Matrix representation	Flow of activities and duration	Relate activities to time	Easy overview representation and control of performance	Not aid for analysis or design	Simple	No clear representation of dependencies
IDEF0	Structural graphical representation, text and glossary	Flows of activities, inputs, outputs, control and mechanisms	Based on SADT Sub-layers The most popular	Shows inputs, outputs, control and mechanisms overview and details	Trend to be interpreted only as a sequence of activities Roles are not represented	Strict rules Possible to build a software Quick mapping	
IDEF3	Behavioural aspects of a system	Precedence and causality relationships between activities	Allows different views Process flow descriptions and object state transition description diagrams Sub-layers	Easy to understand dynamic aspects in a static way	Many partial diagrams to describe a process	Strict rules and notation Possible to build a software	Need lot of data Time consuming when modelling complex systems

Coloured Petri Nets	Graphical oriented language to design, specify, simulate and verify systems	Network of places, transitions and arcs	Extended Petri nets Token are differentiated by colours Hierarchical decomposition	Easy to understand how individual processes interact with each other	Models are excessively large	Formal mathematical representation Well defined syntax and semantics Possible to build a software Data concepts	Time consuming when modelling
Object Oriented Methods	Describe a system with different type of objects	Object's structure and behaviour	Three concepts: objects, classes and messages There are many modelling techniques based on OO	Enactable model to control and monitor processes	Model are excessively large and detailed Fragmented information	Internal consistency across, design, analysis and programming Possible to build a software	Need lot of data Time consuming when modelling Complexity
Workflow	Computerised facilitation or automation of a business process	Flow of information, tasks and procedural rules	Flow of tasks between computers and people Decentralised	Easy to analyse Shorter learning time		Possible build a software Data transfer Easy to make changes	Lack of a particular notation Many languages
Rich Pictures	Contextual representation of things	Represent process human problematic	Represent some of the richness of the process being examined	Support communication and understanding of the process	It is not structured approach	Easy to illustrate components as clients, people, tasks and environment	Lack of a particular notation
GRAI grid and GRAI nets	Descriptive diagrams of the process focused on decisions	Decision making process and flow of activities	Sub-layers Distinction between period and event driven activities	Shows inputs, outputs, control and mechanisms, overview and details	Many partial diagrams to describe a process	Strict rules and notation Possible to build a software	Need lot of data Time consuming when modelling Complexity

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ERP Implementation Methodologies and Frameworks: A Literature Review

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Abstract: Enterprise Resource Planning (ERP) implementation is a complex and vibrant process, one that involves a combination of technological and organizational interactions. Often an ERP implementation project is the single largest IT project that an organization has ever launched and requires a mutual fit of system and organization. Also the concept of an ERP implementation supporting business processes across many different departments is not a generic, rigid and uniform concept and depends on variety of factors. As a result, the issues addressing the ERP implementation process have been one of the major concerns in industry. Therefore ERP implementation receives attention from practitioners and scholars and both, business as well as academic literature is abundant and not always very conclusive or coherent. However, research on ERP systems so far has been mainly focused on diffusion, use and impact issues. Less attention has been given to the methods used during the configuration and the implementation of ERP systems, even though they are commonly used in practice, they still remain largely unexplored and undocumented in Information Systems research. So, the academic relevance of this research is the contribution to the existing body of scientific knowledge. An annotated brief literature review is done in order to evaluate the current state of the existing academic literature. The purpose is to present a systematic overview of relevant ERP implementation methodologies and frameworks as a desire for achieving a better taxonomy of ERP implementation methodologies. This paper is useful to researchers who are interested in ERP implementation methodologies and frameworks. Results will serve as an input for a classification of the existing ERP implementation methodologies and frameworks. Also, this paper aims also at the professional ERP community involved in the process of ERP implementation by promoting a better understanding of ERP implementation methodologies and frameworks, its variety and history.

Keywords: ERP, ERP implementation, methodology, framework, phases, model

1. Introduction

Implementing an ERP system is a major project demanding a significant level of resources, commitment and adjustments throughout the organization. Often the ERP implementation project is the single biggest project that an organization has ever launched (Moon 2007). As a result, the issues surrounding the implementation process have been one of the major concerns in industry. And it further worsens because of numerous failed cases including a few fatal disasters which lead to the demise of some companies. In previous studies can be found that almost 70% of ERP implementations fail to achieve their estimated benefits (Al-Mashari 2006). Although ERP can comprehend many benefits for organization goals are often changed to getting the system operational instead of realizing the goals (Scheurwater & De Swaan Arons 2009). Reflecting such a level of importance, the largest number of articles in literature belongs to this theme. It comprises more than 40% of the entire articles (Al-Mashari 2006). Many of these articles share implementation experiences from various companies. Also, various models of implementation stages and different implementation methodologies are presented. Furthermore regarding ERP implementation will be discussed in next section.

2. ERP implementation in general

ERP implementation is a complex and dynamic process, one that involves a mix of technological and organizational interactions. Unlike other computer applications, ERP has the multidisciplinary scope of enterprise system concepts that requires internal cross-disciplinary coordination. Learners must acquire and understand cross functional processes while implementing and configuring the ERP software (Anderson, Nilson, & Rhodes, 2009). Generally, ERP systems should improve an organization's key performance indicators such as proficiency, efficiency, profitability, customer satisfaction and other measures of value. According to Al-Mashari & Al-Mudimigh (2003) implementing ERP systems in many instances cause dramatic changes that need to be carefully administered to reap the advantages of an ERP solution. In some well-documented cases, spectacular results have been achieved (Johnston, 2002). Failures, however, have been relatively high (Fisher 2004).

However, there have been various definitions of failure of ERP implementation. Failure has been defined as an implementation that does not achieve a sufficient Return On Investment (ROI) identified in the project approval phase. Using this definition, it has been found that failure rates are in the range of 60–90% (Ptak, 2000). Shehab et al. (2004), point out that although organizations spend millions on ERP packages and implementation process, there is extensive evidence that they experience considerable problems, particularly during the actual implementation. Unisource's Worldwide, Inc., a \$7 billion distributor of paper products, wrote off \$168 million in costs related to an abandoned nationwide implementation of SAP ERP software while FoxMeyer Drug, a former \$5 billion drug distributor, went bankrupt in 2006 and has filed a \$500 million lawsuit against SAP (Monk & Wagner, 2006). FoxMeyer accused the ERP giant as a significant factor that led FoxMeyer into financial ruin. Dell Computer Corp. abandoned a much-publicized SAP ERP following months of delay and cost overruns. Dow Chemical, after spending half a billion dollars over seven years of implementing SAP ERP R/2, decided to start all over again on the new SAP platform (new version R/3) (Soh & Sia, 2007). All these cases urge a need for better understanding of ERP implementation process and development (defining) of more rigid and concrete ERP implementation methodology/framework.

3. ERP implementation methodologies

ERP implementation methodologies have similar factors with software development life cycle or framework on developing software. However, the main difference is, in the ERP implementation methodology, we do not talk about how to develop ERP system. We are mainly discussing how to adopt ERP system with the organization (Dantes 2010).

Perhaps the biggest distinction between ERP systems and “traditional systems” is the way they are developed and implemented. Simplified, the traditional way means that the company hires a consulting company, a requirement specification is developed and then the system is developed according to that specification as well as the organizations business processes. Either from an open template or from scratch, all parts are customized to fit the particular business. On the other hand, an ERP is a packaged software application that is bought “off the shelf” (Davenport, 1998). It consists of modules for different business functions such as finance, HRM, accounting and Inventory Management. Instead of the system being created with respect to what the business processes looks like, an ERP is developed independently and it's up to the organization to adapt to the ERP. It's not “plug and play” software and do generally require some degree of customization in order for the organization to enjoy any benefits. Due to these issues, some research has been conducted on creating frameworks for reaching success when implementing an ERP system (Ross & Vitale, 2000).

ERP implementations are modeled in order to structure such a large entity into pieces capable of being controlled, i.e. stages or phases. A similar approach has been used in modeling e.g. software engineering projects. The phases can then be described by the objectives, activities, and stakeholders involved. The implementation models serve as managerial, planning and educational support in ERP implementation process. Several models of ERP implementation methodologies are provided in literature (and in practice) and they vary according to e.g. the number of phases. The phases in ERP implementation frameworks are often counted as between three and six, according to Somers and Nelson (2004).

However, the model of Umble et al. (2003), for example, includes 11 phases and provides practical checklist-type guidance for an ERP implementation. On the other hand, the models of Markus and Tanis (2000) or Parr and Shanks are (2000a) are very general, do not provide any stiff phases of implementation and are merely used in ERP implementation process. Those models are useful in studying, analyzing and planning ERP implementation. It is important to stress out that the selection of ERP implementation method mentioned in this paper is based on the degree of “institutionalization” in the scientific community. Livari and Hirschheim (1996) described six criteria to determine institutionalization: including 1) the existence of scientific journals, 2) scientific conferences, 3) textbooks, 4) professional associations, 5) informational and formal communication networks, and 6) citations.

There are number of different ERP implementation methodologies mentioned and described in literature. However, there is an issue with methodology scope, context and its ambiguity. For example, some methodologies treat the phases before the acquisition of an ERP system, while some methodologies put stress on phases after the ERP system has started to be used (production phase). A board concept of an ERP implementation process covers these after and before phases.

Different authors provide different sequence of phases and diverse naming practice. The preliminary phases are, for example, initiation and requirements definition defined by Kuruppuarachchi (Kuruppuarachchi et al. 2002), project chartering by Markus (Markus and Tanis 2000) and initiative and selection by Makipaa (Makipaa 2003). Verviville and Halington (2003) even present a Model of the ERP Acquisition Process (MERPAP). The phases after the ERP system is put into use are described as termination (Kuruppuarachchi et al. 2002, Makipaa 2003), onward and upward (Markus and Tanis 2000), exploitation and development (Makipaa 2003) enhancement (Parr and Shanks 2000a), acceptance, routinisation, and infusion (Rajagopal 2002) and stabilization, continuous improvement and transformation (Ross 1999). In some cases an ERP implementation concept may cover only phases between the acquisition and beginning of usage of a system, for example, “go live” phase. For instance, Ross (1999) proposed a five-stage model for ERP: implementation, stabilization, continuous improvement and transformation (covering only phases between the acquisition and a production phase of system).

It is obvious that there is no ground based ERP implementation methodology, widely accepted and tested. Even though they are commonly used in practice (ERP implementation methodologies) they still remain largely unexplored and undocumented in Information Systems research domain. Next table summarize list of described implementation methodologies followed by the degree of institutionalization in scientific community.

Author(s)	ERP implementation model
Bancroft et al. (1998)	(1)Focus, (2)Creating As – Is picture, (3) Creating of the To-Be design, (4) Construction and testing and (5) Actual Implementation
Kuruppuarachchi et al. (2000)	(1) Initiation, (2) Requirement definition, (3) Acquisition/development, (4) Implementation, and (5) Termination
Markus and Tanis (2000)	(1) Project chartering, (2) The project, (3) Shakedown, and (4) Onward and upward
Makipaa (2003)	(1) Initiative, (2) Evaluation, (3) Selection, (4)Modification, Business process Reengineering, and Conversion of Data, (5) Training, (6) Go – Live, (7) Termination, and (8) Exploitation and Development
Parr and Shanks (2000a)	(1) Planning, (2)Project: a. setup, b. reengineer, c. design, d. configuration and testing, e. installation (3) Enhancement
Ross (1999)	(1) Design, (2) Implementation, (3) Stabilization, (4) Continues improvement and (5) Transformation
Shields (2001)	Rapid implementation model of three phases and 12 major activates
Umble et al (2003)	(1) Review the pre-implementation process to date, (2) Install and test any new hardware, (3) Install the software and perform the computer room pilot, (4) Attend system training, (5) Train on the conference room pilot, (6) Established security and necessary permissions, (7) Ensure that all data bridges are sufficiently robust and the data are sufficiently accurate, (8) Document policies and procedures, (9) Bring the entire organization on – line, either in a total cutover or in a phased approach, (10) Celebrate, and (11) Improve continually
Verviville and Halington	(1) Planning, (2) Information search, (3) Selection, (4) Evaluations, and (5) Negotiation

4. Bancroft model

Bancroft et al. (1998) presented a view of the implementation process which was derived from research provided from discussions with 20 practitioners and from studies of three multinational corporation implementation projects. The Bancroft et al. (1998) model has five phases: focus, as is, to be, construction and testing, and actual implementation. The “focus” phase could be seen as a planning phase involving the setting-up of the steering committee, selection and structuring of the project team, development of the project’s guiding principles, and creation of a project plan. The “as is” phase includes the analysis of current business processes, installation of the ERP technology, mapping of business processes on to the ERP functions, and training the project team. The “to be” phase entails high-level design, and then detailed design which is

subject to user acceptance, followed by interactive prototyping accompanied by constant communication with users (The Bancroft et al., 1998).

5. Kuruppuarachchi model

Kuruppuarachchi analyzed differences of opinion among educators and practitioners on strategic emphasis and implementation methods. For Kuruppuarachchi implementation of IT projects, especially large IT projects, is synonymous to management of changes in an organization. When formulating effective change management strategies to support the introduction of IT, Kuruppuarachchi suggested that it would be useful to integrate concepts and practices drawn from disciplines such as traditional project management, organizational/product innovation, and change management theory and practices. His work examines project management and product innovation literature to identify change management concepts and practices. Phases proposed by him are (1) Initiation, (2) Requirement definition, (3) Acquisition/development, (4) Implementation, and (5) Termination (Kuruppuarachchi, 2006).

6. Makipam model

Makipaa described a model of ERP implementation that involves 10 stages and presents an alternative implementation path. These 10 stages are initiative, evaluation, selection, business process reengineering, modification, training, data conversation, go-live, termination and the last one is exploitation and development. In his work he suggests the use of the human-centered dimension in measuring the human centeredness of the ERP system at the early ERP implementation stages such as initiative, evaluation and selection stages (Mäkipää, 2003).

7. Somers et al. (2000) framework

Framework proposed by Somers et al. (2000) includes contextual factors such as industry type, size, structure, which are critical in achieving positive outcomes from ERP acquisitions (implied by researchers). The Somers et al. framework is shown in Figure 1. He is suggesting that the value that adopting organizations would obtain from their ERP software could depend on the extent to which there is a match between the process, contexts, and contingency factors. Somers et al. (2000) framework is rooted in the contingency approach. Somers proposed those implementation phases: Initiation, Adoption, Adaptation, Acceptance, Routinisation, and Infusion.

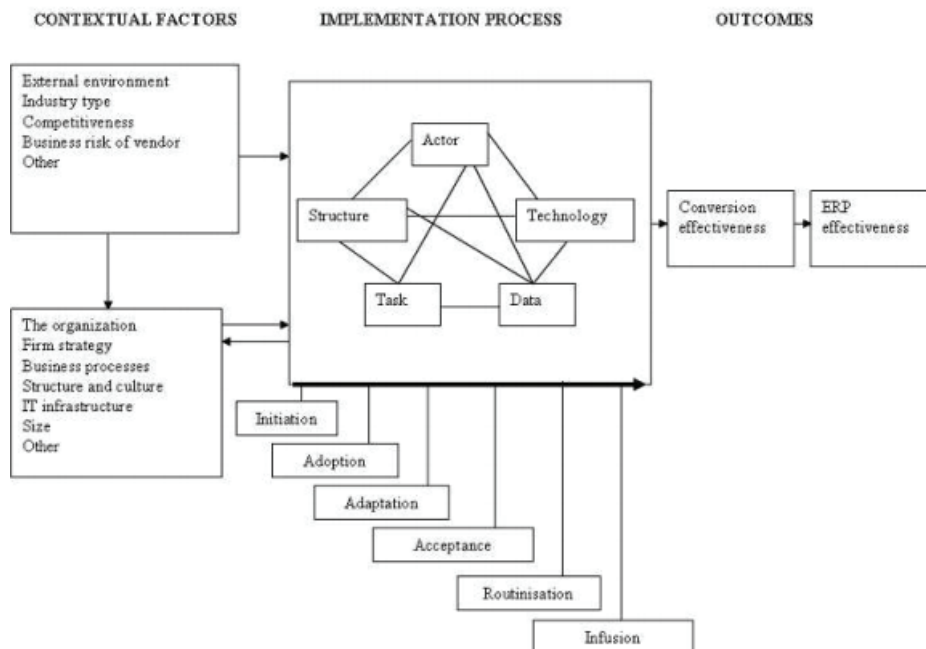


Figure 1: Somers et al. (2000) contextual framework

8. Prisoner escape framework

The study conducted by Ross and Vitale (2000) includes data from 15 different organizations that had gone live with one of the leading ERP packages. Annual revenues for the companies varied between \$125 million to \$25 billion. The implementations were either company-wide or limited to one major division. All ERP implementation included a manufacturing module and a combination of finance, sales and marketing (and other modules). Out of the 15 companies, 8 had deployed SAP. The project lengths varied from one to five years and the total project cost varied from \$2 million to \$130 million. The study resulted in a classification of five different phases in an ERP implementation; design, implementation, stabilization, continuous improvement and transformation.

Design	Implementation	Stabilization	Continuous Improvement	Transformation
Standardization?	Form project team	Clean up process	New modules and/or add-ons	One with system
Customization?	Installation	Additional Training	Organizational changes	External integration
	Training	Fine-tuning		

Figure 2: Summary of phases and activates in the Prisoner Escape framework (Ross & Vitale, 2000)

9. Project phase framework (Parr and Shanks (2000a))

The model framework proposed by Parr and Shanks (2000a) is based upon a synthesis of five previous frameworks. The result is a three-tiered Project phase model (PPM) that distinguishes between planning, project and enhancement. The focus of the model is in the project-phases, which has been divided into five sub phases; Set up, Re-engineer, Design, Configuration and testing and finally Installation. Since the PPM is concerned with helping to achieve a successful implementation, different CFS's are added to the different phases to facilitate the project being done in time and on budget. Important to note is that this concept of success differs from those frameworks that measure success in terms of business contribution from the ERP. To establish which CFS's that were crucial in each phase of the PPM; a multiple case study with two cases was conducted where at least five stakeholders in each organization participated. Below are the phases described as well as which activities and CFS's they each contain:

Phases	Set-up	Re-engineering	Design	Configuration & Testing	Installation
Activities	Set-up project team	Analyze processes	High-level design	System tuning	Networks
	Set guidelines	Process-System mapping	Prototyping	Real data testing	Desktop
		Initial Training	User interaction		Training & Support

Figure 3: Activities in project phases (Parr & Shanks, 2000a)

10. Enterprise system experience cycle framework

The four-stage model of Markus and Tanis (2000) is consisted from: (1) "charting", which comprises decisions leading to the funding of a system, (2) "project", which comprises activities intended to get the system up and running in one or more organizational units, (3) "shakedown", which relates to the organization's coming to grip with the enterprise system, and (4) "onward and upward", which continues from normal operation until the system is replaced with an upgrade or a different system (Markus & Tanis 2000). The four stage model was adopted here for two reasons. First, it is deemed more comprehensible from practitioner's perspective; second, existence of stage-dependent success indicators in addition to overall success will help provide greater insight.

The framework includes a pinpointing of problems during specific phases of the implementation and how the success is measured. Validity was ensured by having a large number of respondents and also collecting the data in different ways. In-depth Case studies were conducted with representatives from five companies that just finished or were in the process of finishing a roll-out of an ERP system. In addition, 11 other companies in the same situation were interviewed as well as 20 ERP consultants and vendor representatives (Markus & Tanis 2000).

Phases	Project	Shakedown	Onward & Upward
Activities	Expenditure planning	Transition	ERP as natural part
	Developing enterprise model	Adapt to new system	ERP to aid process improvement
	Customization	Configuration	
	Design & execute processes	Revise processes	
	Training	Further training	
	Installation		

Figure 4: Summary of phases and activities in the ERP experience cycle (Markus et al., 2000)

11. Davies framework

Davies (2009) presented information system implementation stages which are concerned with a number of key activities in the process. In addition, this information system implementation process concept is similar to O'Brien (2004) who explained a five-step process called the information systems Frame of Reference development cycle which includes the steps of: (1) investigation; (2) analysis; (3) design; (4) implementation; and (5) maintenance (see Figure 5). The first phase of information system development process is systems investigation or system conception which is aimed to determine how, based on informatics planning and management, to develop a project management plan and obtain management approval. Systems analysis is focused on identifying the information needs and developing the functional requirements of a system. Systems design is the process of planning a technical artifact and developing specifications for hardware, software, data, people, and network. In addition, this phase involves building the information system to its specifications. System implementation involves delivery of systems, testing the system, training people to use the system, and converting to the new business system. Finally, system maintenance is the process of making necessary changes to the functionality of an information system (O'Brien, 2004; Davies, 2009).

Phases	System Investigation	System Analysis	System Design	System Implementation	System Maintenance
Comment	Understand the Business Problem or Opportunity	Develop an Information System Solution	Develop prototype, test and provide user training	Implement the Information System Solution	Production support and implementation of system's add-ons

Figure 5: Information system development cycles (source: O'Brien, 2004: p. 345)

12. Umble framework

The author has compiled a list of 11 recommended steps for a successful implementation. These steps have been integrated from several works (G. Langenwaller, 2000). Umble proposed those activates in ERP implementation process. First is review of the pre-implementation process in order to make sure the system selection process has been satisfactorily completed and all factors critical to implementation success are in place. Second is to install and test any new hardware before attempting to install any software. It is essential to make sure that the hardware is reliable and is running as expected (Umbel, 2003). Third is the installation of the software. Fourth is system training. Software training will teach users the keystrokes and transactions required to run the system. Fifth is training on the conference room pilot. The conference room pilot exercises the systems and tests the user understanding of the system. The project team creates a skeletal business case test environment which takes the business processes from the beginning, when a customer order is received, to the end, when the customer order is shipped (Umbel, 2003).

Sixth is establishing of security and necessary permissions. Once the training phase is finished, during the conference room pilot, begin setting the security and permissions necessary to ensure that everyone has access to the information they need. Seventh step is to ensure that all data bridges are sufficiently robust and the data are sufficiently accurate (Umbel, 2003). The data brought across from the old system must be sufficiently accurate for people to start trusting the new system. Eighth phase is to document policies and procedures. The policy statement is a statement of what is intended to be accomplished; the procedural steps to accomplish that statement may be detailed in a flowchart format. Ninth step is to bring the entire organization on-line, either in a total cutover or in a phased approach. In a "cold turkey" approach, the whole company is eventually brought onto the new system. The entire company prepares for the cutover date, which would preferably be during a plant shutdown of one to two weeks. In a phased approach, modules/products/plants are brought on-line sequentially. After the first module/product/plant is live, procedures may be refined and adjusted, and then the remaining modules/products/plants are sequentially

implemented. The phased approach may allow for improvements to be made during the implementation (Umble, 2003).

13. Zmud implementation stage framework

The implementation and performance stage model (Cooper&Zmud, 1990) is a useful tool for understanding the implementation of the ERP technology and provides six stages: initiation, adoption, adaptation, acceptance, routinization and infusion. This six-stage model sets the framework to investigate the implementation and performance issues of utilizing an ERP system within an organization. The initiation stage analyzes the factors that influence the decision to utilize an ERP system such as incompatibility, need for connectivity, top management vision, and need to change. Implementation issues are addressed in the adoption and adaptation stages including: investment decisions, cost/benefit analysis, and choice of appropriate technology (Cooper&Zmud, 1990). Implementation and performance measures such as system modifications, training, integration of functional units, enhanced performance, user acceptance, flaws corrected, and organizational integration realized, are identified during the acceptance and routinization stages. Finally, the infusion stage addresses future innovations including IT integration at global levels and future opportunities (Cooper&Zmud, 1990).

14. Conclusion

As several authors (Markus et al., 2000; Parr and Shanks, 2000) have stated, the implementation process of an ERP system is best conceptualized as a business project rather than the installation of a new software technology. The ERP implementation literature has provided a solid theoretical background. However, this brief review of literature suggests that there seems to be insufficient research investigation on current/proposed ERP implementation methodologies by various authors. Context and scope regarding proposed ERP implementation methodologies profoundly differs. Number of implementation phases varies from three till eleven. For example, some methodologies treat the phases before the acquisition of an ERP system (and are focused on it), while some methodologies put stress on phases after the ERP system has started to be used (production phase). Also, as mentioned in paper, different authors provide different sequence of phases and miscellaneous naming practice (there is no any widely accepted phase nomenclature). Further in-depth research seems justified here in order to provide useful information for academicians and practitioners for better understanding of ERP implementation process and classification of ERP implementation methodologies.

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Role of IS in Brazilian SMEs: Management Perception and Impact on Results

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Abstract: In this competitive environment globalized that we live nowadays there is a growing recognition of the central role of Information Systems (IS) to determine the success of the company, leading to better results. SMEs have also adopted IS with the same purpose, obtaining benefits of such use, but their reality is quite different in most cases of the large enterprises, especially for lack of the same resources and skills in the IS field. From the requirement imposed by the Brazilian government for all companies to submit their tax information digitally, according to a law approved in 2007, the Brazilian SMEs have also had to seek a better and greater informatization. As companies are in different kind and stages of informatization, and especially also because IS play a different role in each company, this study aims to determine the impact of this requirement and consequent greater informatization on the company's results. The study seeks to capture the differences in the outcome of the company arising from the use of IS, and for this observes financial data, taking into account also the executive's perceptions about the role that IS play in business. The methodology involves a survey to obtain quantitative data about the use of IS and also financial information, as well as qualitative data about the executive's perception of the role that IS play in business. The preliminary results show that the perception of the majority of the managers of the companies surveyed is that the Information Systems present in the company, as well as the portfolio of systems in development have a strategic impact for the company. Especially regarding to customer loyalty, to increase the barriers of entry for new competitors, and for better balance of power in the supply chain; factors that can improve the performance of the company bringing best results. The findings may contribute to the growing field of study of Information Systems in SME's, as well as can help SME's managers to examine and make better decisions regarding the use of Information Systems.

Keywords: information systems (IS), SMEs, IS role, perception of informatization stages, firm performance

1. Introduction

As we can see in several previous work (Kim and Utterback 1983, Foster and Flynn 1984; Barley 1990) IS has always been a central variable in organizational theory, and their use by companies has intensified, as indicated by the increasing spending. In Brazil, the total annual expenditure and investment in IS by companies, when measured as a percentage of revenue, grew at an average rate of 7.2% per year from 1988 to 2012 (Meirelles, 2013).

Also a central issue regarding the IS use by companies is whether such practice leads to improved performance, topic already studied by several authors (Melville, Kraemer and Gurbaxani 2004; Gilley and Rasheed 2000; Lozinsky 2008; Greaver 1999), but with controversial results, since some studies show positive results, while others say there is no relationship, or even that the results are negative, having space for better understanding.

As said Orlikowski (2000), both organizations and technology has undergone dramatic changes in the shape and function, and hence it is also imperative to change in the forms of management and evaluation.

