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The IJISPM publishes leading scholarly and practical research articles that aim to advance the information systems management and project management fields of knowledge, featuring state-of-the-art research, theories, approaches, methodologies, techniques, and applications.

The journal serves academics, practitioners, chief information officers, project managers, consultants, and senior executives of organizations, establishing an effective communication channel between them.

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The IJISPM offers wide ranging and comprehensive coverage of all aspects of information systems management and project management, seeking contributions that build on established lines of work, as well as on new research streams. Particularly seeking multidisciplinary and interdisciplinary perspectives, and focusing on currently emerging issues, the journal welcomes both pure and applied research that impacts theory and practice.

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Editorial

The mission of the *IJISPM - International Journal