This view is also shared by Nolan and McFarlan (2005), for whom the dizzying pace of change in the world of technology, and the changes IS can force upon a business, are raising IS matters to a high degree of importance.

Similarly, Albertin (2010) shows that organizations in this new reality became virtual in a fully interconnected environment, which has required significant changes in the organizational guidelines, including their structure and rules of authority and responsibility.

An even greater complexity is found when analyzing small and medium enterprises (SMEs), that despite playing an important role in economic and social development worldwide, can't be seen with the same lenses used for the large company (Devos, Landeghem and Deschoolmeester, 2012).

From these changes and also factors such as the growing digital business environment, with new laws created by governments that force small businesses to computerize, the IS providers increasingly seeing small and medium businesses as potential prospects; we also found several academic papers that seek a greater understanding of this topic in small and medium enterprises (Southern and Tilley, 2000; Baines, 1999; Stanworth, 1998; Stroeken and Dierckx, 1999, Fuller, 1996).

In Brazil, there are also some studies investigating the effect of IS use by small and medium Brazilian companies, such Gill (1994), studying the service sector.

According SEBRAE - Brazilian Service to Support Micro and Small Enterprises (2014), the rate of entrepreneurship in Brazil has increased consistently in comparison to other countries, and in 2010 had more than 21 million Brazilians ahead of entrepreneurial activities, which means also small and medium businesses.

This work aims to contribute to the growing field of study of IS use by small and medium enterprises, and how this can affect your performance and consequent competitiveness.

The main objective of this work is to verify the relationship between IS investments and firm performance, mediated by the managers perception on the role that IS plays in business.

2. Literature review

2.1 IS and competitiveness

The concept of Information Systems (IS) is more comprehensive than the data processing, software, computers or set of hardware and software engineering, since it also involves human, administrative and organizational aspects (Keen, 1993).

As the Henderson and Venkatraman (1993) vision, the term for us Information Systems (IS) covers the technical aspects, the use of hardware and software, telecommunications, automation, multimedia features, used by organizations to provide data, information and knowledge (Luftman and Brier, 1999; Weill, 1992) as well as issues related to workflow, people and information involved.

IS has evolved from a traditional orientation of administrative support to a strategic role within the organization. We can see the evolution of the importance of IS area looking at the rapid development of this technology in business, as shows Meirelles (2013), more than 50% of total capital expenditures by U.S. companies have been in IS; in large Brazilian companies, it is estimated that this figure is above 45% and growing.

According to Mata, Fuerst and Barney (1995), although the concept that Information Systems is a powerful weapon of competitiveness be emphasized enough, not always the sustainability of this competitive advantage is well explained. With the support of the resource-based view theory, the authors developed a model to analyze the subject and conclude that only what gives sustainability for this competitive advantage is the expertise in IS management.

Combining arguments from the resource-based view theory, with the command and control theory in organizations, Ravichandran et al. (2009) developed research along the U.S. industries, and also concluded that IS investments contribute to improved business performance.

Also contributing to a better understanding, Lin (2007) did an interesting study with 155 banks, which, confirming the resource-based view theory, shows that the IS ability in the companies studied involves the creation of value and performance, the author shows that the IS ability can be an important tool for creating economic value.

On the other hand, there are also studies that question whether IS has the ability to create value for the company, as shown by Mooney, Gurbaxani and Kraemer (1996), who claim there is little evidence that this value creation exists. The authors also question the approaches that are made to study this relationship, even proposing a new approach to conceptualize the IS impact on firm value, which they say offers a new perspective and a practical guide to review the creating value of the business.

Given this lack of consensus on the IS effect in the company results, in this paper we seek to contribute to a better understanding about the subject in a special way for the Brazilian SME's.

2.2 Performance measures in organizations

Although performance is a key concept in various theoretical perspectives such as resource-based view, or management teams, and even be used in several academic studies, in fact there is no consensus about what is performance, as shown by Glick, Washburn and Miller (2005).

In the same vein, Carneiro and Dib (2006) tell us that the empirical results on the determinants of corporate performance have been conflicting, among other possible reasons, due to inappropriate approaches used to conceptualize and measure the phenomenon.

In the same direction also claim Neely, Gregory and Platts (2005), that performance measurement is a widely discussed topic, but rarely defined. Literally, it is the process of quantifying action, where measurement is the process of measuring and action leads to performance.

Some scholars of strategic management have provided examples of differing definitions of performance, such as: "profit maximization, or more precisely, the present value." (Jensen and Meckling, 1976); or "high for extended periods of time returns" (Wernerfelt, 1984); or "rate of return on assets" (Rumelt, 1991); or "simple results based on financial indicators" (Venkatraman and Ramanujam, 1986), or "the value that an organization creates using their productive assets compared with the value that the owners of these assets expect to get" (Barney, 2001).

How also reinforce Venkatraman and Ramanujam (1986), although performance is a recurring theme that interests both administrators and scientists, the definition of what performance is also one of the thorniest issues in academic research. Increasingly there is a growing body of literature addressing the topic, which does not leave us much hope of reaching some agreement or consensus on basic definitions and terminology.

Still the same authors present a model of scope covered by the performance of the firm, where the narrower concept of financial performance is based on financial indicators (sales growth, profitability expressed by return on investment, return on sales) reflecting compliance with the financial goals of the firm.

However as shown in Chakravarthy (1986), to measure performance there are some key measures, but does not seem to be true that a single measure can properly evaluate the performance, hence the suggestion of the author of adopting a multidimensional factor.

As in the study published by Bharadwaj, Bharadwaj and Konsynski (1999) on how IS contributes to firm performance, once again we see financial indicators serving to measure performance in this case Tobin's Q was referenced as a good measure, and authors conclude that IS investments contributes to better financial performance.

With similar reasoning, Wernerfelt and Montgomery (1988) in his work on the importance of focus to business performance also use Tobin's Q to measure performance.

Within those divergent ways of seeing what is performance, the work of March and Sutton (1997) brings us interesting perspectives. They show that many studies of organizational performance defines performance as a dependent variable, and seek to identify variables that produce variations in performance, but the authors do not take into consideration various complications such as instability of competitive advantage coming of better performance, and the environment complexity as a whole.

The authors further argue that such complications are well known by whom studies the subject, but nevertheless the most continue using this pattern due to the organizational research context itself; that on the one hand demand and reward speculation about improving organizational performance, and on the other hand demand and reward rigorous adherence to academic research standards.

Likewise, Brito (2007) states that business performance is still a construct in search of a more precise and consensus definition among researchers. For the author one of the central questions is dimensionality, and consequently how to measure each of performance dimensions. From research with Brazilian managers, the author concludes that the financial performance scale ends up being the most studied.

Through empirical work that analyzes 252 Brazilian companies results from 1998 to 2001, Brito and Vasconcelos (2004) conclude that both higher as lower performance is common; and still warn that the business performance, contrary to the neoclassical economic model predicts, shows great heterogeneity.

For Neely, Gregory and Platts (2005) already mentioned, the performance can be measured in relation to several factors: quality, time, cost and flexibility.

According Coppeland, Koller and Murrin (2004), the increasing shareholders importance in most developed countries has led a growing number of managers to focus on value creation as the most important measure of corporate performance. In this respect, the evidence points that the concentration on firm value is significant not only for shareholders but also for the economy and other stakeholders.

How Ceolin also argues (2006), information is the basic input in the decision making process of assets investment; and in the last decades, the creation of value and corporate performance has become cause for concern at all levels of the market.

Also Melville, Kraemer and Gurbaxani (2004) relate the value of the IS impact on organizational performance, including improved productivity, improved ability to make profit, cost reduction, competitive advantage, inventory reduction, and other performance measures. The authors cite as examples of metrics to measure the organizational performance associated with the IS use, the following criteria: customer satisfaction, inventory turnover, on-time delivery, reduced costs, increased revenue, competitive advantage and company market value.

In this paper is adopted as measure of performance the financial performance dimension, as Lefebvre; Mason and Lefebvre (1997) did, because it is a widely accepted measure and easy to measure, we will consider information on revenue and net profit.

2.3 SMEs

Small and medium sized enterprises plays an important role in the economic and social development around the world, and many studies point that we could not want to analyze this type of company with the same lenses used to analyze large corporations (Devos, Landeghem and Deschoolmeester, 2012; Southern and Tilley, 2000; Baines, 1999; Dierckx and Stroeken, 1999; Ballantine, Levy and Powell, 1998; Stanworth, 1998; Fuller, 1996); and in the case of Brazilian companies like the work of Prates and Ospina (2004) that also contributes in the same way.

There are several qualifications of what is micro, small or medium enterprises, varying in terms of number of employees and revenue (Devos, Landeghem and Deschoolmeester, 2008; European Comission, 2003), and SEBRAE - Brazilian Service to Support Micro and Small Enterprises also classifies associating the time of existence of the company, calling TEA - Rate Initial Stage Entrepreneurship (SEBRAE, 2014), and shows interesting relationship between the lifetime of the company and the use of current technologies.

Baines (1999) presents interesting work which examines the role of technology in very small companies, often consisting of a single person, even using telework, working in virtual organizations, as already mentioned by Albertin (2010) and Stanworth (1998).

Still in the SMEs context Lefebvre, Lefebvre and Mason (1997) demonstrate the power of the CEO perception on the environment of the company for setting technology policy, and how it brings a moderating effect on the company's results.

The Southern and Tilley (2000) research also follows the path of pointing the main determinants of technology adoption in SMEs, and once again we see the importance of the perception of the owner or CEO, on the role that technology plays as important factor in the company.

3. Perception of informatization stages and IS role

Through literature review we can find several approaches to the Information Systems role in organizations, such as diagnostic models, that provide tools and criteria for diagnosed about the IS role in organizations. This category include: Centralization and Decentralization of IS Analysis (Buchanan and Linowes, 1980 and Donovan, 1988); Intensity of Information Matrix (Porter and Millar, 1985); Relationship between IS Investments and Organizational Performance (Byrd and Marshall, 1997; Mahmood, 1993); The Strategic Alignment Model (Henderson and Venkatraman, 1993; Luftman, Lewis and Oldach, 1993).

In this group, there are works such as Nolan (1979) Stages of Informatization on Enterprise, which proposes 6 stages - Initiation, Contagion, Control, Integration, Data Administration and Maturity.

And also the model proposed by McFarlan (1984), with their strategic grid of impact of IS applications, that allows to view how is the relationship of IS and the business strategy and operation. This model analyzes the impact of current and future IS applications in business, defining four "quadrants" that represent the company situation, with the following settings:

"Support": IS has little influence on the current and future business strategies. No need for prominent positioning of IS area in the company hierarchy. Is usually what happens in a traditional manufacturing.

"Factory": existing IS applications contribute decisively to the success of the company, but are not provided for new applications that have strategic impact. The IS area should be positioned at a high hierarchical level. The classic example is the case of the airlines companies, which rely on their systems to booking tickets, but new developments are just for update those applications.

"Transition": IS area moves from a more discreet position (quadrant "support") for a greater emphasis on company strategy. The IS area tends to a position of greater importance in the company hierarchy. The example usually cited in the bibliography is the desktop publishing. Today, e-commerce has the same profile, beginning as a supporting role in the commercial operation of an enterprise, becomes a transforming agent of the business.

"Strategic": IS has a great influence on the overall company strategy. Both current and future IS applications are strategic, affecting the company's business. In this case, it is important that IS area is positioned on the high level of the company hierarchical structure. In banks, for example, IS presents this strategic role.

In this work is adopted the concepts of those two authors, Nolan and McFarlan, applied to the context of the Brazilian SMEs, especially "The IS Strategic Impact Grid" (Nolan and McFarlan, 2005).

This choice is due to the fact that we believe that the combination of these concepts (level of maturity in the IS use and IS role in the business), combined with the level of IS spending can point interesting patterns, indicating better practices to obtain better results from the IS use.

4. Methodology

The methodology adopted involves survey application to obtain quantitative data about the IS used and financial information of the company; as well as qualitative data on the perception of executives about the role that IS plays in business.

Based on the understanding of Orlikowski and Baroudi (1991) proposal, this work is part a positivist perspective, premised on the existence of a phenomenon (the IS use by businesses) associated with an

outcome (company performance), which will be investigated with a pre-defined instrument (questionnaire), perspective that has been dominant in the IS study field.

However, it is also adopted one interpretive perspective, which assumes that people create and associate their own interpretations as they interact with the world around them (perception of managers regarding the Information Systems role in their companies).

As discussed by Piccoli and Ives (2005), the importance of the research focus in a specific initiative of IS as unit of analysis can help minimize the effect of other variables on the outcome, in this work the IS initiative as focus is the requirement imposed by the Brazilian government for companies to submit their tax information in digital form.

5. Data collection

Data is being collected through questionnaires sent electronically to managers of Brazilian SMEs (maximum of 160 employees), since December of 2013.

The collect of questionnaires is being made from different fonts, such as GVcev - Center of Excellence in Retail of EAESP / FGV; SEBRAE - Brazilian Service of Support for SME's.

The questionnaires are composed of two distinct parts, a first one with the purpose of collecting cadastral data, as well as figures on their financial performance in the last four years (2010-2013), like Meirelles (2013). And the second part consists of six questions to find out the managers perception about the IS role in business, with development process according Moore and Benbasat (1991) proposal.

6. Data analysis, results and discussion

This paper aims to test some hypotheses concerning to the use of Information Systems and business performance, having as variables the perception of the IS role in the company, the level of maturity in the use of IS, as well as the volume of spending in Information Systems.

To achieve this result it is intended the use of cluster analysis technique in accordance with Hair et al. (2009), dividing the companies in different groups, and checking the performance of each group according to the chosen variables.

As this work is part of a Phd research in progress, preliminary results show that the managers perception of most of the companies surveyed is that the IS existing in business, as well as the portfolio of IS development represent strategic impact; particularly with regard to customer loyalty, increased barriers to entry, and better balance of power in suppliers relationships.

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The use and Challenges of Cloud Computing Services in SMEs in Nigeria

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Abstract: This research paper aims at understanding the potential impact of cloud service usage in Nigeria. Currently, cloud computing is gaining a high rise in its acceptability among business organisations in Nigeria due to its affordability and its importance in competitive advantage and operational benefits. Many researchers have predicted that cloud computing will breach the gap between developing and developed countries. Small and Medium Scale enterprises (SMEs) in Nigeria are making frantic efforts not to be left out of the benefits associated with the use of the technology. In recent time, SMEs play a critical role in the economic development of the country with about 70% of the working population employed by them and 50% of the GDP generated by SMEs. In summary, this research paper is based on focus group discussion and analysis on the adoption, usage and challenges of cloud services in SMEs in Nigeria as well as questionnaire distribution to SMEs which were selected based on International Standard Industrial Classification (ISIC). Similarly, it looks at the current state of cloud usage in SMEs in Nigeria delving into the possible barriers and challenges being faced by cloud computing adoption by SMEs such as infrastructure, government policies, security, trust of users, reliability, payment, service providers etc. Using Nigeria as a case study, the findings of this research will further be used to design a framework for aiding government of developing countries to evaluate and control cloud services for SMEs.

Keywords: cloud services, SMEs, internet, Nigeria, challenges

1. Introduction

Cloud computing generally refers to the application delivered as a service over the internet as well as the hardware and software in the datacentre where these services are being provided. According to Haag and Cumming (2010) Cloud computing is a technology model in which any and all resources application software, processing power, Data storage, back-up facilities, development tools etc. Literally, everything is delivered as a set of services via the internet. However, Calheiros et al (2009) in their own perspective suggest that cloud computing delivers infrastructure platform and software (applications) as services which are made available as subscription based services in a pay as you go model to consumers. Against the above background, it can be seen that many researchers view cloud computing differently but from the concept of cloud computing they are all right. This is because no specific definition has been accepted for cloud computing but the most generally accepted globally is that proposed by the United States National Institute of Standard and Technology(NIST) which states that "Cloud computing is a model for enabling ubiquitous ,convenient, on-demand network access to shared pool of configurable computing resources (E.g. networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or services provider interaction"(NIST, 2011).

Notably, one of the biggest opportunities of cloud computing is in its potential to help organisations in developing countries to achieve full benefits of information technology without the significantly huge upfront investment that have jeopardised past efforts. It is believed that cloud computing might have a similar effect on computing as the effect of mobile phones in communication which allows the government and local firms to benefit tremendously from the effective use of information technology (Marstona et al, 2011). Another great opportunity is for small and medium scale enterprises to exploit high-end applications like ERP software or business analytics that were unavailable to them due to financial constraints (Tucker, 2009). The advancement in technology around the world most especially in developed countries has brought about a new wave of technology adoption in developing countries.

Nigeria as a developing country located in sub-Sahara Africa with a population of over 150 million people, rich in human and natural resources and a giant in information and technology advancement. In Nigeria, 70% of the countries employment is generated by SMEs (Aina, 2007). Odeyemi (2003) further refers to SME's in Nigeria as a diverse group of businesses that operate in different sectors of the economy and accounts for about 50% of the country's Gross Domestic Product (GDP). According to Ongori and Migiro (2010) the use of

technology in SMEs can assist in promoting SME competitiveness, due to the high competitive nature of businesses today; SMEs are compelled to adopt technology in order to stay strong in the competitive business environment and this is why the implementation of a technology that will sustain the SMEs and bring about an optimum production level cannot be overlooked.

2. Definition of SMEs

SMEs are a very important entity in any country; they play a critical role in the economic development of every country. However, there is no universal definition for SMEs as the definition is dynamic and is viewed based on a country's level of development (Aruwa & Gugong, 2007). Different researchers view SMEs in various ways. According to Jutla, Bodorick & Dhaliwal (2002) even though SMEs vary from country to country, they are defined based on certain criteria which are value of assets, employment and the use of energy. The views of Rahman (2001) is in agreement of that of Jutla, Bodorick & Dhaliwal (2002) but Rahman (2001) went further to elaborate on the criteria and added some other factors such as location, size, age, structure, number of employees, sales volume, worth of assets, ownership, innovation and technology. On the contrary, Aruwa & Gurong (2007) attribute SMEs to be based on the role SMEs are expected to play in a particular economy.

Looking at SMEs from a worldwide perspective, Bolton committee (1971) described SMEs as small firms and went further to define a small firm as an independent business, managed by its owner or part-owner and having a small market share. It recognizes size as a very important factor to the sector by noting that a given firm may be small in size where the market is large and many competitors. However a firm of similar size may be considered as large in another sector with fewer players or smaller firms within that sector. It further attributes the number of employees as an alternative measure of size as well as use of turnover in others. The committee stressed the need to view SMEs according to the number of full-time employees or its equivalent when looking at SMEs from a government perspective (Lukacs, 2005).

2.1 SMEs in the United States, Canada and United Kingdom

The United States of America which has the world's largest economy depends on SMEs for "Innovation, productivity and employment (SBS Report, 2000). SMEs represent: about 99% of employers, with 51% from the private sector; 38% from hi-tech occupations; provides 75% of new jobs from the private sector; and 96% of exported goods (Twist, 2000). Based on findings from Net impact study Canada (2002) SMEs account for 60% of the country's economic output, generates 80% of new jobs and creates 85% of new jobs. In the United Kingdom SMEs account for 99.8% of businesses including those without employees, 55.6% of employment and 52.0% of turnover (ODPM, 2005).

2.2 SMES In the developing world

The International Corporation sees developing countries almost generally comprised of private SMEs and also sees them as the only realistic employment opportunity for millions of poor and underprivileged people globally. Some researchers explained that a section of SMEs in developing countries remains in traditional activities with a general low level of productivity, low quality products serving small localized markets. The International Corporation stated that SMEs generally possess few graduate staff with skills in modern technologies.

2.3 SMEs in Nigeria

In the Nigeria context, there is no clear cut definition between the small scale enterprise and the medium scale enterprise. The Central Bank of Nigeria defined small scale enterprise as having an annual turnover not exceeding 500,000 naira (1USD equals 160 Naira at the time of writing) in its Monetary Policy Circular no.22 of 1998. The Federal government of Nigeria, in its budget, defined small-scale enterprise as organizations with an annual turnover not exceeding 500,000 Naira for purpose of commercial bank loans. This conforms with the view of the Central Bank of Nigeria. The National Economic Reconstruction Fund (NERFUND) further puts a ceiling for small and medium scale industries at 10 million Naira.

The National Council of Industries refers to SMEs as enterprises that have a total cost (excluding land cost) of less than two hundred million Naira (Onugu, 2005). The Small and Medium sized Development Agency of Nigeria (SMEDAN) defers in its definition, it defines SMEs based on the following criteria: A micro enterprise which refers to a business with less than 10 people with an annual turnover of below five million Naira; a

small enterprise as a business with 10 – 49 people with an annual turnover of N5,000,000.00 - 49,999,000.00 and a medium enterprise as a business with 50 – 199 people with an annual turnover of N50,000,000.00 to N499,000,000.00.

3. An analysis of cloud computing (SWOT)

3.1 Strength

The strength of cloud computing is in its ability to upgrade services in a very short period of time. This describes the need for underutilized servers in anticipation of peak demand. Cloud computing further gives organizations the ability to request more computing resources instantly; it also gives organizations the ability to use time-distributed computing resources. An example of this is Smugmug, an internet photo website company which has a uniform computing workload almost every month of a calendar year except in the months of January and December whereby the resources required is as high as five times the usual workload. Cloud computing makes it possible for the company to meet the outrageous requirements during this months without costing the company extra funds for hosting the traditional infrastructure for the rest year when the workload is stable. Cloud computing helps reduce infrastructural cost, upgrade cost; maintenance cost energy as well as energy savings (Armbrust et al, 2010).

3.2 Weakness

Big organizations will be uncomfortable entrusting mission-critical applications to cloud computing when they are not sure providers cannot guarantee high quality service and availability which are demanded in such environments. For example amazon web services Service Level Agreement (SLA) currently commits to an annual uptime percentage of 99.95% over 365 days and this might just be enough for most SMES but will be insufficient for mission-critical applications for big organizations. Although many in-house IT services often fail to live up to such uptime standards, such failures are not held up for media scrutiny, unlike much publicized failures of prominent cloud computing service providers (Broderick et al, 2010).

3.3 Opportunity

Mashups is a great opportunity in cloud computing. In regards to web development, a mashup could be a web page or application that combines data or functionality from two or more external sources to create a new service in an originally unintended way. The new type of Mashup is different cloud computing services combining and integrated into a single service or application. An example is Amazon's Grepthe web where cloud computing service composition within the domain of a single provider. Cloud computing also promotes green IT by reducing energy related operating cost thereby representing a smarter use of energy (Datta, 2009).

3.4 Threats

One of the biggest threats to cloud computing is the possibility of backlash from entrenched incumbents. While we believe that many forward-looking organizations will see cloud computing as an opportunity to migrate to better computing practices that open up exciting opportunities for the in-house IT staff, there will probably be many other IT departments who will view it as a threat to their corporate IT culture (in terms of data security, IT audit policies, etc.) or just in terms of job security. Even though it is seen that small businesses have quickly adapted to cloud computing, larger corporate customers have voiced their concerns about handing over their operations to another company. Another major concern is the uncertainty of cloud service providers going bankrupt especially in the shrinking economy. Security is one of the biggest concerns in an on-going survey conducted by a research firm IDC, almost 75% of IT executives and CIOs report that security is their greatest concern, followed by performance and reliability (wired.com, 2009).

3.5 Cloud computing services

The most common classification of cloud services as seen in Table1 below is usually known as the SPI (Software, Platform and Infrastructure as a service) model (NIST, 2011).

Table 1: Extended cloud service model: Showing what each cloud service layer represents (Source: Rhoton, 2013)

SaaS- Application	CRM	Email	Unified communication
PaaS- Platform	Programming language	APIS	Development environment
IaaS- Virtualization Hardware Co-location	Provisioning Memory Real estate	Virtualization Computation Power	Billing Storage Cooling &Bandwidth

4. Challenges of cloud computing usage and adoption by Nigeria SMEs

4.1 Methodology

This study employed a quantitative research approach where questionnaires will be used as it will help provide quantified data for decision-making. It also provides a transparent set of research methods and supports the presentation of complex data in a succinct format. According to Gilson (2012) quantitative methods provide the opportunity to apply a comparable methodology across cross-sectional studies. This quantitative study is conceptualized from a theoretical base in order to ensure that the instrument employed in this process will have prior validity, reliability and will be appropriately designed to address and answer the research questions.

Also this research will adopt a qualitative research approach which will be based on focus group. This will enables the stakeholders in the SMEs from varying range of businesses to have a say in the design of the framework thus giving a holistic approach in the design development and minimizing the level of bias.

4.2 Data collection methods

A purposive stratified sampling technique has been chosen in developing the sampling frame (Saunders et al, 2007) – using this sampling strategy units will be chosen because they have specific characteristics that enable a core theme to be understood in greater detail. Purposive sampling ensures that key research themes are addressed and that diversity in each category is explored (Silverman, 2005). The sampling frame was based on the definition for SMEs provided by Small and Medium sized Development Agency of Nigeria (SMEDAN). Which defines SMEs based on the following criteria:

- Firms must have less than 200 employees
- Firms must be located in Nigeria.
- They must have an annual turnover of less than 500,000,000.00 Naira

Within each SME, the owner or manager was chosen to answer the research questions, as he/she is regarded to be in the best position to answer questions pertinent to the research problem. Each focus group sessions consist of 7 SMEs stakeholders spread across different businesses sectors. These 7 SMEs have been chosen based on their International Standard Industrial Classification (ISIC) so that everyone had a say and bias was eliminated to give the research an all-inclusive approach. The researcher distributed 300 questionnaires to SMEs managers across the six geo-political zones of Nigeria and got a response rate of about 90%. A map of Nigeria can be seen in following link: <http://www.mapsofworld.com/nigeria/cities/>

The seven SMEs present in the focus group were based on the International Standard Industrial Classification (ISIC). See Table 2 below:

Table 2: International standard for industrial classification

D	Manufacturing
F	Construction
G	Whole and retail trade, repair of motor vehicle, motorcycle and personal household goods.
H	Hotel and Restaurants
I	Transport, Storage and Communication
J & K	Financial intermediation, Real estate, Renting& Business activity
M,N&O	Education, Health and social work

4.3 Survey findings and analysis

From the questionnaire, the researcher tried to determine if the Business met the criteria for the research by asking the following questions:

What is your company's annual turnover?

All the 276 respondents were within the category of companies with an annual turn-over between 5million to 499 million naira.

How many employees do you have?

The number of employees which varied from 1 to 199 shows that the businesses that took part in this survey lie within the SMEDEN classification of SMEs.

What sector does your company operate?

From the respondents, all the businesses that took part in this survey were chosen based on International Standard for Industrial Classification and this gives the researcher a diversified sample size for analysis.

The next set of questions was used to determine if the Businesses make use of ICT

Do you use any form of ICT in your organisation?

From the responses it was shown that 100% of the respondents use ICT for their businesses and this indicates that most of Nigeria's SMEs have adopted ICT in their businesses.

Do you have internet access within your organisation?

From the responses to this question, 59% of the respondents don't have Internet connection within their organisation while 41% have internet connection within their organisation. This shows that more businesses need to connect to the internet if they are to adopt cloud services.

How will you rate importance of ICT in your organisation?

From respondents, it is seen that the use of ICT is very important to Nigerian SMEs as 81% of the respondents rate ICT as a very strong aspect of their organisation.

The next set of questions is used to determine cloud computing service awareness, usage, adoption and challenges.

Do you have any prior knowledge of cloud computing?

From the above analysis, it can be seen that 47% of the respondents do not have any prior knowledge of cloud computing while 53% of the respondent have prior knowledge of cloud computing. This shows that the majority of SME managers do not have knowledge of cloud computing and this might be attributed to the fact that the technology is still new to the country. There need to be more advertisement from service providers so that businesses can be aware of this new technology.

Have you used any cloud application?

From the analysis, it can be seen that 72% of the respondents have not used any cloud application and only 28% of the population have used cloud services.

Do you use any cloud service in your organisation presently?

From the above analysis it can be seen that 23% of the respondents use cloud services in their organisation while 73% of the respondents do not use cloud services in their organisation. This shows that some SMEs in Nigeria have started using cloud computing services for their businesses thereby taking advantage of the new technology.

If question above is yes, what cloud services do you use?

From the analysis, it can be seen that those SMEs that have adopted cloud services in their businesses have IaaS in majority with 49% of the respondents and SaaS with 31% of the respondents, the least services being used is PaaS based on the research findings.

What issues do you have with cloud computing?

Majority of the respondents see broadband and bandwidth as the biggest challenge of adopting cloud computing services with 38% of the respondents and the next is security with 34% of the respondents, lack of standards is third with 19% of the respondents and cost with 6% and the least challenge is the issue of data lock-in.

5. Focus group analysis

The focus group research continues with 6 sessions planned. At the time of writing, 4 sessions have already been completed. Each Focus group comprises of different categories of SMEs based on International Standard for Industrial Classification (Table 2 above). These sessions have helped towards the identification of the challenges being faced by SMEs in cloud computing services adoption as follows:

5.1 Security

Security of data was identified as one of the biggest challenges in the adoption of cloud computing services. The participants believe that cloud computing will make it easier for data to be hacked into and also the issue of spoofing which they are not convinced about how the cloud service providers will handle. Furthermore, they are concerned that cloud service providers will have constant access to their data and may disclose it to a third party intentionally or use it for other purposes without their consent. They believe very stringent measures need to be put in place for data protection and confidentiality for SMEs to have confidence in adopting this new technology. This also can be seen from the survey whereby 34% of the respondents are in the view that security is one of the biggest challenges as it is the second highest issue going by the survey report.

5.2 Lack of standard

The focus group participants identified lack of standard governing ICT generally in developing countries as a major concern. They argued that there has to be standard governing the adoption of cloud services as well as other ICT where the user protection is given high priority. They further identified the ability of developed countries to implement standards governing ICT adoption which include cloud services as well as data protection for the successful usage of ICT for businesses they mentioned such standards as:

- Distributed Management Task Force (DMTF): Which focuses on interoperable management of enterprise computing and cloud computing.
- Object Management Group (OMG): This focuses on modelling deployment of applications and services on cloud for interoperability, portability and reuse.
- Open Group cloud work group: The group is collaborating on standard models and frameworks at eliminating vendor lock-in for enterprises.

They believe that with such similar standards their fears in cloud service adoption for their businesses will be drastically reduced. The argument of the focus group is in alignment with the survey as 19% of the respondents identified lack of standards as one of the challenges that affects their adoption of cloud services.

5.3 Broadband and bandwidth

The focus group participants could attest to the wide spread of internet services around the country from different mobile network providers but they still have concerns about the speed and disruption in connectivity. They have identified that SMEs in the big cities have higher accessibility to internet access but when they have to travel to remote areas their might be little or no internet connectivity and this will affect them if they have to retrieve vital information by using the internet to access the cloud. Furthermore they are also concerned about the time it will take to transfer data to the cloud as internet speed (bandwidth) is slow most areas. From the survey report, 38% of the respondents see broadband /bandwidth as a major challenge to cloud computing adoption by SMEs in Nigeria having the highest number of respondents from the survey.

5.4 Data lock-in

The focus group participants were concerned about what will happen to their data in the cloud if they decide to opt out from the cloud service. They argued that they cannot guarantee that the service providers will keep their data confidential and for how long will their data still be in the possession of the service providers before they are deleted. However, based on the survey, most respondents see data lock-in as the least challenge in cloud computing adoption as only as little as 3% of the respondents identified data lock-in as a barrier for cloud service adoption for their business.

5.5 Cost

The focus group participant they agreed that the cost of adopting cloud services is fair enough going by the available price list from MTN Nigeria which is the leading cloud service provider in the country but they fear that going by the Nigerian culture, if other service providers do not come into the market, the available service provider will at the long run take advantage and increase the cost and this might be a challenge if they are fully dependent on cloud services. Going by the survey findings, it is evident that cost is seen one of the least challenges that the SMEs are worried about with only 6% of the respondents identifying cost as a barrier for cloud service adoption.

5.6 Reliability /accountability

The focus group participant identified the issue of reliability and accountability in relation to normal services in Nigeria whereby the service provider maybe very efficient and reliable at the initial stage of providing cloud services but at the long run when many businesses have subscribed to their services they may be to be less effective in their services, making reference to the mobile phone services in the Nigeria. They further argued that an SLA (Standard Level Agreement) need to be put in place and the consequence of inadequate services must be signed and agreed between the cloud service provider and the customer.

5.7 Migration

The participants all agreed that advantages in cloud services adoption are enormous but they still see migration to a new system as a challenge as they may have to abandon their server which they have paid a lot of money to install. This might be seen as an initial challenge in adopting cloud services.

5.8 Interoperability/compatibility

The focus group participants as identified the issue of data format and application that the service providers will offer. They fear that it may be incompatible with that of the customer or other service providers. They also identified the inability to opt out and change to a different cloud service provider when a customer is not satisfied with the services provided without having to pay any penalty was seen as a challenge to cloud service adoption by the SMEs.

6. Conclusion

It is evident that SMEs in Nigeria do not only adopt ICT in their businesses but they see it as a necessity; with all the respondents agreeing that ICT is very important to their business. Based on findings, the need for an ICT that will increase productivity, reduce cost, easy to use and increase profitability cannot be over emphasised. Furthermore, it is evident that the use of cloud services by SMEs in Nigeria is relatively low due to its novelty. There is the prospect of cloud computing services being the next big thing in ICT for SMEs in Nigeria if the

challenges identified in this research are tackled. This will increase the trust of SMEs in cloud services usage. At the time of writing, the research is still on-going with the final two focus groups expected to take place within the next two months. This research is part of a greater movement in trying to determine if cloud computing should or should not be adopted by SMEs in developing countries.

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Meeting Point of Strategy and Operations: Tactical Management Sense-and-Response Framework Enhancement

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Abstract: We recognize a problem of work overload in every managerial position nowadays. This is complemented with data overload, and still somehow, information inadequacy. We recognize the problem of rather clear strategic or business plan expectations and inability to meet them. We also recognize the problem of complexity of issues every manager has to deal with in all of their diversity. All of these elements persisting in an uncertain and unpredictable environment of today's business, technology and economy, where planning is trading places with structuring, modularizing and preparing oneself in being adaptive to any given circumstances, especially in terms of tactics, denote longing for multidimensional support. There are various efforts and products to automatize and enrich the data in order to give basis for better decision-making and problem solving. Also, there are frameworks to formalize and verbalize the strategic or business plan expectations and targets with respective performance measurement in order to point out the direction where a business unit/company should be headed. And quite a lot is being done on a subject-specific areas such as: Alignment of IT and Strategy, Business Operations and Strategy, ... But the perceived "boiling" zone of tactical management is somehow un-addressed, both in theory and with feasible artifacts. Tactical Management as the managerial function that implements strategies and deploys and utilizes specific resources from the operational level in order to gain that specific advantage prescribed in the strategy has both differentiating and uniting characteristics when compared to operations and strategy. Furthermore, if standing in the shoes of a tactical manager, what one will see as work description, will be overwhelming crossroads of unmatched information flows in structure, depths, sources, manners, complexity, timings, and expectations. How to perceive, organize, handle and utilize all that landscape with what is given, and be able to handle it dynamically, appropriately and with least expenditures, is what we are aiming for. It's neither straightforward, nor an easy, automated task. For anyone. It is both company- and person-dependent task. This research focuses on tactical management, from the perspective of the individual manager. We believe that by Enhancing the Sense-and-Respond Framework on a tactical level we will assist the individual tactical manager with increased adaptability and handling complexity.

Keywords: tactical management, sense-and-respond framework, handling complexity, right-time information, ICT, knowledge management

1. Introduction to the research context

With this research, we are aiming on pointing and filling out a gap in the contemporary theory for the level of tactical management, as well as in the real business environment, with appropriate and focused solutions and artifacts. A tactical manager in the companies is not distinctively supported with theoretical approaches, know-how, methods or tools. The Literature Review performed through the lens of tactical management observes contributions on strategic level both with theoretical concepts (such as Balanced Scorecard, The Performance Prism, Triple Bottom Line, ...) and with designed artifacts with practical implementation. Also, there has been immense contribution focus, especially as technologies and tools, to the operational management level. However, the tactical management, perceived as the managerial function that implements strategies and deploys and utilizes specific resources from the operational level in order to gain that specific advantage prescribed in the strategy has been neglected to some extent, in theory and with practical solutions.

The tactical management area, according to us, should not be addressed with automatized decision making, and information signals fired from the operational line of, nowadays popular "real time information" that are immediately connected with the strategic outcome monitoring. There are mismatches, processing logic and context needed in order to properly perform the "how" of the management, with tactics. It can be addressed with a way of thinking, which enables the role of a tactical manager to be adaptive and open to proper reaction to a dynamic world. Otherwise, there may be impression that we don't even need tactical management, if we automatize the direct connection of operations and strategy. Which is not at all the case in the business world, where the tactical managers are the ones "making the difference" for the company.

Our framework addresses an important deficiency in nowadays management systems: the inability to monitor and fulfill strategy or goals by directly following the everyday operations, in an unpredictable setting. After the initial implementation of a performance measurement framework or even without one, the company is set up to facing a certain direction and knowing what is expected. Additionally, every member (from 30.000 feet (Kaplan et al. 2007) of Strategic Altitude to 0 feet of operational line) knows what to do and what is expected from him/her. The mechanism is in place. Yet, many of the business plans are not fulfilled, many of the projects are over-time, over-budget and revisions and corrections have to take place in order not to conclude that there is mis-planning or under-accomplishment.

The literature review (Petrevska Nechkoska et al. 2014) through the lens of tactical management, has resulted with conclusion that most of the efforts are placed in real-time operation information flows, and in strategic management information systems, some of which tangling tactical management, but not as a primary focus. Also, the closing of the Sense-Interpret-Decide-Act loop, information sensing and logic on ongoing dynamic basis, is being performed with KPIs, Performance Measurement Frameworks, Business Plan Goals and Targets, and Reason for being, Purpose and Accountabilities. But most of the correlations of the incoming and outgoing data are trying to overshoot from operations to strategy or vice versa. Very few are stopping on the bridge of tactical management and performing the reasoning and acting from there. Not many contributions are present for the tactical manager on the level of the person, but most are proposing company solutions, which for the specifics of the tactical management, may not always be appropriate.

2. Research questions and objectives

This research, under the principles of the Design Science Research Methodology, is aiming to produce a method as a way of thinking, for the person (not the company as a whole) being a tactical manager, in order to improve the adaptability and handling of complexity and distinctive characteristics of his/her work, by designing and implementing a role-specific Sense-Interpret-Decide-Act (SIDA) adaptability loop.

The focusing points to enhance the SIDA loop are primarily to the Sensing stage, in terms of proper positioning of the sensors a tactical manager should be able to do, regardless of structured, semi-structured or non-structured data, scope of entities being sensed, depth, manner, ...; the Interpret(&Analyze) stage in terms of proper reasoning with the Endings in mind (be it Business Plans, KPIs, Reason for being, Strategic guidelines, ...) and the necessary logic of aligning the mismatch of received details as input, with summarized information as output of this stage; so that the Decide and Act stages have proper time and basis for being performed.

The research is making a difference in two lines of inputs, in order to improve the tactical management performance in the nowadays world, that breathes with uncertainty (Figure 1) – the Person being a tactical manager – side of the relation (*Overviewing ability of the person* in terms of Scope, Time, Structure, Depth, Manner, ... and the *Personal Qualifications* in terms of Education, Experience, Training, ...) and the Company side (the provision of *Cognitive Artifacts in Information Systems*, for Sensing, Interpreting, Deciding and Acting, in terms of Methods, Tools, Platforms, ...) as well as by provisioning proper *Authority level* for the role of the tactical manager. The claim is that these two groups of elements work together towards improving the *Tactical Manager's Sense & Respond capability*, by improving the *Tactical Management Performance*, as well as the *Knowledge Management* in the company (directly and indirectly). There are iterations in time in which tactical management improved performance improves the Information Systems as element receiving influence from the concepts in place in this research, as well as operations, management, processes, ...

The issues being addressed with this research, on the level of tactical management, are summarized as follows:

- Support with dynamic positioning, using and revising of Information Sensors
- Sensibility for the “right” information in terms of context, scope, role, manner of obtaining, structure, timeframe, frequency, ...
- Connection with Ends – Strategic guidelines, Targets, Reason for being, ...
- Alignment of mismatch of incoming/outgoing information
- “Right time” information

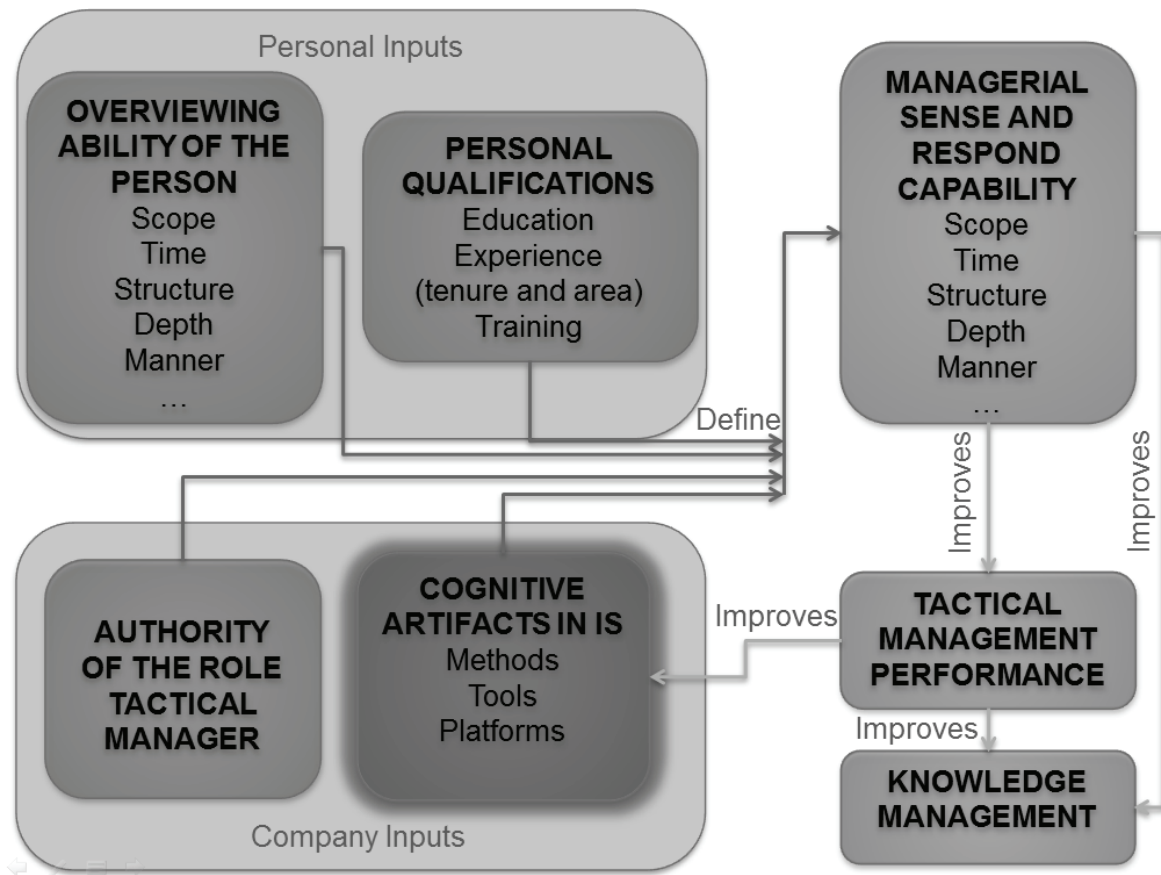


Figure 1: Research prepositions and focus of the contribution

The specific view this research is taking is by addressing the tactical management from the point of view of the person being a tactical manager – and in direction of his/her complex, diverse and uncertain issues, and not only from the point of view of the company, and not only in one domain, such as for example HR, or Marketing. What, so far, we are seeing in the field work, are various information flows, processes, requests, expectations, job descriptions, categories of activities starting from core business, through client communication, HR issues, marketing, legislative, ... The current approaches give usually a domain specific prescription on how to handle IT issues, throughout the company, Customer Relationship Management, and others, which leaves the tactical manager at a crossroad of things to pick up and implement, that are very much domain, not role specific, to the tactical manager. And eventually, he/she is the one who should sublime all those diverse impulses and result with proper and good guidance of the business unit. The wider area of the research's ground is taking in consideration the sociological and behavioral aspects, combined with information system knowledge. The artifact should not be another platform, or system to be invested in, to redesign the Business Processes in the company or to be hard to implement but a method and a way of thinking that when apprehended and performed by the tactical managers, would result with effect throughout the unit, company, and the wider net of stakeholders in a real business environment.

The objectives of the research are wider and with behavioral, technical, personal and organizational connotation. "As companies around the world transform themselves for competition that is based on information, their ability to exploit intangible assets has become far more decisive than their ability to invest in and manage physical assets." (Kaplan 2007). "The most productive business strategies will become cooperative, not competitive" (Haeckel 1999)

3. Concepts in the research

3.1 Sustaining low-latency in the information flow

The latency in the information flow towards responding with an action is an interesting place to search for hidden potentials of valuable reserves in a company. Intriguingly, in a broader sense, the word 'latency' is

synonym with 'potential'. From this standpoint, the expression 'to achieve zero-latency' sounds like an oxymoron, because nobody would like to achieve zero-potentials. However, if trying to explain the attempt to point out and extract the latencies i.e. potentials that exist in the information flows, in order to use them to shorten the sense-and-response time for the benefit of the decision making reactions in the companies, it would have significant scientific and practical implication. For practical purpose, and with the consideration that zero-latency can't be achieved on a tactical level, the term low-latency will be used.

The definitions for 'latency' vary in close proximity, depending on the area of use: in the Oxford Dictionaries, as adjective 'of a quality or state, existing but not yet developed or manifest, hidden, concealed' and 'present, but needing particular conditions to become active, obvious, or completely developed', in the Cambridge Advanced Learning Dictionary. In technical terms, the defining goes as: 'In a call for data from a storage unit, the duration of the period between (a) the instant that the call is initiated and (b) the instant that data transfer begins.' (Springer 2014), where it is perceived the same as 'waiting time'. 'Synchronization' and 'Communication' latency are discussed in wider technical terms also. (Savadi 2013)

However, the definition of 'zero-latency' extends beyond the pure combination of the two words: 'Situation or state in the development of information technology infrastructure where no time is lost in exchange of information from one interface to another, or where the system responds instantly to an input of information'(Business Dictionary) which takes in consideration the time between an action and the appropriate information for it to be generated, plus the time from obtaining the information till response. The zero-latency approach is more useful as a focus in the operational level of the business, but for the tactical level, the low-latency concept is selected as more important. The sub-structures of latency are: data latency, analysis latency and decision/action latency, and as more time passes between those latencies, the value of the decision will have lesser effect.

This is the area that is going to be aimed with this research, with the idea that various elements, systems and approaches can be activated and orchestrated in direction of shortening the time the information flows from the business activity happening or business event occurring through the reach of the responsible employee or system and to the action taken which serves as response.

The perceived benefits of information reaching the users in real-time or right-time are much more than the downsides, especially within organizations. The proposition is that, by shortening the time to take action (shortening the SIDA loop), the value of the taken actions will increase.

3.2 Positioning of the information sensors

Complementary to the attempt for discovering and reducing latencies in the information flow, there are two more important aspects that this research will aim for, fittingly named here as 'positioning'. One is regarding the positioning on necessary and appropriate information points that will not just facilitate what is already given by the information systems as ocean of data, but will place, maybe modify or add checkpoints out of which information will be extracted for the needs of current decision making and consecutive fulfillment of plans (as described in the previous section). The other type of positioning is viewed in the connections from two sides: as 'givens' – inputs of strategies and targets (top-down) plus their operational realization (bottom-up) and as 'deliverables' – outputs of actions that feed back the related systems in order to continue the work in the established or modified form.

The points of interest of this research are the three sub-layers of latency: the Data Latency, the Analysis Latency and the Decision Latency (Hackathorn 2004). The subsequent focus is in the following order:

A. The initial contribution can be made in the Analysis Latency layer, where there is a need, for tactical decision-making purposes, to have in overview many more aspects of data than what is currently given and automatized in companies. Our observation of types of data inputs, with the criteria of how they can be obtained from existing information systems, is the following:

1. Core-business data, usually generated from software applications, available as data flow or on-demand in fast and one-click routine reports

2. Core-business data, usually generated from software applications, available after some modifications, gathering and filters, in relatively fast obtainable reports
3. Unstructured data obtainable from software applications that needs further processing to be in appropriate form for the user from within the company
4. Data that needs collection and then processing to be in appropriate form for the user from within the company (there may be some software in place, or not)
5. Data that needs collection and then processing in the appropriate form from other participants (departments, management, branches, ...) within the company
6. Data that needs collection and then processing in the appropriate form from other participants in the value net or stakeholders out of the company

Out of all these shapes and different contents of data that is served to the decision-makers on tactical, and sometimes even strategic level, the first two (1 and 2) are already available, and many efforts of the tech industry have been placed to reduce the Data Latency occurring from the Business Event trigger till the data is being ready for analysis. Nowadays user has to ingest huge amounts of high frequency data and consume streaming info as well as do analysis in real-time on large datasets – the environments called “high frequency/low latency environments” (Khan 2013) are out of the scope of this research because many efforts and solutions exist in the technical terms, for coverage, exploitation and speeding up of the flows of information on operational levels.

However, the other data types (3, 4, 5, 6) that are deriving from Business events of unstructured or semi-structured nature and that are being covered with less or no software support, with various excel or e-mail lists, organizational silos and are scattered across the company, the business unit or the project participants, are not tangled by the efforts of the IT, to be served in front of the decision-makers in order to provide them with a wider worldview of relevant data prior considering making a decision. The reasons for this are partially that not everything can be automatized, programmed and static for years, and also in the perception that the combinations of needed reports vary to a great extent depending on the decision-maker, the context and the moment in time of the work.

B. The indirect contribution of the research towards the Data Latency layer is the plan to provide ‘positioning’ of data inputs. Not everything needs to be recorded or placed in logs and act as a big data burden for querying databases or delivering through bandwidths. Also, some of the business activities and events are not pointed to emit data, so the data collectors face a problem of having lot of data but that needs a lot of break-points or summarization in order to be useful for a specific information. By pointing out the logic of setting up the data inputs (regardless whether there is software or system in place or not), a significant contribution can be made to every line of decision-makers in dynamically organizing and feeding-back the information systems.

C. The third effect, perceived as ancillary, would be to the Decision Latency layer, where time may be shortened as a result of serving comprehensive and context appropriate information set to the decision-maker, as a result to the improvements described in the A and B paragraphs. Also, What-if analysis, Modeling and Simulation tools and the historical access to previous data can be performed at this point, which will not only reduce the time-to-action but will also contribute to the quality of making the decisions. However, in this layer, out of the sequence Sense-Interpret-Decide-Act, only the first two steps Sense-Interpret will be addressed with this research. The Decide-Act stages are out of the scope of the research.

3.3 Striving for right-time information

Big portion of the efforts of the Information Technology are going in direction of real-time information systems, platforms and processes: “Technical issues related to architecture and integration using technologies like SOA, Event Driven Architecture (EDA), Business Intelligence (BI), and Business Activity Modeling (BAM) need to be addressed.” (Zhao et al. 2008) And further on that, hardware and communication issues are getting innovations directly posed from the businesses, such as integrate streaming; in-database analytics and others. But all of these efforts enhance mostly the operational level of information flow for decision-making, and provide state of the art report (sometimes even overflow) for strategic decision-making. Real-time makes sense in terms of first line of business, the supply chain line and the participant communication (clients, collaborators, company).

But for answering “how” the strategy should be fulfilled, and for following whether the operational results are in line with the expected projections, there is no urgency for real-time. In fact, if the effort would be to strive for real-time information on every business event, the Pareto efficiency would be surpassed to a great extent. The sensing mechanisms for middle layer of decision makers or for any profile of decision makers that are involved in translation of strategy with tactics and/or provision of operations towards fulfillment of tactical plans should reside on right-time information. This should explain the motivation for selecting right-time information instead of the nowadays “hot” expression of real-time information. The right-time information will have some latency in the Data Latency layer, and it may be significantly higher than the real-time information, but its contribution to quality and trade-off between high marginal costs for obtaining real-time information will be sufficient reason for not aiming to reduce that specific portion of time in the event-to-action cycle, in this research.

3.4 The adaptability (sense – interpret – decide – act) loop of the sense & respond framework

In this research, the main direction on “how” to improve tactical management is towards the adaptation and appropriate design of the SIDA adaptability loop for the role of the tactical manager. This concept provides solid foundation that supports the tactical management with the general elements of adaptability – Reason for being, Governing Principles, Roles and Accountabilities, then to continue with the Heads Up Displays and the detailed distinctions in the continuum from make-and-sell to sense-and-respond organizations. The configuration proposed is Purpose, Strategy, Structure, Governance, which provides managerial and organizational adaptivity, as stepping aside from strive towards efficiency. (Haeckel 1999)

4. Research process and methodology

This research is basing on the Design Science research methodology in Information Systems. It finds appropriate foundation in the problem-solving paradigm. It is aiming to fulfill the expectation from research in Information Systems discipline to “further knowledge that aids in the productive application of information technology to human organizations and their management” (ISR 2002) and to develop and communicate “knowledge concerning both the management of information technology and the use of information technology for managerial and organizational purposes” (Zmud 1997). Design science sees “an opportunity for IS research to make significant contributions by engaging the complementary research cycle between design-science and behavioral-science to address fundamental problems faced in the productive application of information technology.” (Hevner et al. 2004). As Hevner et al. prescribe, the guidelines this research is aiming to follow, are to:

- Produce a viable Artifact (construct, model, method, instantiation) – by designing a method;
- to find and position the Problem Relevance in a real important and relevant business problem – the tactical management function;
- to Evaluate the Design rigorously – through Survey and Interviews;
- to provide Research Contributions that are verifiable and in direction of generalizing to a Class of Problems, Design Principles and Class of Solutions (Rossi et al. 2012);
- to comply with the Research Rigor – by employing methods for construction and validation such as the Action Design Research, Interviews, Expert opinions;
- to Design through a Search Process – by following CIMO logic (Context, Intervention, Mechanisms, Outcome) (Van Aken, 2004);
- and to Communicate the Research to multifaceted audiences – IT, Management, Researchers, Academics, ... - because the meeting point of a solution to a problem is the common understanding and support of both.

The problem we are trying to solve is the Tactical Management dealing with complexity and adaptability, from the point of view of the person being a tactical manager. This is to be achieved by designing the Sense-and-Respond Framework for the role of the tactical manager, with all the specifics that differentiate it from the other managerial functions. The tactical management information sensors and emitters, their positioning and revising are to be the baseline of distinction in the managerial information system canvas. The framework of evaluation risks in design science research (Baskerville et al., 2008) is to be followed with research-relevant risks.

The desired artifact to be produced is in the form of a method, way of thinking, to be given at hands of the tactical managers, that will take in consideration their context, specifics of the role, necessities from the information systems and in general, and will have incorporated prescriptive knowledge for adaptable and dynamic handling complexity.

One specific of this research is that it will be performed in two countries, Belgium, as developed one, and Macedonia, as developing one. The starting point is that a tactical manager is facing complexity in both environments, however, depending on the Cognitive Artifacts provided by the company, the tactical management as a function, brings better outcomes as a result of the person's part of the flow, or the company's support systems. From the research design, it is visible that the method of gathering good practices and expert advice is by interviews with Executive, Middle, Project Managers and SME Owners, identified as groups that deal mostly with tactical management and its effects to the company, both from Belgium and Macedonia.

The research design is consisted of the following:

- Literature research and pointing out a gap in theory for supporting tactical management with information systems in general
- Confirmation of the problem existence in companies in Belgium, as a developed country, by conducting Interviews with managers on different levels, involved in tactical management
- Confirmation of the problem existence in companies in Macedonia, as a country in development, by conducting Interviews with managers on different levels
- Gathering knowledge of practitioners and experts by conducting Interviews in companies in Belgium and Macedonia with:
 - *Executive Managers*
 - *Middle Managers*
 - *Project Managers*
 - *SME Owners*
- Performing Action Design Research (Sein et al. 2011) in a company in Belgium/Macedonia with tactical managers (Project Managers) where the design artifact will be tried and solution reached in few design cycles (Gregor et al. 2013) and evaluated for successful contribution to the addressed problem. This step is needed to be performed in companies and with individual managers because the Sense-and-Respond framework as adaptability approach should be planted in a real context and environment, where from the behavioral and the information systems components can be observed and guided towards the wanted direction of increasing adaptability and assisting handling of complexity of the tactical management function. Also, the standpoint that the tactical management adaptability and support with information systems influence its effects (Figure 1), regardless on the development of the country, should be proven right or wrong with the two settings – a developed country company and a developing country company. The difference should be in the level of both variables development. Why a developing country company's input is important in building such an artifact – is because the managers in such circumstances have high level of adaptability, because of comparably low level of provisions of information systems or certainty in the environment – which should be of significant Importance for achieving the wanted adaptability. The reasons for involving a developed country company are pretty obvious – because of the higher level of provision with information systems, practiced concepts and enterprise organization.
- Specification of a generic method for Tactical Management improvement by enhancing the Sense and Respond Framework
- Publishing of work and results as ongoing process

5. Discussion/results so far

The initial standpoint that the performers of the tactical management function need specially designed information setting – with regards to content, time, accessibility, scope, frequency, modularity, maneuverability, ... directs this research into mapping the actual nature of the information system needs for tactical managers (as persons or positions) or tactical management (as function). The “hologram” layers of

information sensors, but also information emitters, are to be placed in a borderless company or in a service system network, at least. We perceive the tactics as the alternative paths with given inputs and outputs – for which the person performing the decision making should be able to acquire and capture, develop and share, and effectively use their and the organizational knowledge – all the way to a way of adaptable thinking, provided by the Sense-and-Respond managerial framework and the Sense-Interpret-Decide-Act loop. Briefly, we believe that tactical management performance is complex, diverse and needs to be adaptive. Its specifics need non-universal addressing with information systems and its acting needs special framework aside from the command-and-control one towards manager as facilitator of the context, not the people. Because of its vast miscellany, domain-specific prescriptions have been given, but the personal approach is still diverse and un-counseled, especially with regards to IS and Knowledge Management. We hope to open a door for many to follow, because “hot” business issues and competitive advantage latencies lay here.

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A Conceptual Framework for Capability Sourcing Modeling

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Abstract: Companies need to acquire the right capabilities from the right source, and the right shore, at the right cost to improve their competitive position. Capability sourcing is an organizing process to gain access to best-in-class capabilities for all activities in a firm's value chain to ensure long-term competitive advantage. Capability sourcing modeling is a technique that helps investigating sourcing alternative solutions to facilitate strategic sourcing decision making. Our position is applying conceptual models as intermediate artifacts which are schematic descriptions of sourcing alternatives based on organization's capabilities. The contribution of this paper is introducing a conceptual framework in the form of five views (to organize all perspectives) and a conceptualisation (to formulate a language) for capability sourcing modelling.

Keywords: capability sourcing, capability sourcing modeling, capability sourcing conceptual model, conceptual framework for capability sourcing

1. Introduction

Sourcing is evolving into a strategic process for organizing and fine-tuning a company's value chain. Companies should be looking for alternative sourcing of business capabilities to seize new market opportunities. Strategic sourcing allows companies to take full advantage of cost, flexibility and new capability opportunities; whether delivered by traditional suppliers, trading partners, distributors, agents and even customer self-service models. Sourcing decisions are strategic decisions at the management level about choosing the right sourcing alternative solutions like **outsourcing**, **insourcing**, **co-sourcing** and **multi sourcing**. At the strategic management level of organization, decision makers need to share a common ground or a common language to facilitate their discussions (Clark and Brennan 1991). A common language is needed to define and articulate concepts that facilitate the description of objects of strategic interest and that improve the strategic discussions and enhance related decision making (Osterwalder and Pigneur 2013). Current analytical methods for strategic sourcing planning such as strategy maps, SWOT analysis, PEST analysis, Porter's five forces analysis, and value chain analysis are not based on common languages, conceptual frameworks, and visual schemas that could be used to facilitate the strategic sourcing discussions and strategic sourcing decision making. Our position is introducing a conceptualization as a language and five views as perspectives for conceptual modeling of strategic capability sourcing. This conceptualization and five views can serve as a common language and perspective to facilitate discussions about sourcing at the strategic management level in an organization

2. Capability sourcing

Capability sourcing is a process of gaining access to best-in-class capabilities in a company's value chain to ensure sustained competitive advantage. Right sourcing of capabilities improves the competitive position of firm across the value chain and within a changing environment. Right sourcing means leveraging the right capability at the right cost from the right source and the right shore to improve the competitive position. Capabilities are the key to alignment and successful strategy execution. Capabilities exist across the value chain and in order to achieve high-performance a business must learn to manage capabilities that other parties in the value chain perform. They must learn to govern a network of capabilities. Right sourcing allows sharper focus on differentiating capabilities. On the other hand, incorrect sourcing decisions limit agility and increase costs (Loftin et al. 2011).

We propose capability sourcing modeling as a technique to explore sourcing alternative solutions which are insourcing, outsourcing or sharing forms (e.g. in-house, spin-off and joint venture). A capability sourcing model is a model of an organization's capabilities like a blueprint (i.e., a capability map) to express the capabilities that are necessary to execute the stated strategy. The capability map as a capability sourcing model is a black-box model to support strategic decision makers to organize their firm's resources and capabilities in a right way (cost, source and shore). This model can express the firm's capabilities across the value chain as 1) Insourced capabilities that are assigned to an internal (but 'stand-alone') entity that specializes in that

operation. 2) Outsourced capabilities that are assigned to a third party to perform on its behalf. 3) Co-sourced capabilities that are assigned to a partnership as a long-term cooperation between two (or more) business partners.

3. Capability sourcing conceptual modelling

Our position to create a capability sourcing model as a part of sourcing solutions is applying conceptual modeling. "Conceptual modeling is a widely applied practice and has led to a large body of knowledge on constructs that might be used for modeling and on methods that might be useful for modeling" (Thalheim 2010). The main purpose of conceptual modeling is extraction of a high-quality conceptual schema of a system. "Conceptual models are used as intermediate artifact for system construction. They are schematic descriptions of a system, a theory, or a phenomenon of an origin thus forming a model" (Thalheim 2011, 2012). A conceptual model is a model enhanced by concepts. Conceptual models use a language as a carrier for the modeling artifact and are restricted by the expressiveness of this carrier (Thalheim 2011, 2012). This language is often also used for the description of the concepts that are incorporated into a modeling result (Thalheim 2011, 2012).

Therefore, for capability sourcing modeling, we use conceptual models as intermediate artifacts which are schematic descriptions of sourcing alternatives based on organization's capabilities. In this paper a conceptual framework is introduced for capability sourcing modeling. A conceptual framework is needed to organize all perspective of decision makers (views) and the things (concepts) viewed from each perspective across enterprise. Conceptualization and views of decision making are two main parts of this conceptual framework. Views organize all perspective of decision making and the conceptualization formulates the language of decision making. To introduce a conceptual framework of capability sourcing, five views and a conceptualisation have been defined for capability sourcing decision making.

3.1 Views of capability sourcing

Competitive Advantage View (CAV) is the objectives view of capability sourcing. The primary objective of strategic sourcing is to achieve a sustained competitive advantage which in turn results in superior profit and profit growth. Competitive advantage is the ability to create more economic value than competitors and results in superior profitability. It is a firm's profitability that is greater than the average profitability for all firms in its industry. Furthermore, sustained competitive advantage is a firm maintaining above average and superior profitability and profit growth for a number of years. According to CAV, capabilities can yield competitive parity and either temporary or sustainable competitive advantage. So competitive consequences of capabilities are competitive disadvantage, competitive parity, temporary competitive advantage, sustained competitive advantage. Subsequently, performance implications resulting from (disadvantage, parity, temporary, sustained) competitive are "below-average return", "average return", "average return to above-average return" and "above-average return". The CAV can be used to analyze whether capabilities are able to provide the sustained competitive advantage to superior profit or not. This analysis results in a decision on making the capabilities with a sustained competitive advantage or buying the capabilities with a competitive disadvantage (Hill and Jones 2012).

Resource Based View (RBV) is the foundation view of capability sourcing. RBV argues that resources are heterogeneously distributed across firms and are imperfectly transferred between firms. Firms can obtain above-average returns if they can use their existing resources to sustain competitive advantage by exploiting opportunities in the market or neutralizing threats from competitors' so-called strategic resources. Strategic resources enable organizations to sustain competitive advantage, if the resources are Valuable, Rare, Inimitable, and Non-substitutable (VRIN). Valuable resources increase revenues or decrease costs. Valuable common resources can lead to competitive parity but no advantage. Non-value-adding resources lead to competitive disadvantage. Rare resources are those possessed uniquely by one organization or by a few others only. Valuable rare resources can provide, at best, temporary competitive advantage. Inimitable resources are those that competitors find difficult to imitate or obtain. Only valuable, rare and hard-to-imitate resources can provide sustained competitive advantage. Non-substitutable resources are resources that do not have a strategic equivalent. Valuable, rare, hard-to-imitate resources and non-substitutable resources can also provide sustained competitive advantage. The RBV on a capability can be used to analyze whether resources are strategic (VRIN) within a capability or not. This analysis results in a decision on making the capabilities based on VRIN resources or buying the capabilities based on non-valuable resources (Barney 1991,2002).

Dynamic Capability View (DCV) is the core view of capability sourcing. The dynamic capability of an organization is defined as “the capacity of an organization to purposefully create, extend, and modify its resource base” (Helfat 2007). The DCV has evolved from the RBV. The RBV proponents argue that VRIN resources can be a source of superior performance, and may enable the firm to achieve sustained competitive advantage. The DCV has lent value to the RBV arguments as it transforms what is essentially a static view into one that can encompass competitive advantage in a dynamic context (Ambrosini et al. 2009).

The DCV can be used to analyze whether capabilities critically underpin competitive advantage that others cannot imitate and obtain (core capability) or not (non-core capability). This analysis results in a decision on making core capabilities or buying non-core capabilities.

Transaction Cost View (TCV) is an external view of capability sourcing. Transaction costs are the costs of negotiating, monitoring, and governing capability exchanges between parties. According to TCV, a firm seeks to balance transaction and production costs in its decision to internalize (insource) or externalize (outsource) a capability. Effectively, TCV explains why some firms choose to make whilst others purchase a capability. Firms provide a capability internally when it is economically more cost effective than purchasing the same capability on the open market. Therefore, the higher the transaction cost, the more likely that the capability is provided within the firm rather than purchasing (e.g. outsourcing). TCV viewed the firm as an avoider of negative opportunism, whilst the RBV viewed the firm as a bundle of superior (VRIN) resources inside the firm that create competitive advantage. TCV focuses on the role of efficient governance through transaction analysis, whilst the RBV focuses on the search for competitive advantage through resource analysis. In effect, TCV is focusing primarily on governance skills, whilst the RBV focuses primarily on production skills. In TCV, sourcing decision making is influenced by the potential for opportunism in the exchange. In the RBV, sourcing decision making is influenced by the ability of an organization to develop a sustainable advantage in the resource. The TCV can be used to examine organizations with regard to the efficient boundary of an organization, i.e. which capability should be produced in-house and which should be sourced externally (McIvor 2005).

Governance Structure View (GSV) is based on TCV. This view is about the governance mode of capability transaction between organizations and markets. Some transactions are coordinated by markets and some transactions take place inside firms. A market governance mode is preferred when transaction costs are low. TCV assumes that the market will always be the lowest-cost producer of a capability. Alternatively, an internal governance mode is preferred when transaction costs are high. The production cost advantage of the market is overwhelmed by the high transaction costs incurred (Williamson 1975, 1985).

These five views can support strategic decision making about capability sourcing. The high level of sourcing decisions are: 1) Make: a firm will build an capability in-house (insourcing) if it represents a sustainable source of competitive advantage. These capabilities are core capabilities or capabilities to bundle superior resources. This decision will be chose for capabilities with high transaction cost. 2) Sharing or ally: a way of cooperation where hybrid structures are used to gain efficiencies by bundling capabilities between competitors to realize scale and skill economies (co-sourcing). Sharing is preferable, if there is no real differentiation to the competitors, i.e. no lasting competitive advantage (parity) and also no measurable competitive disadvantage. In this case a major source of differentiation is size, i.e. realizing scale economies. And 3) Buy: will be taken if the capability does not provide any competitive advantage and is not considered a core competence. These capabilities are non-core capabilities with low level transaction cost and can be outsourced to an external provider (outsourcing). (Arnold 2001)

3.2 Conceptualisation of capability sourcing

Resources are What the firm Has. They are stocks of available factors that are owned or controlled by the firm. Resources are bundled to create organizational capabilities (Amit and Schoemaker 1993). *Superior resources* are strategic resources (VRIN) that enable organizations to sustain competitive advantage.

Capabilities are What the firm Does. This concept represent the firm’s capacity to deploy resources to effect a desired end. Capabilities are considered core if they differentiate a company strategically. *Core capabilities* are those that critically underpin competitive advantage and that others cannot imitate or obtain. They are deeply embedded in the firm and therefore difficult to transfer (in-housed capabilities). *Enabling capabilities* don’t distinguish the firm competitively from its competitors. They qualify the firm for competition but do not

provide potential for competitive differentiation. They enable the firm's core capabilities. *Supporting capabilities* exhibit the least degree of competitive advantage. They support the firm's core capabilities but they can readily be imitated by competitors. They are not essential to the firm for competitive advantage and can be outsourced without any serious compromise to the firm competitive position (Birchall and Tovstiga 2005).

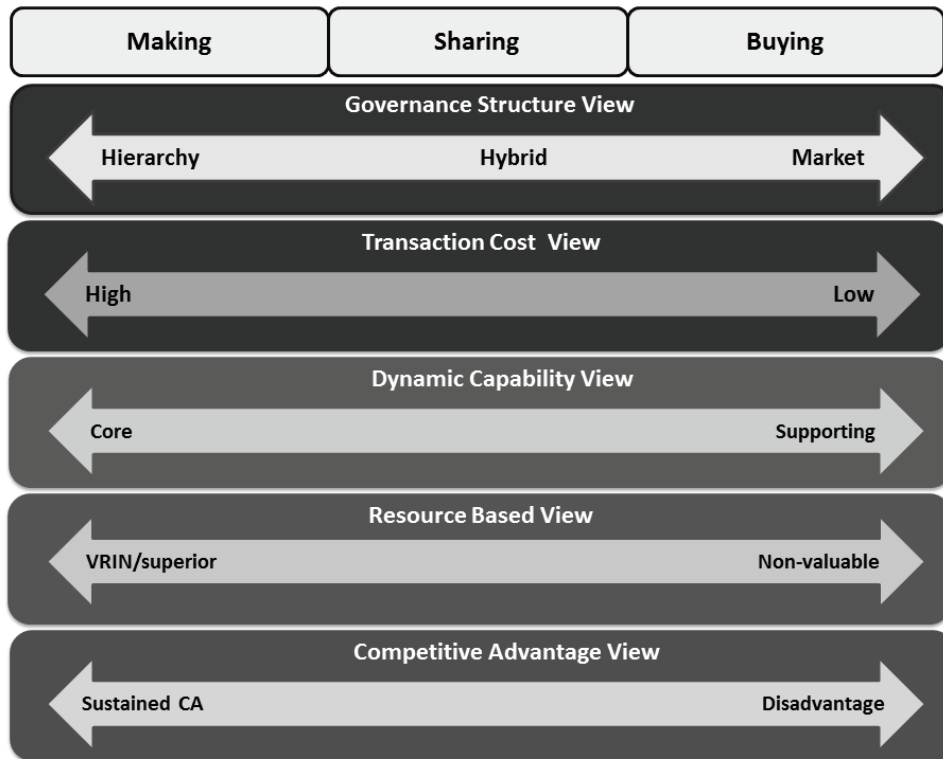


Figure 1: Views of capability sourcing

Competencies are What a firm Does that is strategically valuable. This concept captures the essence of what makes an organization unique in its ability to provide value to customers. *Distinctive competencies* are firm-specific strengths that allows a company to gain competitive advantage by differentiating its products and/or achieving lower costs than its rivals (Hill and Jones 2012). Resources and capabilities are source of a firm's distinctive competencies and basis for competitive advantage. To possess a distinctive competency, a superior resource and the capability necessary to take advantage of that resource is needed. If a firm has superior resources, it must also have the capability to use them effectively to create distinctive competency. However, a firm can also create a distinctive competency without superior resources if it has core capabilities (Hill and Jones 2012).

Transactions are What a firm Does that is transferable. Transaction is the transfer of a good or service across "technologically separable interface". Our definition of transaction is the transfer of a capabilities between parties through services (Rafati and Poels 2014). A transaction takes place whenever a capability is transferred from one party to another. Transaction cost include measurement costs, negotiation costs, contracting costs, monitoring and enforcing costs, etc. Transactions have two key dimensions that determine how their costs affect governance choice: *Uncertainty* about environments and the degree of *asset-specificity* involved in a transaction. *Asset specificity* refers to the transferability of the assets that support a given transaction. Specific assets under transaction cannot be transferred to other users without a significant reduction in value and leads to a "lock-in" effect that causes "hold-up problems". Therefore organizations opt for internal governance structure to protect against hold-up problems for transactions supported by high-specificity assets. On the other hand, organizations opt for the least-costly governance mode available in the market for transactions not supported by high-specificity assets. *Uncertainty* has two forms: behavioral uncertainty and environmental uncertainty. *Behavioral uncertainty* creates problems for performance evaluation. Monitoring and enforcement costs will be increased to evaluate partners' performance, therefore, organizations are likely to choose an internal governance structure to decrease transaction costs arise from behavioral uncertainty. Environmental uncertainty undermines an organization's ability to predict future outcomes. Partners may act

opportunistically to cover changed circumstances which lead to increase costs relating to communication, negotiation, and coordination. So organizations have more difficulty in writing market contracts and use internal governance structure for highly environmental uncertainty (Williamson 1981).

Governance is How firm Manage the transaction. It is about management and administrative control mechanisms of a transaction. Three fundamental forms of transaction governance are: 1) *Hierarchy_* exchanges are governed by a unified owner like a firm. 2) *Market_* exchanges are governed by price mechanisms. Here, hierarchical control is replaced by contractual agreements. 3) *Hybrid_* exchanges are governed by forms of long-term contracts that bind the parties for a period of time, e.g. joint ventures, alliances, shared service organizations (Williamson 1975, 1985).

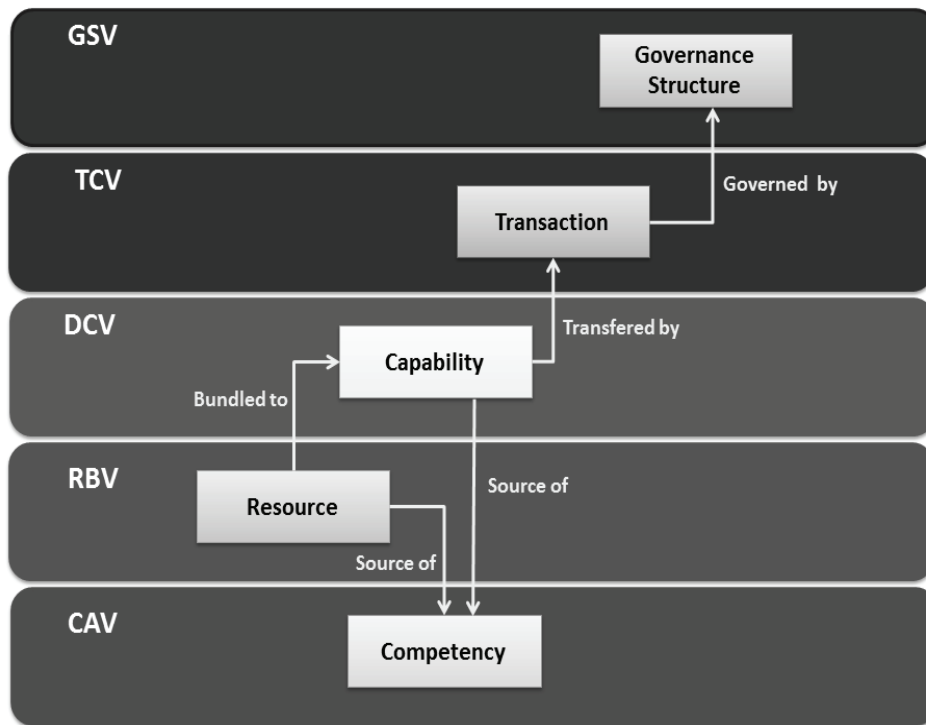


Figure 2: Conceptualisation of capability sourcing

4. Future work

Capability sourcing conceptual models as intermediate artifacts are schematic descriptions of sourcing alternatives based on organization’s capabilities. These models help decision makers to choose the right sourcing alternatives for capabilities such as insourcing forms (e.g. in-house, captive center), outsourcing forms (e.g. spin- off, divestment) and sharing forms (e.g. strategic alliance, joint venture). The proposed conceptual framework is more an integration of different views and theoretical concepts. It provides a frame of reference to define a more specific meta-model for modeling strategic sourcing alternatives and elaborating analytical techniques to explore, compare, and evaluate alternatives and make the right decision. The next steps in our research are 1) Further defining capability sourcing conceptual models as intermediate artifacts and capability sourcing conceptualization as a language through elaborating more the proposed abstraction and views; 2) Applying capability sourcing conceptual method, artifacts and language to create sourcing alternative solutions.

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The Development of an IT Governance Maturity Model for Hard and Soft Governance

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Abstract: To be able to advance in maturity, organizations should pay attention to both the hard and soft aspects of governance. Current literature on IT governance (ITG) is mostly directed at the hard part of governance, focusing on structures and processes. The soft part of governance is related to social aspects like human behavior and organizational culture. This part of governance receives much less attention in the literature. The goal of the study is to design a model which covers hard and soft governance and can be used as a basis for a maturity model (MM). We adopted a research method based on a combination of design science and a Delphi study using the Splitter Group Decision Support System. In this paper we build upon a systematic literature study we conducted. In this study we did not find a MM for ITG that covers the hard and soft part of governance. We thus designed a new maturity ITG (MIG) model using knowledge from literature and experts. As the first step we designed an initial model using literature. This initial model was discussed and improved with experts from practice during a Delphi study with four rounds. The result was a MM with four domains and a context of the organization. The four domains are 'Collaboration', 'Structure', 'Process' and 'Behavior'. Within each domain focus areas were defined based on knowledge from literature and experts. The focus areas 'Culture' and 'Internal organization' from the initial model were moved to the context component because they could be seen as value free. They belong in the situational part of the MM and not in the maturity grid. The contributions of this paper are twofold: n1) a description of the focus areas of the MIG model, i.e. an ITG MM which covers both hard and soft governance: this is of value because such a model for ITG does not exist and is needed in practice; 2) a description of the design process of the MM: this is of value because the procedures and methods that led to current MMs have only been documented very sketchily or implicitly.

Keywords: IT governance, maturity model, behavior, organizational culture, design science, Delphi study

1. Introduction

IT governance (ITG) is an ongoing concern for organizations worldwide. A McKinsey global survey in 2014 showed that 30% of the interviewed executives mentioned "*improving governance processes and oversight*" as most important to improving IT performance (Khan & Sikes, 2014). The CEB Audit Leadership Council has included ITG in their top 10 'hot spots' for 2014 (Kann et al, 2013).

ITG is a relatively new topic. The first publications discussing ITG appeared in the late 1990s (Webb, Pollard & Ridley, 2006). Definitions of ITG in the literature vary greatly (Webb, Pollard & Ridley, 2006; Lee & Lee, 2009). An analysis of the ITG literature revealed that six streams of thought can be distinguished in ITG (Smits & van Hillegersberg, 2013). These streams see ITG as: decision-making; as part of IT auditing; as part of corporate governance from a performance perspective; as part of corporate governance from a conformance perspective; and functioning either top-down or bottom-up.

Recent studies showed that ITG maturity has a significant positive impact on IT performance and firm performance (Liang et al, 2011; Simonsson, Johnson & Ekstedt, 2010). Most maturity models (MMs) used for ITG are related to existing frameworks like COBIT, ITIL and CMMi, and are largely focused on processes and structures (Rogers, 2009).

Still, people are an important asset in organizations. People don't work or think in terms of process and structure only. Human behavior and organizational culture are equally important aspects of governance. A survey by the IT Governance Institute showed that the culture of an organization was seen by 50% of the participants as one of the factors that most influenced the implementation of ITG, surpassed only by "*business objectives or strategy*" which scored 57% (ITGI, 2011). Improvements are needed less in terms of structure and process and more in terms of the human or social aspects of governance (Davies, 2006). To be able to grow in maturity, organizations should thus pay attention to the hard and soft aspects of governance (ITGI, 2011).

In a systematic literature study we conducted we could not find a MM for ITG that covers process, structure, human behavior and organizational culture (Smits & van Hillegersberg, 2013). We thus designed a MM

covering both soft and hard aspects using knowledge from literature and experts. The basic concept of a MM consists of a number of areas—henceforth called focus areas—which mature along a predefined path to achieve higher levels of maturity. A higher level of maturity is defined as a better means to fulfill its purpose; the predefined path is described by a set of capabilities. Capabilities are the ability to mobilize and deploy resources to achieve a goal (Bharadwaj, 2000).

The goal of this study is to answer the following research question: *Which focus areas should an ITG MM for soft and hard governance contain?*

This paper is organized as follows. Section 2 presents the research methodology. Section 3 covers the design of the initial model. The results of the Delphi sessions and the introduction of the maturity ITG (MIG) model, are described in Section 4. Limitations, implications for future research and conclusions are described in Section 5.

2. Research methodology

We adopted a research method based on a combination of design science and a Delphi study using the Spiliter Group Decision Support System (GDSS).

There are many views on how to design a MM and no shared vision exists on which approach should be followed (Mettler & Rohner, 2009; Pöppelbuß & Röglinger, 2011). As a design process for the MM we combined the general process steps as described by Maier, Moultrie and Clarkson (2012) for the design of maturity grids with the more specific process steps for the design of focus area maturity frameworks adapted from van Steenbergen et al (2010).

We started with a literature study on MM design to select the design methodology for the MM. Next, as a preparation for the first meeting with practitioners, an initial version of the MM was designed based on current literature. This model will be explained in the next section. The initial model was discussed in a Delphi study with four rounds. (see Figure 1).



Figure 1: Research approach

A Delphi method may be characterized as a method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem and obtain *“the most reliable consensus of opinion of a group of experts”* (Linstone & Turoff, 1975). The Delphi method is used to *“generate propositions”* on how focus areas grow in maturity and as a *“construct validation”* (Okoli & Pawlowski, 2004). The construct in this study is the MM.

After each round the model was improved using the feedback from the meetings. The meetings were organized between October 2013 and February 2014. To invitees it was explained that it was important to attend the complete series of meetings. When experts invited to the meetings were not able to attend a meeting they were asked to give their feedback online at a later time.

Careful selection of participants is important. The quality and responses of a Delphi panel are as good as the experts (Linstone & Turoff, 1975; Taylor-Powell, 2002). For the series of meetings we invited participants with many years of experience in ITG. These were found among the members of the special interest group Governance of the Ngi (the Dutch association of IT professionals) and the NAF (Dutch Architecture Forum) workgroup on IT governance. In this way the research approach combined knowledge from literature and experts from practice to achieve both *“problem relevance”* and *“research rigor”* (Hevner et al, 2004). The resulting MIG model will be validated in organizations in different industry sectors as a next step.

2.1 Technical details of the Delphi study

The efficiency of face-to-face meetings was increased by a supplemental group communication process (Linstone & Turoff, 1975). We used the GDSS to improve the effectiveness of the group meetings (Fjermestad

& Hiltz, 2000). For this purpose we selected the innovative tool Spilter by Canast which is a user-friendly, web-based GDSS (Spilter, n.d.).

The participants had to respond to questions and statements using a laptop or tablet. There was no hierarchy or dominance; each opinion counted and could be recorded. Responses were anonymous to the rest of the group. For example, when asked to rate some changes to the model, we used the tool to show graphs of the responses and obtain consensus before going on to the next step (see Figure 2).

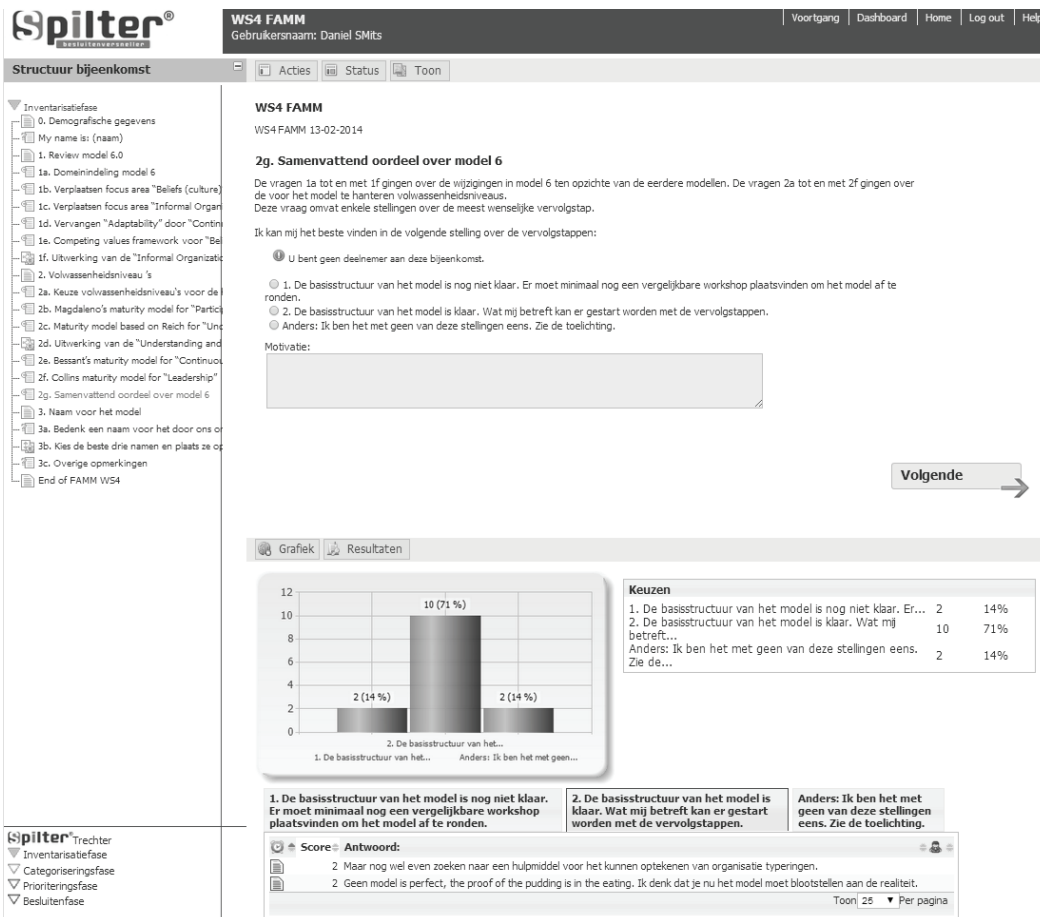


Figure 2: Example screenshot from Spilter

When experts invited to the meetings were not able to attend they were asked to give their feedback online (into Spilter) at a later time. In Spilter, all feedback is traceable to the participant. It is thus possible to separate the responses from persons present during the meeting and those participating online.

3. The design of the initial model

The first step in the design of a focus area MM was the determination of the ITG domains. The second step was the selection of a set of focus areas for each domain. The ITG domains could be defined in different ways depending on the adopted definition for ITG. We use a broad scope based on six streams (Smits & Hillegersberg, 2013) which we included in the model.

The design of the soft side of the initial model required the most attention. The split of governance into hard and soft governance has been made before. Moos (2009), for example, differentiates between legislation and the more 'soft' forms of governance based on persuasion and advice or obligation, precision and delegation (Tucker, 2003). Related to participatory governance Cook (2010) writes about "rules and structures" as being "far less effective" than soft governance. Uehara (2010) and Tarmidi (2012) separate hard and soft ITG using the soft power theory. Joseph Nye is the founder of the soft power theory. Soft power is related to "intangible power resources such as culture, ideology, and institutions" (Nye, 1990). This is close to how we see soft governance. We define the hard side of ITG as the functional aspects of governance like structures and

processes. The soft side of ITG is defined as relating to social aspects like human behavior and organizational culture.

To prepare for the first meeting, the usability of several ITG models from the literature and practice, such as COBIT, ISO/IEC 38500 (2008) and the ITG trichotomy, were discussed within a small group of specialists. As proposed by several scholars, ITG can be deployed using a trichotomy summarized as structures, processes and relational mechanisms. We decided to use this trichotomy as a starting point for the initial model. A more detailed analysis of the literature which describes this trichotomy showed the lack of a clear definition of the ITG domains and some differences in the precise formulation (see Table 1).

Table 1: Evolution of the trichotomy of ITG domains

Domain 1	Domain 2	Domain 3	Source
Structural integration mechanisms	Functional integration mechanisms	Social integration mechanisms	(Peterson, O’Callaghan & Ribbers, 2000)
Structural coordination	Functional coordination	Social coordination	(Peterson, 2001)
Structure	Process	Mechanisms	(Weill & Woodham, 2002)
Structure	Process	Relational mechanism	(van Grembergen, de Haes & Guldentops, 2004)

The third column in the table shows the replacement of the word ‘social’ by the much more restricted phrase ‘relational’. Relational mechanisms or relations between people are relevant for soft governance. However aspects like culture, values or personal characteristics are also of interest. By incorporating ‘relational mechanisms’ into our model we expected that the collaboration between people would be properly covered. To cover the rest of the social aspects we added a fourth domain for the behavioral or social aspects of governance. This domain was named ‘Behavior and culture’. The significance of behavior for ITG could be seen in its inclusion as one of the six principles of the ISO/IEC 38500 standard for ITG (2008).

The same sources were used to split up the domains into focus areas. During the elaboration of the model we selected the focus areas from the sources listed in Table 2 which fall within the rather broad concept of human behavior. These subfields were needed for the design of the MM. The focus areas which could be categorized as a part of soft governance were moved to the fourth domain ‘Behavior and culture’. The result of this process was the initial model (Table 2).

Table 2: The initial model

Governance	Domain	Focus area
Soft	Behavior and culture	Beliefs (values, norms)
		Informal organization
		Leadership
	Relational mechanism	Participation
		Understanding
Hard	Process	IT decision-making
		Monitoring
	Structure	Functions and roles
		Formal networks

The initial model consists of four domains and nine focus areas. For each domain or focus area a definition was selected based on the sources in Table 1 or, when not available, drawing from alternative sources.

4. Results

The number of participants at the first meeting was 19. Participation at the following meetings was only possible for this group of 19 (see Table 3).

Table 3: Number of participants for each meeting (WS: workshop number)

Participation	WS1	WS2	WS3	WS4
On location	18	11	10	7
Online (afterwards)	1	5	4	7
<i>Total</i>	<i>19</i>	<i>16</i>	<i>14</i>	<i>14</i>

A fourth meeting was added later in consultation with the participants. Some participants were not able to attend the complete series of meetings. The reasons stated were: too difficult (1x); it takes too much time (1x); time and private circumstances (2x); and job loss (1x).

The average age of the participants was 51 years. The group consisted of three women and 16 men. Eleven had a Master's degree, six a Bachelor's degree and two followed a different type of education. A specific ITG training was attended by eleven participants. Eight participants were consultants and nine were managers or directors. All participants have specific interest in and experience with ITG. The average years of work experience was 25 years of which 13 years with ITG. The self-reported expertise in/knowledge of ITG was high: six on a scale of one to seven.

The changes, during the meetings of the Delphi study, to the initial model are summarized in Table 4.

Table 4: The changes in the model (in chronological order)

No.	Description of the change	When
1.	Domain 'Relational mechanisms' was changed to 'Collaboration'	WS1
2.	Focus area 'Planning' (incl. bottom-up) was added to the model	WS1
3.	Focus area 'Continuous improvement' was added to the model	WS1; WS2; WS3; WS4
4.	Focus area 'Understanding' was changed to 'Understanding and trust'	WS2
5.	'Context' was added to the model	WS3
6.	Focus area 'Beliefs (culture)' moved to '(Internal) context'	WS3
7.	Focus area 'Informal organization' moved to '(Internal) context'	WS4

In the column 'When' the moment when the remarks or discussion with the participants occurred is stated. The third change was to a focus area which has been changed repeatedly. Only the final result is stated. Each change will be discussed in more detail later in this section.

After each meeting, an interim research model was created based on the results. At the beginning of each meeting the participants were asked to state their opinion on the current model. The progress of the support for the interim and final models by the participants during the meetings is shown in Table 5.

Table 5: Support for the interim models and the resulting model

Meeting	Assessment of research model	Not improved	Improved	Ready	Different	Total	Consensus
WS2	Domains interim model	12%	31%	56%	0%	100%	87%
WS2	Focus areas interim model	6%	56%	38%	0%	100%	94%
WS3	Focus areas interim model	7%	36%	50%	7%	100%	86%
WS4	Resulting model (the MIG model)	14%	n.a.	71%	14%	100%	71%

As a rule to decide to change we aimed at 80% or greater consensus level. In a group there is always some disagreement and participants who have particular preferences can't be allowed to hamper the results of the group.

The options the participants could choose from were specific but could be summarized as: the model is 'Not improved', 'Improved', 'Ready', or 'Different' opinion. The sum of 'Improved' and 'Ready' is listed in the column 'Consensus'. During WS4 the choice 'Improved' was not available.

The first discussion concerned the domain 'Relational mechanisms'. The name 'Relational mechanisms' was assessed by the participants as being unclear. During the meeting 'Collaboration' was mentioned as an alternative. The replacement of 'Relational mechanisms' with 'Collaboration' was rated as an improvement by 88% of the participants.

The second change was the addition of the focus area 'Planning' to the model. It was added after a discussion on the need for business strategy in the model. When asked to rate the change during WS2, 94% of the participants stated that it was an improvement. One participant remarked that it is hardly possible to plan in our complex world and preferred to drop it.

The third change was the most discussed during the meetings. The name of this focus area was changed several times: from 'Changeability' to 'Adaptability' and finally to 'Continuous improvement'. This focus area was always intended to be a characteristic for the organization. The last change was made with the notion that learning is required for change in the right direction. When asked if 'Adaptability' should be replaced by 'Continuous learning' 43% supported the change or didn't have a preference (14%). However, 29% preferred 'Adaptability' and 14% had other concerns.

The focus area 'Understanding' was changed to 'Understanding and trust'. The reason for this change was a discussion during WS2 on the relevance of trust. This change is also in line with literature. Nelson and Coopriider (1996) showed that shared knowledge and trust leads to increased performance in an IT department. Through this shared knowledge base, barriers to understanding and acceptance between IT departments and other lines are removed (Churchman & Schainblatt, 1965; Krauss & Fussell, 1990) and both groups increase their ability to work toward a common goal. In WS3 86% of the participants rated this change as an improvement.

The fifth change was the addition of a context to the model, as shown in Figure 3.

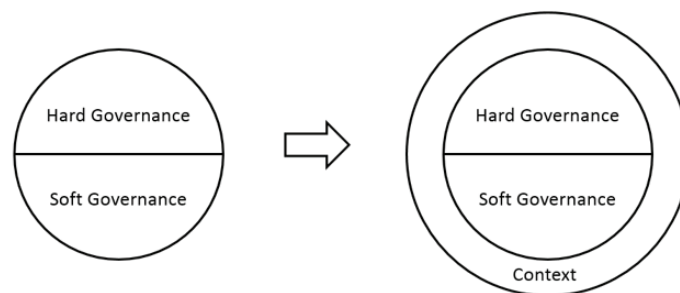


Figure 3: Change of the basic model

The resulting model adds a third pillar to the initial model: the context. Participants argued that some of the focus areas could be seen as value free. If a focus area is value free, it is not possible to improve or grow because the direction of the improvement can't be determined. These focus areas should be added to the context component as the situational part of the MM, as proposed by Mettler and Rohner (2009).

This was discussed with the participants in the third meeting; adding the model was proposed in the fourth meeting. In meeting four, the participants were asked to give their opinion on this change. The outcome was that 93% of the participants preferred the new model including a context.

The sixth change was moving the focus area 'Culture' to the area of '(Internal) context'. In discussions during the third meeting, moving 'Culture' to the context component was proposed because culture could be seen as value free. During meeting four 86% showed their preference for 'Culture' to be part of the context component. One participant thought culture has maturity too because a culture could be desirable. A second participant thought culture has value and proposed looking at the work of Barrett (1998).

The final change was moving the focus area 'Informal organization' to '(Internal) context'. It could be seen as value free, just like culture. When asked to rate this change in meeting four, 83% of the participants agreed to move 'Informal Organization' to the context component.

In Table 5, the support for the MIG model was 71%. The remarks of the participants who chose 'Different' also agreed that the model was 'Ready'. They, however, wanted to add remarks like "The basic structure is far enough for practice but not complete", or "Every model is a limited reproduction of reality and searching for the right model is an eternal journey. I miss models from social psychology". Adding them to the total score makes it 85% and as such we decided to stop the series after the fourth meeting.

The resulting MIG model is summarized in Table 6.

Table 6: The MIG model

Governance	Domain	Focus area
Soft	Behavior	Continuous improvement
		Leadership
	Collaboration	Participation
		Understanding and trust
Hard	Structure	Functions and roles
		Formal networks
	Process	IT decision-making
		Planning
		Monitoring
Context	Internal	Culture
		Informal organization
	External	Sector

The definition of the domains and focus areas were adopted from the literature. The source of each definition is listed in Tables 7. The definitions were discussed with the participants before they were asked their opinion regarding any changes or (interim) models. The domains and focus areas are defined in Table 7 and 8.

Table 7: Definition of the domains

Domain	Definition	Source
Collaboration	Collaboration is defined as making a joint effort towards a goal	(de Vreede & Briggs, 2005)
Structure	Structural (formal) devices and mechanisms for connecting and enabling horizontal contacts, or liaisons, between business and IT management (decision-making) functions	(Peterson, 2004; Peterson, O’Callaghan & Ribbers, 2000)
Process	Formalization and institutionalization of strategic IT decision-making or IT monitoring procedures	(Peterson, 2004; Peterson, O’Callaghan & Ribbers, 2000)
Behavior	Anything that an organism does involving action and response to stimulation; the response of an individual, group or species to its environment; the way in which something functions or operates	(Merriam-Webster, n.d.)

Table 8: Definition of the focus areas

Focus Area	Definition	Source
Continuous improvement	A continual stream of innovation to enhance the value or quality of the products and processes of an organization	Focus area only (Bessant, Caffyn & Gallagher, 2001)
Leadership	Behavior which results in supervision, organization and change of the life, perceptions, expectations and values of the members of an organization	(Burns, 1978)
Participation	Having a part or share in the interaction between the stakeholders in an organization	Focus area only (van Grembergen, De Haes & Guldentops, 2004)
Understanding and trust	Shared knowledge and confidence between the stakeholders in an organization	Focus area only (Peterson, 2001)
Functions and roles	The organizational hierarchal and non-hierarchal positions as defined in the organization	Focus area only (van Grembergen, De Haes & Guldentops, 2004)
Formal networks	The formal governing bodies which are part of the organization	Focus area only: (van Grembergen, De Haes & Guldentops, 2004)
IT decision-making	The IT-related decision-making processes, decision rights and the accountability framework	Focus area only (Weill & Woodham, 2002)
Planning	The establishment of goals, policies and procedures for a social or economic unit. In this model, seen as a top-down and bottom-up process	(Merriam-Webster, n.d.)
Monitoring	The monitoring of costs, values and risks of the continuation and change of the IT services in an organization	Focus area only (van Grembergen, de Haes & Guldentops, 2004)

Focus Area	Definition	Source
Culture	The beliefs, values and norms of the members of the organization which define the way they interact. The whole organization, not just IT	(Trenholm & Jensen, 2000)
Informal organization	The emergent pattern of social interactions within the organization that emerge rather than are mandated. The whole organization, not just IT	(Chan, 2002; Gulati & Puranam, 2009)
Sector	A sociological, economic or political subdivision of society	(Merriam-Webster, n.d.)

The definitions of the focus areas are based on the literature listed. If a definition was available in these sources it was adopted. If not, we added a definition similar to the way the focus area was used in the source listed (preceded by “*Focus area only*” in the column ‘Source’).

5. Conclusions

The domains of the resulting MIG model could be seen as an improvement of the contemporary ITG trichotomy. Several studies showed that soft governance needs more attention (e.g. Davies, 2006; Rogers, 2009; Mettler & Rohner, 2009; ITGI, 2011) and showed that ITG is situational (Sethibe, Campbell & McDonanle, 2007; Rogers, 2009; ITGI, 2011). The need to include both the social aspects of governance and the context as a situational element to a MM are thus supported by practice and literature.

Which focus areas should an ITG MM for soft and hard governance contain?

This question is answered by the description of the MIG model. The support following each interim version of the model increased and after four cycles the response of the group was that it was time to test the model in practice. Especially for the soft governance part, it was quite a quest to select the right areas and prevent them from having too much overlap. During the validation in practice more changes in this part of the model may be needed. The MIG model is the first version of an ITG MM for soft and hard governance designed using literature and improved in collaboration with experts from practice.

While the model was created in close collaboration with customers, a limitation of the study is that the model has not yet been validated in practice. Another limitation is that the composition of the group of Dutch experts might have impacted the resulting MM. The model is not complete yet and will be further developed by adding maturity levels, capabilities, descriptions and assessment questions. As a next step, maturity levels and capabilities will be added to the model. During the meetings we already collected data for this step. As soon as this step is complete the model will be validated, tested and further improved in several organizations in different kind of industries.

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Adopting eModeration: Understanding the User Experience in This Organizational Change

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Abstract: Automated marking has been applied widely and researched in depth. Online-moderation of examination scripts, however, is an emerging technology in the area of online teaching. Despite the potential for optimizing examination procedures, the application of online moderation is limited. Likewise the literature reflects a paucity on studies about the factors that determine the adoption of eModeration. The focus of this study is not automated marking but rather eModeration. Furthermore the relationship under investigation is that between the eModerator and the dean of the faculty - and not between the student and the lecturer as in automated marking. This study is guided by the questions: What is an appropriate framework for measuring the User Experience for an eModeration system? This research investigated what an appropriate framework for measuring the user experience in using an eModeration system would be using a design science methodology. The research methodology will use multiple data generation methods. The data generation methods used to collect empirical (field) data or evidence, in determining the user experience of the electronic moderation process are interviews (qualitative) with four deans from the faculties and questionnaires (quantitative) with moderators. The research was conducted at a Private Higher Education Institution in South Africa. The paper provides some insights into the user experience of deans and eModerators and some insights on improving the user experience by aligning the system structures with the user expectations. The improved understanding of the eModerators and dean's user experience contribute to our understanding of the factors that determine the adoption of eModeration.

Keywords: eModeration, eModerators, user experience, functionality, effectiveness, efficiency

1. Introduction

The processes of moderating examination scripts online involve different actors like examiners, moderators and deans of Faculties. The widely used manual moderation process is time-consuming and cost-ineffective; it relies on paperwork, storage space, management of the process, and presents problems regarding feedback on the assessment of answering scripts of students (van Staden, 2010). The educators at Midrand Graduate Institute (MGI) a Private Higher Education Institution (PHEI) reviewed the manual moderation processes and practices to meet the changing demands of academic processes and structures embedded in technology, for example, adoption problems and resistance to change. Given the main research questions as: What is an appropriate framework for measuring the User Experience for an eModeration system? The study is guided by the following sub-questions:

- what would be the most important user experience constructs for the electronic moderation systems framework?
- what user experience frameworks already exist in literature which are relevant for evaluating electronic moderation systems?
- how do the insights gained influence the design of the framework?

2. Literature study

The objective of the literature review is to distinguish between online assessment and electronic moderation; secondly manual versus online moderation; and lastly user experience and eModeration.

2.1 Online assessment and electronic moderation

This study will thus focus of this study however is on eModeration rather than automated marking since it remains an underutilised application. Online-moderation of examination scripts is novel and the application of online moderation is limited. While automated marking has been applied widely and researched in depth.

Technological developments in education include areas such as computer-assisted assessment, online delivery of formal examination and automated marking make use of online assessment, to mention a few of the current technological developments in education (Dennick, Wilkonson, and Purcell, 2009; English, 2002). Related fields of technological development in education involve electronic moderation where the lecturer or assistant lecturer acts as an eModerator providing feedback to students on assessments (Morgan, 2008; Vlachopoulos, 2008; Salmon, 2003).

Currently a major area of research is the role of Information Communication Technologies (ICT's) based assessment in light of the growing use of virtual learning environments (VLE) in universities (Salmon, 2003). An example would be the automated scoring of text (Gipps, 2005; English, 2002) with a focus on the lecturer's task in the assessment process (Campbell, 2005). Case studies of eAssessment and how ICT's can support the formative assessment processes have also been carried out, for example submission of assignments online, and how feedback between the lecturer or facilitator as the eModerator and students is conducted (Dennick et al, 2009; Bridge and Appleyard, 2008; Nicol, 2007; Salmon, 2003; Hodson, Saunders, and Stubbs, 2002). Research has found that the online submission of assignments and the ability to provide feedback to the student enhanced the learning experience and assisted the lecturer with the record keeping of assignments. Because eModeration is related and influenced by assessment practices, it is therefore important to point out the similarities between eAssessment and eModeration.

Existing literature on eModeration provides evidence of research that focuses on learning and teaching development between the student and the lecturer or facilitator where the lecturer or facilitator is the eModerator in online discussions (Vlachopoulos, 2008; Salmon, 2003). The term "eModerator" is derived from the word "moderator" that is usually associated with a mediating role (Salmon, 2003). According to Morgan (2008) a moderator is someone who presides over a meeting and an eModerator is someone who has a more extensive role within the context of computer moderated learning (CML), a role that is still evolving. Salmon (2003) developed an eModerate framework to provide a guide for a lecturer who acts as an eModerator over online discussions with learners. Given the emergent nature of eModeration, there seems to be a lack of consensus on the meaning of the term. However, for the purpose of this study the following definition will be accepted: "eModerate can be defined as the electronic moderation of summative examination scripts by external moderators in a virtual learning environment called eModerate" (MGI, 2010). It must be pointed out that it is the relationship between the eModerator and the dean of the faculty that is under investigation in this study, and not the relationship between the student and the lecturer as in automated marking.

2.2 Manual moderation and online moderation

Moderation is the process of ensuring that those who are being assessed are assessed in a consistent, accurate, well-designed manner, and that moderators are making similar and consistent judgement about that learner's performance (SAQA, 2001). Moderation produces reports on how assessments are scored (Gipps, 2005). Moderation further ensures that assessors are using comparable assessment methods and are making similar and consistent judgements about the learner's performance.

An eModerate system is supposed to provide a user interface through which examination scripts can be submitted and graded electronically. It is important to note that the scripts in this eModerate system contain hand written answers by students and grading done by the lecturer. After grading of these scripts, they are scanned into electronic format before it is ready to be uploaded for grading by the eModerator.

During a pilot study done by van Staden (2010), the outcomes indicated that the eModeration system definitely had a positive impact on managing the processes efficiently without compromising standards, quality and integrity. Despite the findings eModerators and deans still demonstrate resistance to adopt eModeration. Given this rationale the study investigates the user experience of the eModeration system.

2.3 User experience and eModeration enterprise resource system planning

User experience (UX) is a characterisation of what the user feels while using a product, especially web applications and digital devices (Paluch, 2006). User experience can further be defined in terms of elements that contribute to the positive emotional outcomes of UX such as pleasure, fun, pride and excitement (Preece, Sharp and Rogers, 2009; Hassenzahl and Tractinsky, 2006). The Usability Body of Knowledge (2012) further explains that UX design as a discipline is concerned with all elements that make up the user interface, including

layout, visual design, text, brand, sound and interaction. While the International Organization for Standards (ISO 9241-210, 2010) defines UX as a person’s perception and response that result from the use of a product, system or service. ISO 9241-210 (2010) also describes UX as being all aspects of the user’s experience when interacting with the system. Tullis and Albert (2008) agrees that UX looks at the individual’s entire interaction with a system, the thoughts, feelings and perceptions that results from interaction. User experience concepts also include attention, pace, play, interactivity, conscious and unconscious control and flow (Paluch, 2006). In the investigation it is also necessary to consider the relationship between UX and usability as well as which usability metrics are relevant to electronic online moderation systems.

Usability is generally defined in terms of effectiveness, efficiency, safety, utility, learnability, memorability and user satisfaction (Preece et al, 2009; International Organization for Standardization, 1998). Usability includes both usability of system as well as the user’s experience when interacting with the system and the user’s ability to use a system to carry out a task successfully (Preece et al, 2009; Tullis and Albert, 2008). For the purpose of this study a definition of usability by Nielsen and Loranger (2006) will be used: how quickly people can learn to use a system, how efficient they are while using it, how memorable it is, how error prone it is and how much users prefer using it. Usability is essential for the success of any interactive system, be it an eLearn site, ERP system, the intranet of a company or an online moderation system. If the interactive systems are difficult to use and implement, users will simply stop using the system and find other alternatives (Barnum, 2002; Nielson, 2003). If deans and moderators find the online moderation system difficult to use, they will revert back to the manual paper-based moderation process.

Based on a synthesis from the literature on UX, online moderation and the application context, a mapping between components (Rubinoff, 2004), elements (Paluch, 2006) and eModerate actors is depicted in Table 1. The actors concerned would be the deans and moderators, and processes (moderation) involved in the eModerate system.

Table 1: Mapping between user experience and eModerate system

Rubinoff	Paluch	eModerate
<p>Functionality: Timely response to submission and query Task progress clearly communicated Application adheres to security and private standards Online functions are integrated with offline business processes Administration tools enhance administrator efficiency</p>	<p>Fluidity of interaction: The ability to input information Quick response time from system Intuitive workflow Quick and easy progression to feeling comfortable with the system (short learning curve)</p>	<p>For the people and processes involved: How functional is the eModerate system with respect to fluidity of interaction and progress? How functional is the task progress? How functional is the security? How functional are the tools that enhance administration efficiency?</p>
<p>Usability: Navigation and accessibility Visitors accomplish common goals and tasks Site adheres to its own consistency and standards</p>	<p>Pleasing appearance of the interface. Usability: Effectiveness Efficiency User satisfaction</p>	<p>How usable will the system be for the users? How effective and efficient are the processes to be followed in the eModerate systems? How usable is the navigation and accessibility? How consistent is the design and layout and what impact will it have on usability?</p>
<p>Context: Link density provides clarity and easy navigation Content is structured in a way that it facilitates the achievement of user goals Content is up-to-date and accurate Content is appropriate to customer needs and business goals</p>	<p>Information: Comprehensibility of the information and features. Accuracy of information presented.</p>	<p>Accuracy of information. Comprehensiveness of information. Features of the eModerate system. Up-to-date and accuracy of information. Content is relevant to moderation.</p>

The Venn diagram in Figure 1 illustrates the relationship between the actors, process and UX within an eModerate enterprise resource system.

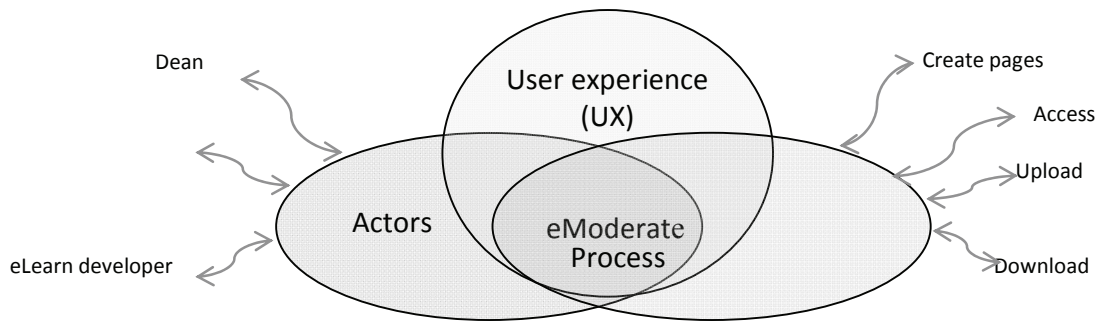


Figure 1: Relationship between actors, processes, user experience and eModerate in the enterprise resource system

The evaluation of user experience in this context includes aspects that will support the academic processes which users will follow in the ERP system known as eModerate. The theoretical contribution of this study will be to establish a framework for measuring UX of eModeration systems.

3. Research approach

The research process consists of components such as personal experiences and motivations, literature review, research question(s), concept framework, strategies (design and creation strategy, case studies), data generation methods (interviews, questionnaires) and quantitative and/or qualitative data analysis (Oates, 2006). Creswell (2009) identified four different worldviews: post-positivism, constructivism, advocacy participatory and pragmatism. With a philosophical perspective of interpretivism or constructivism, the research design involves an exploration of a research topic or theory, rather than being a test of it (Myers, 2009). Research in the Information Systems (IS) domain can be regarded as interpretive when knowledge of reality is gained only through social construction such as language, shared meaning and documents (Klein and Myers, 1999; Klein and Myers, 2011). The philosophical worldview proposed in this study will be interpretivism.

The research design according to Yin (2014) is the logical sequence that connects the empirical data to the initial research questions and ultimately its conclusions. Research design also deals with four problems: what questions to study, what data are relevant, what data to collect and how to analyse the results (Philliber, Schwab, and Samsloss, 1980). In Design Science Research (DSR) and creation research the focus is on developing new IT products or artefacts with the intention to offer a construct, model, method or instantiation as a contribution to knowledge (Oates, 2009). The development of a framework for measuring the User Experience for an eModeration system fits the design-science paradigm. Design Science Research is an embodiment of three interwoven cycles of activities (namely the Relevance, Design and Rigor Cycles) (Hevner, 2007). It begins with a relevance cycle of literature review and context analysis to develop a conceptual framework for the research. The second cycle, design and development, is an iterative design, development and formative evaluation of an artefact or intervention. The third cycle is a rigor/theory building cycle that targets generation of design principles. The cyclic procedure, however, is not always linear, and overlapping as well as going backward and forward between the cycles is not uncommon. This article covers the first two DSR cycles. The literature was covered in Section 2 and the design is explained in Section 3.3. The results are presented in Section 4 towards an initial evaluation of the usefulness of a framework for measuring the User Experience for an eModeration system.

3.1 Research in context

The eModerate system is embedded in the eLearn system of MGI. The PHEI decided to use the eModeration system in all the faculties: Information Technology, Creative Arts, Commerce, Social Science, Science and Law. The electronic moderation system allows the moderator to make use of eAssessment tools, such as free online marking tools that is Internet-based or sticky notes in Adobe, to grade the student's examination scripts.

The relationship in this research is on the eModerator and the dean of the faculty and not between the student and lecturer as mentioned in other studies such as those by Salmon (2003), Morgan (2008), and Vlachopoulos (2008). The dean will report back to the lecturer of the module; hence there are three entities involved in the electronic moderation process, namely the:

- lecturer who grades or scores the papers,
- eModerator who moderates the marking (act as a second marker) and
- dean who receives the moderation report and provides feedback to the lecturer.

3.2 Sampling strategy

All the moderators for modules in both semesters of the PHEI were selected. As some moderators are moderating more than one module, the number of moderators and number of modules does not correspond. The Law faculty did not participate in the study. Table 2 illustrates the various participants involved in the study, the number of modules in the relevant faculty as well as the number of modules selected in the study. Theoretical and practical modules were selected with an even distribution over the two semesters.

Table 2: Comparison between number of modules per faculty and number of moderated modules

Faculty	Number of modules	Number of modules moderated in total per faculty and total number of scripts	Percentage of all modules in faculty used in the eModeration research
Commerce	83	20 modules a total of 388 scripts	25%
Social Science	39	15 modules a total of 111 scripts	38%
Science	37	21 modules a total of 280 scripts	51%
Creative Arts	44	6 modules a total of 150 scripts	14%
Information Technology	37	14 modules a total of 220 scripts	38%

The reason for the low percentage in Creative Arts is because of the format of the assessments in modules, not all can be moderated electronically.

3.3 Evaluation research strategy

The data from both quantitative and qualitative strategies can be used side by side to reinforce each other, with qualitative quotes supporting statistical results (Lazar, 2010) and because they provide the best understanding of a research problem (Cresswell, 2008; Oates, 2006). Evidence from both quantitative and qualitative data will be included and can cover interpretivist perspectives (Yin, 2014). Qualitative data analysis looks for themes and categories within words participants use (Oates, 2006). The researcher has decided to use data triangulation to collect and analyse data.

Therefore, open-ended questions as well as some Likert scale survey items, which are quantitative, were used in the interviews with four deans from the six faculties to determine their views on the user experience of the eModerate system and process. The case study in question was conducted over two examination sessions, collecting detailed information using data collection procedures such as interviews with deans and surveys with the deans and eModerators. The reason for combining both quantitative and qualitative data is to bring about a better understanding of the research problem by converging quantitative numeric trends and qualitative detailed views of data and to advocate change for moderators and deans of faculties.

The interview was arranged in three sections: biographical information, a questionnaire that gathers information regarding the dean’s perceptions of eModeration, and finally a structured interview.

All the eModerators (seventy seven) were asked to participate in the study, except in modules where it is not possible to use online moderation. A total of thirty moderators responded to the survey by completing the questionnaire that was arranged in five sections:

- A-Biographical data;
- B-Questionnaire on moderation;
- C-Questionnaire on usability and design heuristics
- D-Questionnaire on general interface design heuristics criteria to determine user experience
- E-Questionnaire on user experience design heuristics

4. Findings

The following section reports back on some of the research findings between the interviews and questionnaire being used. Faculties had different problems, for example, the Science faculty had a problem with moderators who did not complete the moderator’s report and/or did not upload the report. The deans of the Commerce and Social Science faculties did not experience any problems either with the usability or the user experience of the system. Deans indicated that they accessed the eModerate system from their work station with only one dean accessing it from home. The bandwidth of the user machine might have a direct correlation to the user experience, thus it was for this reason that users of the eModerate system were required to answer questions on their internet access.

None of the deans has previously used an eModeration system. Table 3 illustrates that the move is perceived as a positive development, the process is faster and fewer people are involved. It also reflects their opinion as to whether the internet infrastructure is able to handle the eModerate system and whether the process is easier. A Likert scale from 1 – 5 (Strongly disagree, neither agree nor disagree to Strongly agree) was used.

Table 3: Change-over from manual paper based moderation to eModeration

Statement	Findings
It is a positive development.	Two deans strongly agree and one agrees.
The process is faster. The process is easier.	For both questions the deans responded as follows: Two deans strongly agree and one agrees.
Fewer people will be involved.	One dean strongly agrees and two deans agree.
My Internet infrastructure is able to handle the eModerate system.	Two deans strongly agree and one neither agrees nor disagrees.
Other, describe other positive comparisons	One dean commented that the chance of scripts being lost is less likely.
Other, describe other negative comparisons	One dean complained that the moderators had not followed instructions.

During the interview participants were asked to comment on their initial impression of the eModerate page(s) with reference to graphical intensity, likes and dislikes, etc. Table 4 contains some of the constructs with comments and quotes from the different faculties that were extracted after the interviews.

Table 4: Deans’ initial impression of the eModerate system

Faculty	Constructs identified based on quotes and comments by deans
	Usefulness
Commerce	I think it is a very useful system.
Social Science	Concern however on graphical intensity of the moderator’s green pen, it is difficult to see on screen maybe a different color pen should be used.
Science	Potential to be useful. Less chance to misplace examination scripts.
Creative Arts	It is a very useful system, especially the page layout that is clear and it is quick to find what is needed.
	Usability
Commerce	I think ePortal and the eModeration page colour is consistent with each other making it very usable.
Creative Arts	The fact that multiple documents can be up/down loaded makes it a very usable system.
	Ease of use
Social Science	Moderation sending off is easier than manual courier system.
Science	Did not know anything about it and was initially afraid.
	Easy to understand
Commerce	Clear, easy to understand.
Creative Arts	Page layouts are clear and easy to understand.
	Flow of information
Commerce	Nice flow to process.
Creative Arts	The fact that you are in control of what is happening in the process and of where information are at what time.
	Time
Social Science	Very impressed with the conduct and speed. Not time consuming

Faculty	Constructs identified based on quotes and comments by deans
Science	Should make the moderation process quicker.
Creative Arts	It saves time.
	Process control
Commerce	It made my life easier, it was easier to keep in contact with moderator. It was easier to see how far the moderator is with the moderation process, because I received an email telling me that the moderator uploaded. It is more controllable. A track of the process improved the whole moderation process.
Social Science	More control over bigger packs.
Science	Like to see what moderator is doing both moderator and dean see the same view which makes it easier to assist with queries.
Creative Arts	The control over the moderation process and moderators. A challenge will however be for people to change the way they work – being more software savvy.

The faculties were in agreement regarding the following advantages: the process is acceptable, effective and efficient. A challenge that the team faces is to convince moderators to adapt to eModeration not to print the examination scripts but to rather use technology like online marking tools to moderate. Table 5 demonstrates that the eModerators also agree with the efficiency and use of system

Table 5: eModerators’ initial impression of the eModerate enterprise resource system

Flexibility and efficiency of use	Strongly disagree to Strongly agree		
Instructions are clear, informing participants on what to do next.	3%	10%	86%
The flow of instructions in the process is logical.	0%	13%	86%
The upload process is efficient	7%	17%	77%
The download process is efficient	3%	17%	80%
Overall experience of use, by indication satisfaction with:	Strongly disagree to Strongly agree		
The features of eModeration.	3%	13%	83%
The functionality of eModeration.	10%	17%	77%
Content offered.	10%	7%	84%
Navigation structure	3%	13%	83%
Login page layout.	0%	10%	90%
Module page layouts.	0%	7%	93%
Ease of use.	10%	17%	73%

Table 6 shows some of the positive and negative aspects eModerators identified in using the eModerate system. The deans’ and eModerators perspectives on whether it is a time consuming process are however contradicting. In Table 4 deans from three faculties experienced the use of the eModeration system as faster, not time consuming and they were impressed with the speed of the system, compared to the eModerators comments in Table 6, which are contradicting, 48% of the eModerators perceived the process and use of the system as time consuming.

Table 6: eModerators’ positive and negative aspects identified in the evaluation of the eModerate enterprise resource system

Positive aspects			
Easy to use	80%	Enjoyable	20%
Appealing	36%	Useful	63%
Comprehensive	23%	Friendly	27%
Engaging	23%	Effective	67%
Pleasant	10%	Functional	67%
Negative aspects			
Uncertainty	17%	Frustration	13%
Time consuming	37%	Overwhelming, irritating, in-effective, and not functional	7%

5. Conclusion and recommendation

This research investigated what an appropriate framework for measuring the user experience in using an eModeration system would be, by using a design science methodology. The initial constructs of the framework was abstracted from a literature study on user experience and then synthesized with contextual factors from the Private Higher Education Institution in South Africa, chosen as the application context. Based on these

constructs and existing user experience questionnaires a new questionnaire was developed and tested during interviews with Deans and a survey with moderators.

The analysis of the interviews with the Deans supported the usefulness of the eModeration systems and validated the constructs of fluidity of interaction and progress. Important to note that this is the managerial view and the objectives and functionality is different from the eModerators. New constructs added from XX perspective are process flow. The analysis of the survey with the moderators supported ease of use, usefulness, effectiveness and functionality of the eModeration system.

The theoretical contribution is an updated set of constructs towards a framework for measuring the user experience in using an eModeration system. The practical contribution is the validated questionnaire and also the practical issues uncovered in introducing an E-moderation system at a Higher Education Institution.

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Masters Research paper

Hackathon – A Method for Digital Innovative Success: A Comparative Descriptive Study

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Abstract: The scarcity of resources with the changing fiscal environment of more nations have increased the need for innovative solutions in most fields. Numerous bodies have as a result called for higher integration of ICT in organizational processes. Its adaptation has in several cases democratized innovation processes. From this, open and/or social innovation has emerged. One type of open innovation is the ideation contest known as hackathon. The aim of the paper is to identify factors leading to the success of hackathon contests. This has been done by examining six such contests held between the years 2012 and 2014. Structured interviews have been held with the owner/project manager of each contest. In addition, the authors attended five of the contests. This allowed for both making observations of the events from start till end, and also to hold very informal interviews with participants and event personnel. A total of six factors, reflecting the expectations held by both the hackathon organizers and its participants, were identified. Thereafter an analysis was conducted to see how the contests responded to the identified factors. Of the six examined contests, three are believed to have been successful, two unsuccessful and one is believed to have reached a moderate level of success. The results obtained showed that the identified factors are correlated to the success of such contests. However, the level of influence of each factor on the success of the contests differed in each case. As such, while each factor is of importance, they are all dependent on each another. As a conclusion, the paper stresses the need for organizers of such events to take into consideration each of the mentioned six factors when planning a hackathon. Furthermore, this paper can be of interest to both researchers and practitioners seeking to better understand democratized methods for change efforts, such as with open innovation, social innovation and/or hackathons.

Keywords: hackathon event, innovation process, information sharing, open innovation, Social innovation

1. Introduction

Demand is increasingly harder to meet in many sectors across ever more nations due to the scarcity of resources combined with the frequent changes in fiscal environments. The need for innovative solutions to reach market equilibrium has as a result increased (Chowdhury 2012; European Commission 2011). National and international bodies are as a response calling for a more effective use of the potentials provided by Information and Communication Technologies (ICT) due to its dynamic and innovative nature and ability of developing improved infrastructures and methods for interconnectivity (European Commission 2011; Regeringskansliet 2011). The increasing application of digital tools in various environments have, and still are, reconfiguring organizational structures. External information have simultaneously begun playing a larger role in the many processes organizations have, thus creating a situation in which a dependency on their environments has deepened. The establishment of newer external relationships in processes have resulted in more intertwined innovation ecosystems in which individuals and/or groups technologically either cooperative or compete to have what is beneficial to end-users developed (Selander et al. 2010). Such democratized processes for innovation have been enabled partly due to the advancements made in the area of ICT, from which new methods for channeling information have become available due to a better access to shared digital resources (Yoo et al. 2009).

The European Commission together with its stakeholders in 2010, as a response to the above mentioned circumstances, launched the Digital Agenda for Europe with the aim of improving quality of life and producing economic growth by effectively making use of the social and economic potentials of ICT (European Commission 2011). As part of this, the European Union recently launched the Horizon 2020 programme, the EU's biggest research and innovation programme, with the aim of securing the global competitiveness of the continent (European Commission 2014). Similar international and national initiatives have been launched by

numerous bodies. The Digital Agenda of Sweden, as a collective ICT strategy for all local bodies to follow, is one such initiative on a national level (Regeringskansliet 2011).

The importance of innovation lies in its ability in producing prosperity and progress (Volberda et al. 2013). The advancements made in connectivity has allowed new organizational structures to gain from open and interoperable solutions at lower costs. This due to the enabled ease in coordinating and collaborating with parties not necessarily present at one location, in what is known as a democratized innovation process due to its inclusion of a variety of heterogeneous actors (Yoo et al. 2009). Through such a bottom-up approach, scalable solutions are produced by focusing on rapid and incremental developments. The results, are usually tested immediately and should they show signs of potential success, developed into large-scale services and/or products (Chowdhury, 2012). In addition, another enabler of such democratized innovation processes are the current presence of digital convergence, i.e. the integration of digital technologies into artifacts previously known as non-digital. The collaboration between Nike and Apple as an example resulted in the production of the digitalized Nike+ sneakers that are able to communicate with Apple products (Yoo et al. 2009).

Open innovation, as one type of a more democratized platform, allows for the exploitation of sustainable ICT solutions across industries as a larger pool of resources are included in the development process. As a result an increasing number of organizations have altered their concepts of business strategy from product to service orientated (European Commission 2011; Yoo et al. 2009). The application of idea management and establishment of an ideation system could better the identification of sources of ideas that might potentially lead to innovative solutions. Numerous such systems have been and are in use. While some systems, such as voice of the customer, advocates more effective communication channels and platforms for dialogue with customers so to tap into identified sources of ideas, systems related to open innovation proposes organizations to seek outside their company, not only for ideas but also for individuals capable of developing either full products or prototypes. Whatever the case, this becomes a first phase for the ideation system in place. Furthermore, open innovation methods may vary depending on the needs of the organization (Cooper & Edgett 2008). Crowdsourcing is one such method, used for example by the online encyclopedia Wikipedia (Wikipedia 2014), which seeks to invite external individuals/groups through internet to submit developed products and/or services. Ideation contests as another method have also been widely used (Cooper & Edgett 2008) as if often allows for friendlier interactions to take place between individuals from different fields as social barriers are diminished. Thus, the various competences held by all actors can be merged into the development process. A reason for the success of this approach has been that developers can identify themselves with the end-user of the product and/or service. This raises the idea that the solutions sought after may in fact not be resulted from technical innovations, but rather through social innovations (Chowdhury 2012; European Commission 2011; Yoo et al. 2009), from which a win-win situation can be established for all involved bodies by employing a multidisciplinary approach. Understanding digital innovation does in fact require a multidisciplinary dialogue as more aspects of today's society includes the digitalization of previously known non-digital artifacts and/or processes as mentioned above (Yoo et al. 2009).

Nevertheless, the paper examines six hackathon events, one type of an ideation contest, with the aim of identifying factors leading to the success of hackathon contests. The contests were held between the years 2012 and 2014. A total of six factors, reflecting the expectations held by both the hackathon organizers and its participants, were identified. Thereafter an analysis was conducted to see how each contest responded to the identified factors.

2. Hackathon

Hackathons, as one type of an increasingly popular ideation contest, are events in which programmers, developers and sometimes individuals from other disciplines collaborate on a software project in a friendly environment by generating a solution to a beforehand specified problem. Usually held for no more than a few days; these short-term and intensive events focus on designing, coding and developing testable software prototypes by integrating the preferably diverse expertise of its group members. These events are, due to the value of their outcomes, increasingly being recognized and applied in numerous fields. Hackathons have in fact, in organizations such as Facebook and Foursquare become a routine for research and development (Chowdhury 2012). Being a part of the application of idea management and/or establishment of an ideation system, these ideation contests can be regarded as an early phase in the larger innovation processes undertaken by the firm (Cooper & Edgett 2008).

Such contests have taken place since the 1960s, where MIT students would in a marathon-like process program their way to solutions. The word hackathon is in fact a combination of the two words 'hack' and 'marathon', while the first word refers to the belief that knowledge and information sharing should be positively viewed, the latter refers to the intensive and uninterrupted period of time used for the development of the prototype. Their success have appealed not only technological companies, but in 2011 more than 200 hackathons were held across numerous industries in the US (Chowdhury 2012; Zapico et al. 2013). Their time, size and shape differ depending on the resources available to the organizers. The participants, grouped into teams either before or during the contest, go through a number of stages in their attempt to becoming the winning team. Usually it starts with idea generation, leading into concept development and design to end with the development of a working prototype. This necessitates organizers to adequately accommodate participants with the amenities necessary such as a variety of free edibles, rewards, comfortable facilities, proper internet connection and also an availability of sponsorships and/or potential investors. While some organizers choose to identify a specific problem for participants to find a solution for, other hackathons have themes with a number of focus areas such as the 'Green Hackathon' held in the Swedish capital of Stockholm in 2011, where the theme was sustainability and participants were free to choose areas ranging from climate change, food, energy etc. Many organizers choose to have presentations and lectures at the beginning of the contest so to provide inspiration and direction for the participating teams. Additionally, the presence of mentors throughout the event are increasingly used at hackathons. Mentors are people with certain expertise related to the theme of the hackathon that answers questions and provide guidance to the participants whenever needed. Most hackathons end with each team holding a presentation on their project whereby a jury evaluates each presentation, sometimes in accordance with a list of criteria handed out before the event, thereafter the winning team(s) are announced. Should certain rewards be available or potential investors be in place then an element of competition will either be added or increased (Zapico et al. 2013).

3. Method

The study has been conducted using a qualitative driven research so to enable an understanding of hackathons and the behavioral factors and actions taking place within such environments (Walshman 2006). Therefore, the actual environments of six hackathon contests have been analyzed by both conducting interviews and making observations of the events from its beginning till its end. Interviews and observations allows for the formation of better understanding of both the interactions in place between individuals within a given environment, and also the actual environment itself (Trost 2004). Nevertheless, the aim of the paper has been to identify factors leading to the success of hackathon contests. For the sake of argument, success is in this paper defined as "the accomplishment of an aim or purpose" (Oxford Dictionaries 2014). The 'aim or purpose' of each hackathon examined is set by the event organizer(s). This can in all the cases examined be reflected in what is expected to be developed by the participating teams. It should, however, be noted that innovation contests are merely an early phase in a larger innovation process. Therefore, the paper focuses only on the success resulted from the actual contests and excludes any success, or lack of it, after the contests. The papers research question is thus 'What are the success factors of a hackathon contest?'

Of the six analyzed hackathon contests, five were attended by the authors of this paper. At these contests, the authors have acted as mentors, project managers, owners and/or jury members. In addition, the authors are researchers and/or professionals, each within their given area in the field of IT. Moreover, being present at the contests allowed for very informal interviews and/or discussions to be held with both participants and event personnel. In addition, structured interviews containing six questions were held with the project manager and/or owner of each contest, including the contest not attended by the authors of the paper. This enabled the authors to gain a better understanding of hackathons as events as well as the expectations held by the owner/investor and its participants. Furthermore, the six questions of the structured interviews were related to the contests; (i) area of focus/problem area, (ii) rewards, (iii) competences and skills of participants, (iv) mentor support, (v) jury members and (vi) entry requirements. These areas were chosen to be included in the structured interviews as the prior knowledge and/or experience held by the authors regarding hackathons, together with available data in the found related literature, highlighted their importance. The identification of the six factors leading to success were derived from the data gathered from the structured interviews held with the owner and/or project manager, the informal interviews and/or discussions held with the participants and event personnel, as well as from the observations made during the events. These factors turned out to be within the same six areas included in the structured interviews, thus verifying their importance in producing a successful hackathon.

4. Hackathon cases

A total of six hackathon contests were analyzed, of which all were held in Sweden between the years 2012 and 2014. The article will omit naming the contests examined, instead each is presented as a number (see table 1). Table 1 also shows certain characteristics of the contests so to provide readers with an understanding of each. The chosen characteristics are as follows; focus area, contest duration, number of participating teams, open data availability, amenities provided and inspirational lectures/presentations.

Table 1: Overview of the hackathon contests analyzed

	Theme	Duration	Teams	Open data availability	Amenities	Inspirational Lecture
Case 1	eHealth	24 Hour	6	No	Satisfactory	Yes
Case 2	Open Data	24 Hour	4	Yes	Good	Yes
Case 3	eTourism	24 Hour	11	Yes	Good	Yes
Case 4	eHealth	24 Hour	8	No	Good	Yes
Case 5	Space	24 Hour	10	Yes	Good	Yes
Case 6	Environment, education, culture, health	3 Months	3	Yes	Satisfactory	Yes

As earlier mentioned, hackathons each have a certain theme chosen by its owner(s), thus becoming the purpose of the contest, i.e. to develop solutions within the area of the theme. Should this be the case, then the participating teams are free to develop any solution as long as it is within the chosen area. This was what occurred in cases 2, 3, 4 and 6. The task given to participants was for instance as follows; develop the coming generations mobile experiences (case 3) or add value to health services (case 4). The task could also be in the form of developing any application for the municipality using only and only open data sources provided by the municipality (case 2). In some cases, however, owners identified a certain problem within the area of the theme, and therefore directing participants to develop a solution for that specific problem. In case 1 the task was to develop a digital gamified environment that would tackle obesity, while in case 5 event organizers had selected a few topics within the theme and participants could freely develop any solution wished for as long as it stayed within the selected topics. Furthermore, the duration of a hackathon may differ, and in the cases analyzed, all but one had a time length of 24 hours. The sixth contest lasted for three months. Decisive factors related to the time management of a hackathon could be given budget, availability of facilities or spare time of participants. Similarly, the number of teams vary. While the given budget plays a role here too, other factors for the number of teams signing up could be whether adequate marketing has been conducted and also the opportunity cost for people to actually participate. The availability of open data can in some cases play a difference as it aids participants in their development process. In case 2, the use of open data from the local municipality was mandatory, and as such, contributions not using these sources would be disqualified. Moreover, the provision of adequate amenities are of utter importance as it could either disturb or help avoid any disturbances for the participants. Amenities include the facility in which the event takes place in, the provision of food, internet connection and support amongst others. The event organizers in case 6 provided participants with good amenities. Due to the long duration of the event, however, the amenities were not adequately used by the participants. Lastly, all contests made use of inspirational lectures/presentations with the aim of guiding participants towards successful solutions.

5. Results

The gathered data allowed for the identification of six factors that if taken into consideration could potentially lead to the success of hackathon contests. These six factors are; (i) how well the problem area is defined, (ii) what sort of return is offered to the winning solution(s), (iii) how diversified each team member's competences and skills are (iv) whether mentors were in place and how well they communicated their expertise to the participants, (v) did jury members hold enough understanding of the area(s) in focus and (vi) the entry requirements of the competition. Table 2 illustrates how the six examined hackathon contests responded to the identified factors.

Table 2: How each examined case responded to the six identified success factors

	i	ii	iii	iv	v	vi
Case 1	Not well defined	Exposure at a health conference	Small variations, no to little health-related competences, mostly technical	Mentors in place, but communication with participants only satisfactory	Strong jury	Team size
Case 2	Satisfactory	Mentorship provided	Enough diversified competences	No mentors in place	Good jury	Participating teams had to use open data sources provided by the local government
Case 3	Well defined	Small venture capital	Well diversified competences	Mentors in place	Satisfactory jury	Team size
Case 4	Well defined	A good venture capital	Well diversified competences	Mentors in place	Very strong jury	Participating teams were asked to submit their ideas before the contest, and only teams with original ideas were accepted
Case 5	Well defined	No solid return, but high-level exposure	Diversified competences	Mentors in place	Very strong jury	Open for all
Case 6	Not well defined	Small venture capital	All had only technical competences	Mentors in place, but communication with participants less than satisfactory	Good jury	Age and team size

These six factors reflects the expectations held by both participants and event organizers. Both parties clearly have the ideal digital solution in mind. Yet, the perspectives regarding the path leading to the solution differ. As earlier mentioned, the theme or the problem area of the contests are what decides the type of digital solution demanded. Therefore, should organizers fail to properly communicate the problem area, then the participants might fail to develop the solution demanded. In the cases examined, the problem area has been communicated to the participants through the event website, provided leaflets and/or other hard copy material, inspirational lectures/presentations held and mentors in place providing their expertise. The type of reward given to the winning solution(s) of a contest may act as an incentive for people to participate, and when at the contest, to do their utmost. This tool of motivation could therefore play a role in the type of participants signing up for the contest and also their endurance throughout the duration of the contest. Nevertheless, the right competences are needed to develop any type of solution. As Yoo, et al. (2009) explains, digital solutions require an interdisciplinary cooperation, and therefore a team which hosts members with different backgrounds ought to have a higher chance in developing the most appropriate solution. Furthermore, having a jury with a strong academic and professional background is very important for the event organizers. With a weak jury, organizers may not be able to award the most appropriate solution developed, thus resulting in the event organizers not receiving the planned return. The same can be said about whether or not the organizers have set any entry requirements for the event.

6. Discussion

The paper aimed to have factors leading to the success of hackathon contests identified. From the data gathered and the analysis of the contests, this resulted in six such factors; (1) problem area, (2) reward, (3)

competences of participants, (4) mentor support, (5) jury and (6) entry requirements. Nevertheless, of the six analyzed hackathon contests, only three are believed to have been successful, these are cases 3, 4 and 5. Cases 1 and 6 are believed to have been unsuccessful, while case 2 is believed to have reached a very moderate level of success. Each factor and how the examined contests responded is presented below;

Problem area: Cases 1 and 6 failed to thoroughly communicate the problem area to the participants. This, for instance in case 1, resulted in a slow start for the participants until mentors had spoken with each team separately. Only then, when participants had grasped the task they had been assigned, could any progress with their development of a prototype be made. Both cases are believed to have been unsuccessful. All remaining cases, apart from case 2, managed to adequately inform their participants about the problem area and what was expected from them. Case 2 did actually not have a defined area per se, but the assigned task required participants to develop any solution as long as open data sources from the local municipality were used. So while no problem area was in existence, organizers managed to properly communicate to participants what was required from them.

Reward: All six cases examined had some sort of an award for the team with the winning solution. The awards differed in type and size. Case 1 offered the winning team exposure at a major regional health conference and case 6 offered a small venture capital. Having said that, rewards can be regarded as incentives, participants may calculate the opportunity cost of what is given to what is to be received, and only thereafter decide to partake in the contest. Time was one such factor in case 6, where the number of teams initially were 16, but only three of the 16 teams submitted a solution. The low turnout, as according to its project managers, was the long duration of the contest. Case 5 had no form of return. Instead, the winning team were to continue partaking in yet more contests on an international level. Its owner is internationally recognized within its field. Participation at such events comes with several advantages, one being the greater media coverage received. Cases 3 and 6 on the other hand, both had a similar return offered to the winners despite the former being successful and the later unsuccessful. They did, however, respond very differently to each of the five other factors, indicating that the reward offered may only play a minor role in motivating participants, and thus achieving a successful hackathon contest.

Competences of participants: The right competences are needed for the development of the right prototype. Both cases 1 and 4 had set eHealth as their theme. While the participants in case 1 were given the task to develop a solution against obesity, in case 4 participants were instead asked to add value to health through a digital solution. To develop the appropriate solution both health and technical competences are needed. Case 4, which is considered a successful case, housed participants with a variety of competences. In case 2, participants had enough diversified competences for that particular event. Organizers had only asked for open data sources from the local municipality to be used, thus allowing expertise in many fields to be used. Nevertheless, observations in all six cases shows that a more worthwhile reward may positively correlate to individuals with more diversified competences and/or with the competences needed to develop a potential winning solution to enter the contest.

Mentor support: All but case 2 had mentors. But it was also only in case 2 were participants were free to take on one of many fields. Nevertheless, mentors and the role they play effects whether or not participants manage to develop the required prototype. The three successful cases all had mentors who appropriately managed to communicate their expertise to the participants. In case 1, the mentors in place had enough expertise in the problem area, but the communication with participants were often short and rarely enough informative or inspirational. In case 6, in regards to the previously mentioned duration issue, any communication between mentors and participants were less than satisfactory. Opportunities to meet mentors were overlooked and often digital communication was preferred.

Jury: Jury members do not only judge the submitted solutions but also hold dialogues with the participating teams once or twice throughout the contest. These dialogues can at times be regarded as pre-judging feedback to participants. Judges therefore ought to hold enough competences and expertise so to identify the solution needed. The competences held therefore ought to be within the given theme of the hackathon contest.

Entry requirements: The effect of entry requirements on the outcome of the contest differ. In case 5, organizers allowed nearly anyone to participate. Due to the great reputation of the organizer, however, the

right competences applied. Case 4, as one of the three successful contests, required the participants to submit their ideas before the contest for approval. Only ideas which in no way had been earlier used were accepted. This both allows organizers to filter out a not needed crowd, and also enabled participants to work on their prototypes before the start of the contest. Similar to what took place in case 2, where potential participants could start planning before the event as its only requirement was as mentioned, the use of open data source from the local municipality. All but case 2 and 4 were very positive in accepting anyone applied to partake in the contest.

7. Conclusion

The results show that while all identified factors are in most of the hackathons correlated to whether they reached success or not, in some contests certain factors have played different roles. All factors have in fact a relation to one another. Nevertheless, as can be witnessed in all six cases, how well the problem area has been communicated to participants can be regarded as a decisive element in whether or not organizers attained the solution(s) sought after. In addition, the problem area is what sets the theme of a hackathon and therefore affects many factors throughout such contests. Thus defining and communicating it well can bring about a win-win situation for both organizers and participants. Rewards on the other hand, while it may play a minor role to the outcome of the contest, is not considered a decisive factor. Having not only the right competences but also having a diversified set of competences present at the hackathon is, however, of importance as most present-day solutions require a multidisciplinary approach. Equally needed are mentors in place with a comprehensive understanding of the field in question that are both able to help guide and inspire participants to develop the right solution(s) and highly skilled judges that are able to identify the most appropriate solution(s). Furthermore, making use of an appropriate set of entry requirements could be beneficial and time-saving to both organizer and participants.

As a conclusion, the paper stresses the need for organizers of such events to carefully take into consideration each of the mentioned success factors when planning and executing a hackathon event. As earlier mentioned, these factors are not definite, but each do play a role in the outcome of the contest, and each is related to the other factors. Furthermore, the paper can also be of interest to scholars undertaking research within the area. The authors of the paper do in fact call for further research to be conducted within the field so to enable a better and wider understanding of open innovation, and hackathons as one such type.

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Work in Progress Papers

Towards Using the Creation of a Mosaic as a Metaphor for Change

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Abstract: In this work in progress we aim at using the creation of a mosaic as a metaphor for describing change processes related to Information Technology. The aim of the mosaic as a metaphor is to capture aspects of change not prominent in most normative models of change, and to be able to illustrate change in an alternative manner. This work in progress first briefly presents the process of creating a mosaic as a metaphor, and then applies the metaphor to one case study and discusses the implications.

Keywords: sociotechnical systems, situated action, change management, system development processes

1. Introduction

There are numerous normative approaches to manage change processes related to IT. Some recent examples are Lean systems development (Poppendieck and Poppendieck, 2009), User Centred Systems Design (Gulliksen et al., 2003) and Rational Unified Process (Kruchten, 2003). Most of these processes say that they are based on best practices and research. Hence, in terms of success factors, principles, barriers and enablers, guidelines etc. there are many perspectives from which you can view a change effort. Inherent in all of these perspectives, whether explicit or implicit, is the idea that certain actions are necessary to carry out, often with the purpose of leading a sociotechnical system through a series of transitions between discrete states intended to verify that the change effort is proceeding in the intended direction in a rational manner. However, handling change in relation to normative theories seldom work well in practice as the change process can be seen as an example of a wicked problem (Fyke & Buzzanell, 2013; Rittel & Webber, 1973). Hence, informed by for example reflective practice (Schön, 1983), situated action (Suchman, 2007), path dependence (Burns and Scapens, 2000) and a sociotechnical perspective (Klein, 2014) we believe that the use of mosaic as an metaphor for change in sociotechnical systems could increase understanding of the change process as such, make it easier to communicate, and more manageable. Through the use of the mosaic metaphor we can better understand the complexities of the change process as a complement to the normative theories, and also add the perspective of creativity and situatedness (Suchman, 2007) as well as professional skill and reflective practice (Schön, 1983). This work in progress first briefly presents the mosaic as a metaphor, and then applies the metaphor to one case study and discusses the results.

2. The mosaic metaphor

In our metaphor the pieces of the mosaic are not uniform, and as such they are not interchangeable. Affixing one piece may limit or prevent the use of certain other pieces in the vicinity, and there will always be a gap of varying size between pieces. The idea behind this work in progress metaphor is that several artists creating a mosaic can represent the process of change in a sociotechnical system. The different artists represent different agents influencing the change process, all of which have their own perspective of change (Orlikowski and Gash, 1994), and each piece they add to the mosaic represents an action taken during the change process. The collection of available pieces contains the pieces representing all possible actions that may influence the change process, i.e. this collection is approximately infinite. However, with a limited space for the mosaic to be created within, all pieces cannot be used. Depending on which pieces are used, since their shape is irregular, the relative fit between each piece and surrounding pieces will vary (cf. Burns and Scapens (2000)).

When the number of missing pieces approaches a critical level, we can no longer discern the motif, or perhaps only part of it. This would symbolize, respectively, that not enough activities have been carried out for the change effort to be effectively realized, or that the change effort was unevenly focused on some aspect of the process. Such problems could be related to devoting much energy on IT development while neglecting organizational development, or failing to mitigate user resistance while favouring the refining of formal business policies.

A managed change process usually has an end point, especially if it is organized as a project. Likewise, creating a mosaic has a natural end point when the intended space has been filled with pieces. One might feel inclined

to think that this translates into the sociotechnical system being static once a change process is considered complete. It is more accurate, however, to regard the completion stage as a single point in time. For a mosaic, the process following completion is usually erosion over time, which in most cases is probably much too slow of a process to be an accurate representation when transferred to sociotechnical systems in this context.

3. Application of the mosaic metaphor on a case study

The empirical data is gathered from a case of change efforts related to ICT in healthcare. We have looked at an eHealth service for patients that we have chosen to call JPN in this paper. This change project has been running for about 25 years, starting with a pilot project in a primary care unit and ended with all patients in the county council having access to their medical records online. The introduction of the eHealth service was a notably political process where stakeholders were met on the national and regional political arena, while being almost completely left out of the actual development process. In the creation of this mosaic, however, all the stakeholders were indeed participating in adding pieces to the mosaic and some of them were quite unexpected.

Initially the managers of the JPN development did not think that the healthcare professionals should have any say in the creation of the mosaic. The rationale was that they were not the end users and therefore could be safely kept out. This is an interesting stance since end users (i.e. patients) were not really involved in the design process either. Here, however, the rationale was that no one could know what features would be desired by a future user, so the project team's guess was as good as the current users. Existing technical artefacts, organizational infrastructure and social structures dictated the actions that could be undertaken during the change process. The stakeholders in a sociotechnical system will to varying degrees have different priorities when it comes to what actions to perform (Orlikowski and Gash, 1994), as a natural result of having different goals as in our case study where the managers and the professionals had different views of what the system was.

A particular activity during the change process might be targeted at achieving a set goal for a certain stakeholder. Or an activity might be targeted at improving some aspect of a technical artefact, which in turn might satisfy one stakeholder while the cost of performing this activity negatively affects another stakeholder. Examples of this was found in our case study too, as for example the viewing of the log lists where patients could see what medical professionals had read their patient journal. This technical artefact improved the possibility for the county council to find illegal use of medical records, but was perceived as an intrusion on the medical professionals autonomy.

Even if we include as many stakeholders as possible when deciding what actions to take, external events and actions initiated outside of our control will continuously affect the set of actions available to us, and their expected outcome. In our example the change process was actually halted by a public authority at one point due to it being considered unlawful. The point the authors are trying to make here is that it does not really matter who is included in this group, they still have to deal with the effects of events and actions beyond their control. They may consider themselves to be the main artist of the mosaic, but if they do nothing the pieces will be laid out by someone else. In our case study pieces of the mosaic of change was laid both on a national and on a local level, as there were stakeholders at all levels. The JPN system's development team was aware that they could not control everything in the deployment of the new system. The main project manager explicitly stated that when deploying different artefacts in the system he "had one hand on the start button and the other hand on the stop button" in order to be prepared for unexpected events.

Since neither the users nor the healthcare professionals had any direct means of influencing the project from the outside, the project managed tried to circumvent the social inertia (Keen, 1981) that would have otherwise been generated. Taking this course of action meant the use of one piece in the mosaic that made other pieces unavailable (i.e. the actions necessary to successfully engage the stakeholders in the design process) (cf. Burns & Scapens, 2000). On the other hand, it also meant that a whole other set of actions became necessary as the professionals realized that their demands were not being met and subsequently used the media to openly criticize the project and the new IT system. In response, the project executed actions designed to keep the project in political favour and combat the critical picture being portrayed by the project's opposition among the professionals.

4. Discussion

In our case study it is evident that the creation of the mosaic of change required both artistry and professional skill. Being able to value and reflect on the different actions taken during the deployment process is a necessity. The change process related to the introduction of IT is truly a complex and demanding task to handle, and normative processes are of little help as the change processes have similarities with wicked problems (Fyke & Buzzanell, 2013; Rittel & Webber, 1973). Our standpoint is that methods or advice related to organisational change must inform the planning of the work. However, an understanding and acknowledgement of the complexity of organisations, and human activity as well as artistry an understanding of the need to tailor activities as the change project is launched must accompany the normative methods.

In this work in progress we aim at using the creation of a mosaic as a metaphor for describing change processes. The aim of the mosaic as a metaphor is to capture aspects of change not prominent in most normative models of change, and to be able to illustrate change in an alternative manner. However, the applicability of the metaphor in practice needs to be further studied, and its limitations warrant further attention. Nonetheless, the metaphor shows promising and interesting results so far, and we intend to develop it further in the future.

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IT-Driven Productivity at the Individual Level: Complementarities Matter

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Abstract: This paper presents a conceptual model for the understanding of IT-driven productivity at the individual level when a new IT-system is deployed. The existence of the IT productivity paradox at different economic levels has been a concern for many researchers. Since evidence demonstrates that IT, in fact, increases productivity at the macro-, meso- and micro- level, current research attention shifted to the individual and task level. Since the last decade, the idea that there is a need for a set of organizational factors to be changed in a synchronized fashion when introducing a new IT-system has received particular attention. To investigate these proposals, we have designed a new research model aimed at analyzing individual productivity growth when a new IT-system is deployed, jointly and in a synchronized manner, with both individual capital and organizational capital factors. The aim of this model is to advance our understanding and develop propositions, which will require further testing, of patterns of effective IT-use in order to increase productivity of an information worker. A better understanding of the patterns of effective IT-use together with other factors may help determine where research and managerial efforts have to be concentrated in order to enhance individual productivity of information workers.

Keywords: IT productivity paradox, complementarity, patterns, IT-driven productivity, individual level

1. Introduction

Over the last decade, the idea of the joint adaptation of new IT and innovative human resource management practices to enhance productivity gains has received special attention from IS researchers and economists (Lynch and Black, 1998; Brynjolfsson and Hitt, 2003; Bartel, Ichniowski and Shaw, 2007; Bloom, Sadun and Van Reenen, 2007; Cavusoglu, Al-Natour and Cavusoglu, 2011; Tambe, Hitt and Brynjolfsson, 2012; Aral, Brynjolfsson and Wu, 2012). A complementarity approach states that changing only one or a few factors at a time may not come as close to achieving all the benefits that are available through a coordinated effort (Ennen and Richter, 2010). Very little empirical evidence, however, exists on the exact set and configuration of those factors, especially at the individual level (Brynjolfsson and Milgrom, 2012). The herein proposed research intends to discover what factors are needed and how to synchronize them in order to drive the growth of information worker productivity at the individual and task level. Therefore, based on the complementarity approach, we synthesize current theory by integrating elements from the literature on personality characteristics, HRM and operations management sources to justify the development of a conceptual framework for individual productivity of information workers when a new IT-system is implemented. The developed model provides a better understanding of the synergistic effect of a set of factors on individual productivity in an information-intensive environment.

2. Theoretical background and model development

In this study, we draw on the complementarity theory (Milgrom and Roberts 1990, 1995) to explore the integrative effect of a system of complements when the new IT-system is deployed to increase individual productivity. A long time ago, it was established that tasks (the nature of the task and its complexity), organization (management support and training programs) and user characteristics (cognitive differences, age, past training, education, job experience) are core factors of effective IT-use (Yaverbaum, 1988; Cabrera et al., 2001). This implies that the introduction of the new IT-system requires reconsideration of pre-existing resources, as well as the introduction of new ones in order to increase individual productivity.

Therefore, the research model (Figure 1) includes the following key factors. Firstly, a new IT-system is to be deployed to support the execution of an operational process. One distinction assumed here is with regard to well-structured processes vs. flexible processes. While the former is particularly suitable for stable contexts; the latter is to be preferred in a context where unpredictable changes occur (MacCormack, Verganti and Iansiti, 2001). The second factor accounts for the character of the information worker, where we assume two dichotomies: the adaptive vs. the innovative cognitive styles and the monochronic vs. the polychronic

personalities. The choice of those personal characteristics can be explained by the following prerequisites. Modern companies need to innovate and adapt simultaneously to provide a competitive advantage and organizational stability (Jablokow and Booth, 2006). Moreover, Kirton's adaption-innovation theory is viewed as increasingly important in relation to the management of change and work performance (Xu and Tuttle, 2004). At the same time, current dynamic working conditions require from employees a certain capability to perform a set of tasks in parallel (Appelbaum, Marchionni and Fernandez, 2008). The first mentioned dichotomy is matched to the well-structured vs. flexible process dichotomy, respectively, while the monochronic vs. polychronic dichotomy is matched to the degree of multi-tasking conducted by an information worker. In this case, the assumption is that mono-tasking and multi-tasking practices require different kinds of time-personality: the monochronic personality for mono-tasking and the polychronic personality for multi-tasking.

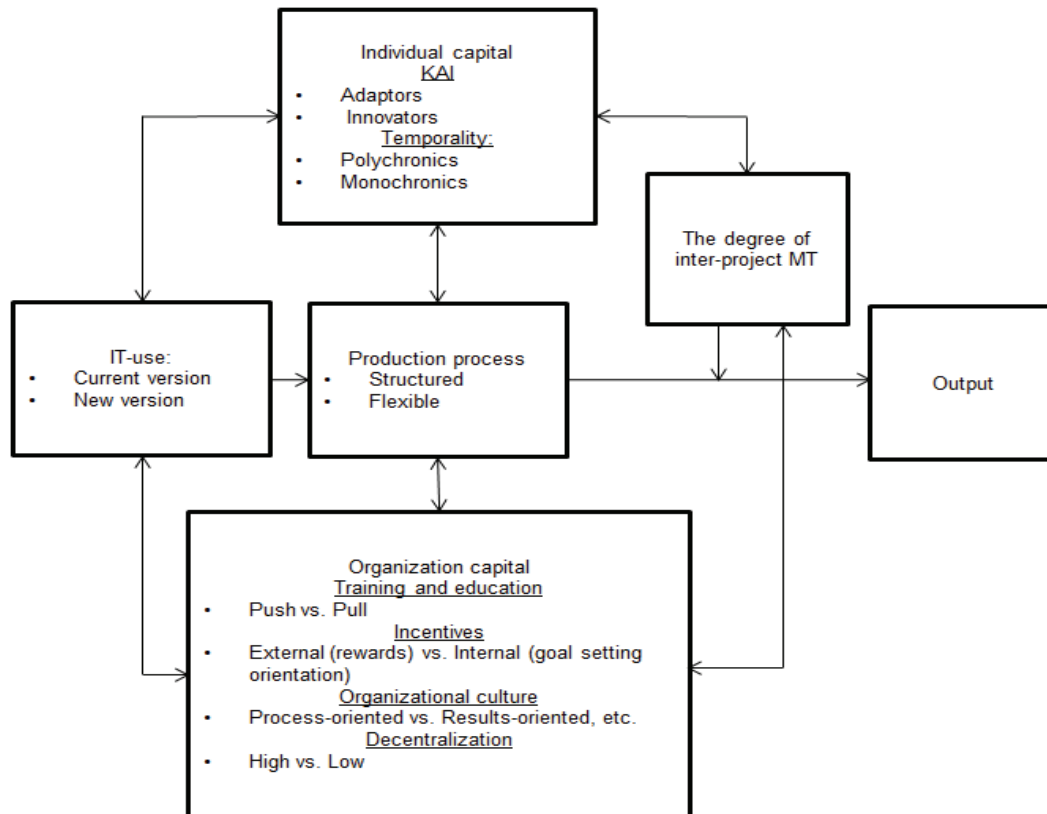


Figure 1: General conceptual model

A set of organizational complementarity factors is collected based on the HRM literature (Bloom and Van Reenen, 2011). A central complementarity factor included in all mentioned set-ups is the education and training provided to information workers when a new IT-system and work process are introduced. Another complementarity factor assumed here is the work incentive for information worker motivation, where the dichotomy assumed is between exogenous and endogenous motivation. The former may be realized with various bonus pay schemes, while the latter by a given work autonomy and managerial coaching. Finally, a specific type of organization culture and decentralization of decision-making are supposed to complement the conceptual model.

3. Research approach proposed

We intend to test this model in two very different empirical contexts. One is a longitudinal clinical study where sales operations of an international pharmaceutical company are investigated, and where three patterns are researched: (i) introduction of an IT-system only, (ii) introduction of organizational capital changes only, and (iii) introduction of an IT-system jointly with individual and organizational capital changes. We hypothesize that the third alternative will produce the highest productivity gains, considering other circumstances being equal. The second empirical context is a lab-based study where the software development process is investigated with the above given factors being tested in several configuration set-ups. Although the two studies target

very different content – pharmaceutical sales and software development – they both target information workers where IT-systems are introduced jointly with individual capital and organizational capital modifications. Both approaches are considered as appropriate as they will enable exploration and learning about the inquired phenomenon in depth. Any identified cross-study patterns of productivity growth will constitute a firm support for the here proposed model.

4. Future research agenda

This study will be conducted in two information-intensive contexts to define commonalities and differences in patterns of IT-use and its economic benefits to the information worker productivity. The approach for conducting an empirical study of information workers activities, how they use IT and how it affects their productivity will begin from in-depth field study of an information-intensive organization addressing various dimensions of information work such as work activities, resources and actors, rules and goals, inputs and outputs, channels, content of the information and kinds of IT utilized. Next, the current impact of the IT-use on work patterns and resulting indicators and, eventually, applied measures of information worker productivity, will be investigated. The next step of this research is devoted to the identification of current practices for information processing patterns with regard to information worker and IT-driven productivity. We intend to gather large volumes of data, representing a long period of time, e.g. 1 year, which characterizes the actual performance of the targeted processes. Finally, we intend to design and conduct experiments based on information worker production within chosen empirical contexts. Further alternation of the work design may unearth patterns of IT-system implementation that generate higher productivity increases of an information worker.

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Shifting From Process Owner to Stakeholder: Roles of IT Companies in e-Health Development

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Abstract: Is it possible to find a progressive country not aiming to create electronic management and cooperation tools in healthcare? However, design, development and implementation of information and communication technologies (ICT) encounter numerous problems and the majority of the problems are of managerial but not technical nature. Volumes of academic literature point to insufficient interplay between e-Health actors as one of the key factors impeding development of the e-Health system. Our research aims at investigating how e-Health system actors in general and IT companies in particular perceive their roles and roles of other key players in e-Health development. The research investigates case of Lithuania, which gave rise to numerous works on the national e-Health system almost a decade ago, but have not produced expected results yet. The main technique applied in research was semi structured interviewing. Interviewees were selected from IT companies specializing in e-Health (6 interviewees), healthcare organizations (48 interviewees), and e-Health policy shapers (4 interviewees). Preliminary research results revealed that Lithuania went through two qualitatively distinct stages in the development of the national e-Health system. The first stage was earmarked by shortcomings in strategy, leadership and management. Therefore, different IT companies took the initiative of proposing their products to various healthcare organizations. The process resulted in a scattered variety of IT solutions for e-Health development, with faint possibilities to integrate. In the second stage, previous mistakes have been avoided and more attention is given to stakeholder management issues. IT companies also changed their position in the e-Health system from an apparent process owner to a partner implementing customer demands.

Keywords: e-Health, e-Health stakeholders, IT companies

1. Introduction

One might argue that independently for the country, e-Health development process continues to be challenging and the progress is still very slow. Designing, development and implementation of innovative use of information and communication technologies (ICT) in healthcare require purposeful convergence of efforts of all stakeholders and in particular three main players: healthcare policy makers, healthcare organizations (hereinafter – HCOs) and vendors (IT companies). However, while introducing ICT in their performance, organizations are being challenged to match interests of different stakeholders, because organizations turn into battlegrounds when stakeholders pursuing individual stakes strive to influence decision-making processes (Guisset, Sicotte, Leclercq and D’Hoore 2002). A growing number of academic papers on the problem of stakeholder integration into organization management demonstrates that it remains topical among researchers (Driessen, Kok and Hillebrand 2013).

Our research strives to measure how e-Health system actors in general and IT companies in particular perceive their own roles and roles of other key players in e-Health development. The case of Lithuania was selected as a field for empirical studies as its e-Health national system, which has been developed since 2005, is not yet fully functioning. To achieve the aforementioned goal, we applied a mix of methods. Initially, we analyzed completed and ongoing Lithuanian e-Health projects with the purpose to retrieve information about IT companies that competed in acquisition procedures to create IT systems for HCOs. As e-Health requires specific knowledge and experience, the list of potential (and/or actual) vendors consisted of only more than 30 national and international IT companies. We selected 10 companies from the list for structured interviews. The interviews revealed some problem intensive areas that required deeper examination. Therefore, the research followed up with semi structured interviews with representatives of IT companies that already had experience in e-Health projects (6 interviews with CEOs and e-Health project coordinators), HCOs (48 interviews with CEOs, medical personnel, administrators and internal IT specialists), and e-Health policy shapers (4 interviews with representatives from the Ministry of Health and institutions under the Ministry). All the interviewees were questioned in four main themes:

- *e-Health elements* (interviewees’ attitudes towards ICT in healthcare architecture, design, technologies, privacy and safety issues in Lithuania in general and in interviewee’s organization in particular; the most problematic e-Health element; opinion on other stakeholders’ attitudes towards e-Health elements);

- *stakeholders' roles and cooperation* (roles of the Ministry of Health and other regulating institutions, HCOs, and IT companies; their impact on e-Health development process; knowledge generation and sharing among stakeholders; extend and features of networking in e-Health; problem identification and solving process);
- *regulation* (e-Health policy design process, outputs and controls; development strategies (priorities, budgeting, and timing); e-Health strategy implementation in organization);
- *problems / consequences* (factors interrupting e-Health development; possible changes forcing for progress in e-Health development).

2. ICT development in healthcare: stakeholder approach

E-Health development, with multiple stakeholders involved, expands beyond the limits of social context of organization (Blake et al. 2010). ICT affects differently different types of healthcare actors, who undergo diverse impacts of technologies. Therefore, success of both the process and results of IT implementation greatly depends on HCOs' abilities to:

- identify each stakeholder group;
- understand their attitudes towards ICT;
- unpuzzle ICT development problems perceived by stakeholders;
- recognize possible solutions proposed by stakeholders to solve these problems (Hage, Roo, van Offenbeek, and Boonstra 2013; Boonstra and van Offenbeek 2010). Therefore, the stakeholder engagement process is among the major challenges that are encountered during e-Health system development (European Commission 2011). Various interest groups in e-Health could be organized into four main categories: producers of ICT, ICT users, patients, and administrators/payers, including the public and policymakers (Kazanjian and Green 2002; Kaplan and Shaw 2004).

Researchers widely discuss key roles of internal stakeholders in ICT for healthcare development. Academic literature focuses on positions of physicians and nurses in e-Health development as these stakeholders' groups are recognized as some of the most influential e-Health actors interested in solving issues of clinical effectiveness. However, decision makers not always regard their interests (Bhattacharjee and Hikmet 2007; Jensen and Aanestad 2007). HCO administrators fall into the next category of stakeholders. Their ideology and demands in e-Health development are different compared to those of medical personnel (Dhillon 2005). Implementing multiple tasks within an organization, administrators expect ICT introduction to contribute to increase the quality of patient care process by streamlining the management of finances and other resources that have an impact on the quality of care (Lions, Tripp-Reimer, Sorofman, DeWitt, Boots Miller, Vaughn and Doebbeling 2005).

External stakeholders, specifically consultants and IT providers, have received limited attention compared with the extent of research dedicated to internal stakeholders (Blake, Massey, Bala, Cummings and Zotos 2010). While ICT becomes more and more complex and HCOs tend to reduce numbers of internal ICT personnel, significance of external ICT entities increases. However, internal actors sometimes think of themselves as forcing introduction of new ICT products without the involvement of adequate internal representatives into the process (Aubert, Barki, Patry and Roy 2008). Failures to recognize perceptions of the roles of different stakeholders in e-Health development, to match their various interests, and ensure continuous data sharing and cooperation could result in building obstacles in e-Health success (King, O'Donnell, Boddy, Smith, Heaney and Mair 2012).

3. Changing roles of IT companies in e-Health: Lithuanian case preliminary findings

Lithuania distinguishes two qualitatively different stages of the development of the national healthcare system. **The first stage** dates 2005-2008. Shortage of knowledge and understanding of overall e-Health system and vague recognition of e-Health actors and their goals earmark this phase. The relevant legal regulation was in the very early stage of its development. Therefore, actors had no clear roles; processes of national e-Health development were fragmented, they faced shortage of coordination and sound managerial solutions.

E-Health projects in this period were local, unsophisticated and mostly oriented to acquisition of hardware. E-Health policy makers, HCOs and IT companies were distanced from each other. This resulted in fragmentation

of e-Health with incompatible IT systems among health care players. Moreover, the IT companies grew in their importance as only they could explain particularities and benefits of IT systems. Therefore, IT companies were perceived as leading actors in the process of e-Health system development with the proposed IT products.

However, adaptation of off-the-shelf IT products in healthcare failed to meet all demands of HCOs. Therefore, the first stage failed to comply with expectations of e-Health system actors. Policy makers had no completed goals of national e-Health system development, HCOs implemented internal IT systems incompatible with those of other institutions, some vendors lost their reputation or even were put on trial (see Table 1 for illustrations from interviews).

Table 1: The interviewees’ opinions on the first stage of e-Health development

Main theme	Attribute	Quotations of participants’ perceptions and experiences
e-Health elements	Lack of knowledge	“Creating the first National e-Health system (NES), Ministry of Health was pumping out information from us <...> They just collected knowledge and images from different organizations and put it all in one document of more than 500 pages calling it NES” (CEO, IT company No.1). “How to integrate these programs now?... There are no interfaces created, none of the programs is open source. Long-term agreements with IT companies were absent. Nobody in healthcare has program codes and can intervene in software” (Director, Private healthcare institution).
	Lack of evidences for decisions	
Stakeholders’ roles and cooperation	Vague stakeholder’s engagement	
	Lack of cooperation	
Regulation	Lack of leadership	
	No evidence based strategy	
Consequences	Disagreements among stakeholders	
	Fragmented e-Health system	

The next stage challenges to introduce new and innovative approach to e-Health technologies and strives to eliminate core problems revealed during the previous stage. It started with the adoption of e-Health development Strategy for the period 2009-2015 and other regulations in 2010. Interviews revealed, that e-Health actors’ attitudes towards roles and interaction with each other had changed. IT companies acknowledge their role as being supporters of the national e-Health development process. They recognize a requirement to meet customers’ needs instead of pushing off-the-shelf products. However, representatives of IT companies stress that customers should step forward coordinating electronic services with processes and procedures that are digitalized.

“E-Health development will continue to stumble over the problems until IS processes are not harmonized with performance processes, and until IS are viewed as control means, but not as work instruments” (Healthcare projects coordinator, IT company No. 2).

Meanwhile, HCOs are not free to make significant changes in the processes, as this sector in Lithuania is one of the most strictly regulated. Therefore tension among policy makers, HCOs and vendors remain and requires further search for closer and mutually valuable interaction.

4. Conclusions

E-Health development is rather a social process than a technical one. Success of e-Health requires recognition of stakeholders’ needs and expectations, and depends on cooperation among the actors and coordination of their interests. Solution of the problem of actors’ perceptions of their roles could significantly contribute to a better harmonized and smoother healthcare development process.

Among the critical factors preconditioning failure of e-Health system in Lithuania in the early stage were lack of knowledge in the field and failure to establish goals, priorities and limits of the national e-Health system, and to ensure coordination and management of the process. In such environment, different IT companies took the lead proposing their products to different HCOs. Such process resulted in a scattered variety of IT solutions for e-Health development with faint possibilities of further integration.

Problems encountered during the first stage of e-Health development in Lithuania triggered a systematic approach towards the national ICT system for healthcare in general, and stakeholder management as one of the key processes in particular. Changing attitudes towards health sector actors, closer attention to their experiences, needs and expectations been noticed across all areas of healthcare. Not surprisingly, perceptions of their role in e-Health system by IT companies has changed from an apparent process owner to a partner implementing customers’ demands.

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The Creation of Business Architecture Heat Maps to Support Strategy-Aligned Organizational Decisions

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Abstract: The realization of strategic alignment within the business architecture has become increasingly important for companies. Indeed, it facilitates business-IT alignment as a well-designed business architecture helps both to identify the appropriate requirements for IT systems and to discover new business opportunities that can be realized by IT. However, there is a lack of alignment techniques that support organizational (re)design decisions during the operation phase as the actual performance of business architecture elements is neglected. Capability heat maps provide a useful starting point in this respect as they focus on the creation of a hierarchy of prioritized capabilities, which are characterized by a performance measure. In this paper, these techniques will be extended to support strategy-aligned decisions within the business architecture. The identification of the relevant business architecture elements is based on state-of-the-art enterprise modelling languages, which enable the development of enterprise models on distinct layers of the business architecture. Strategic alignment between these elements will be realized by using prioritization according to the Analytic Hierarchy Process (AHP), while performance measurement will enable the creation of a proper decision support system. Afterwards, the proposed heat map will be applied on a case example to illustrate its potential use. This results in the completion of a first build-and-evaluate loop within the Design Science methodology.

Keywords: business architecture, heat maps, enterprise modelling, AHP, performance measurement

1. Introduction and background

The realization of strategic alignment within the business architecture of an enterprise is important to understand the complex business context, which is sustained and possibly enhanced by information systems to realize Business-IT alignment (Pijpers et al. 2012). Indeed this ensures that information systems contribute to processes, which support the organizational goals, and to the resulting value creation for the company and its various stakeholders (Andersson et al. 2009).

The business architecture concept originates from the enterprise architecture field, which is a holistic approach offering an integrative view on the company. This includes the use of *models, besides other principles and methods, to design and realize the business architecture, information systems architecture, and technology architecture* (Lankhorst 2009). Enterprise models contribute to the design of the business architecture by three types of models: goal, value, and process models (Andersson et al. 2009, Pijpers et al. 2012). While goal models address the *why perspective* within a company, value models focus on *what* a company must do to implement organizational goals with the aim of value creation. Process models specify *how* value should be created by defining process activities and individual responsibilities at the operational level.

Related research (see review in Roelens and Poels (2013a)) tried to realize strategic alignment between goal, value, and/or process models. Most of these efforts focus on top-down strategic alignment by developing transformation rules based on mappings between the meta-model constructs of the different model types. Other authors (see Buder and Felden (2012)) used annotation to enrich process models with value or goal information to establish a bottom-up strategic alignment. Although all these approaches ensure the consistency between enterprise models, they only offer a static view on the enterprise as the actual performance is neglected. As such, these techniques are useful during the design phase of the business architecture, but they do not support organizational (re)design decisions taken during the actual operation of the company.

This research gap will be addressed by the development of a business architecture heat map, which combines the use of AHP, to ensure top-down strategic alignment between the business architecture elements by prioritization, with performance measurement principles to facilitate the support of organizational (re)design decisions.

The paper is structured as follows. Section 2 describes the creation of the business architecture heat map based on literature about business architecture elements and the creation of heat maps. Section 3 provides a demonstration by a case example, while section 4 briefly discusses future research.

2. Business architecture heat map

2.1 Business architecture elements

The meta-model model elements (figure 1) are related to the perspectives within the business architecture. *Goals* (i.e., the why perspective) are classified as either *financial*, *customer*, or *internal* indicators (Kaplan and Norton 1992). Learning and growth objectives are not included as the developed heat map supports strategy-aligned decisions within the existing business architecture, rather than changing it through innovation. To address the *what perspective*, a literature review was used about the constituting elements of the business model concept (Roelens and Poels 2013b). The *financial structure* of a company is a representation of the costs from acquiring resources and the revenues earned from the offered value proposition (Roelens and Poels 2013b). Hence, the value stream starts from the *financial goals* via the *financial structure* to the *value proposition* of a company. Since the *value proposition* is the set of products and services, which provides value to the customers of a company (Roelens and Poels 2013b), this concept is the implementation of the *customer objectives* in the business architecture. The value stream continues from both the *value proposition* and the *internal objectives* to the *core competences* and the *value chain*. The *value chain* is an aggregation of the elementary value-contributing *activities* of an organization. These *activities* address the how perspective in the business architecture and are the end of the value stream.

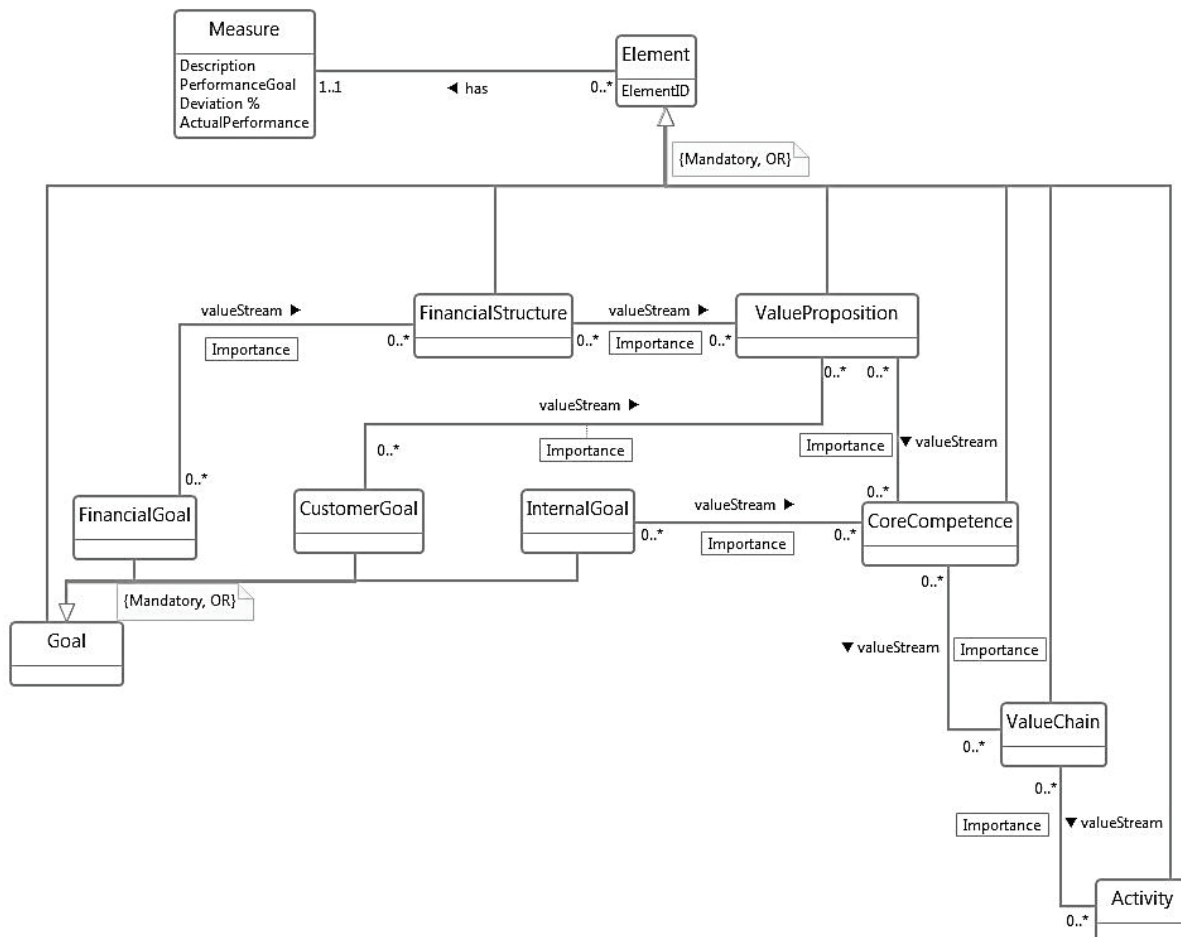


Figure 1: Meta-model of the business architecture heat map

2.2 Heat map

To create the heat map, the value stream relations between the elements are characterized by an importance (figure 1). This allows specifying distinct priorities in case an element supports different upper elements (e.g., a

process contributing to two core competences). AHP is proposed to prioritize between the different business architecture elements as it deals with inconsistencies that are inherent to subjective judgements (Hafeez et al. 2002). To obtain the priorities, pairwise comparisons are made between those elements that have the same upper element in the value stream. This comparison is performed on a 9-point scale (Saaty 2008), ranging from 1 (i.e., two elements contribute equally to the above element) to 9 (i.e., the evidence of favouring one element over another is of the highest possible order of affirmation), and results in the creation of a comparison matrix. The resulting priorities are given by the real eigenvector of this matrix. Afterwards, the lowest priority is rescaled to 1 to account for differences in the number of child elements of a certain upper element. The colour of the value stream relationship depends on whether it is characterized by a high (i.e., ≥ 5 visualized in (solid) red), medium (i.e., ≥ 3 and < 5 visualized in (dashed) orange), or low importance (i.e., < 3 visualized in (pointed) green).

The use of performance measurement enables the analysis of the actual performance of the business architecture elements. This includes the specification of a measure for each of these elements. Measures are characterized by a description, a performance goal, a deviation %, and the actual performance (figure 1). Depending on the actual performance, the colour of the business architecture elements is either (solid) red (i.e., $< \text{performance goal} \times (1 - \text{deviation } \%)$), (dashed) orange (i.e., $\geq \text{performance goal} \times (1 - \text{deviation } \%)$ and $< \text{performance goal} \times (1 + \text{deviation } \%)$), or (pointed) green (i.e., $\geq \text{performance goal} \times (1 + \text{deviation } \%)$). By a proper use of the measure attributes, it is possible to deal with both quantitative and qualitative measures (table 1).

Table 1: Measures supported by the business architecture heat map

Type	Example	Performance goal	Deviation %	Actual performance
Positive quantitative measure	Profit	g	d	a
Negative quantitative measure	Loss	1/g	-d/(1-d)	1/a
Qualitative measure	Satisfied criterion	1=yes	0	0=no or 1=yes

3. Case example

This case example describes the business architecture of a fictitious bakery, facing a declining customer loyalty. Based on the data model (figure 2), it is possible to develop the business architecture heat map (figure 3) according to the described procedure. Due to limited space, the comparison matrices of the AHP are omitted and only the resulting priorities are given.

Several insights emerge from the developed heat map. The critical path to *increase customer loyalty* is constituted by value stream relations that are characterized by a medium or high importance. Within this path, attention must be given to elements with a bad performance (i.e., the activity of *preheating*). In practice, a buzzer indicates when dough can be put in the oven. However, due to the time that is needed to put the dough in the oven, the temperature gets too high. This increases the number of collapsing breads after baking. By adapting the *preheating* activity, improvements can be made to *offer higher quality products* and to *increase customer loyalty*.

Another analysis is based on elements with a bad performance that are not on a critical path (i.e., *fill in evaluation forms*). As this activity is not the main driver for the core competence of *resource sourcing*, it should be questioned whether to perform this activity in-house. A solution includes asking suppliers to perform the quality checks themselves and to provide certificates. Another improvement is to incorporate quality checks in the performance evaluation of the responsible employees. This should improve the awareness for this activity in the workplace.

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Element Group	Element	Measure: description	Measure: performance goal	Measure: deviation %	Measure: actual performance
Customer goal	Increase customer loyalty	# bonus breads / year	1000	10	920
Value proposition	Sale additional products	sales additional products / total sales	25%	20	45%
Value proposition	Offering high quality products	mean quality assessment score	4	10	3.8
Core Competence	Resource sourcing	% rejections	5%	10	3%
Value Chain	Buying process	origin resources = supplier x	yes	0	yes
Value Chain	Quality check	# complete checks / day	8	0	7
Activity	Take sample	% correct selected resources	95%	2.5	97%
Activity	Perform quality procedure	followed procedure = correct	yes	0	yes
Activity	Fill in evaluation forms	# correct completed forms	16	0	14
Core Competence	Operational excellence	# faulty breads / day	10	5	11
Value Chain	Kneading	# minutes kneading	5	0	5
Value Chain	Resting	# minutes resting	10	0	10
Value Chain	Baking	# faulty breads / day	8	25	11
Activity	Set up oven	temperature = 175°C	yes	0	yes
Activity	Preheating	time = 8 minutes	yes	0	no
Activity	Put bread in oven	# fallen breads / day	3	25	3
Activity	Get bread out of oven	# collapsed breads / day	5	25	8

Figure 2: Data model supporting the case example

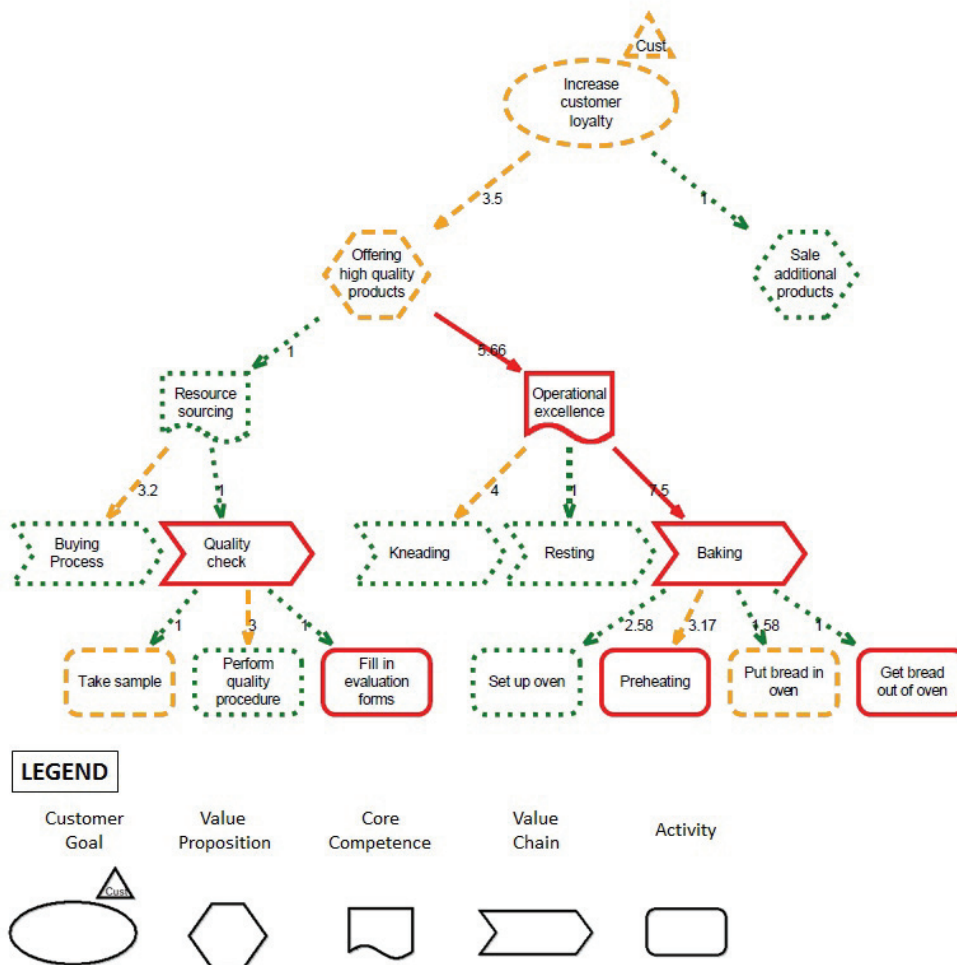


Figure 3: Business architecture heat map applied on the case example

4. Discussion

This paper completes a first step in the development of a strategic decision support system. Future research includes applying the proposed heat map by practical case study research to evaluate the meta-model and its visualization. This evaluation will provide support for the claimed benefits of the business architecture heat map in comparison to the existing techniques. An important benchmark in this respect is the Business Intelligence Model (Horkoff et al. 2014), which also uses performance measures to align activities with strategic objectives. However, the approach is different as performance measures are exclusively used on the level of activities, which prevents the creation of visual heat maps. The evaluation also requires the development of tool support, which facilitates the large-scale creation of business architecture heat maps that can easily be exchanged between business users.

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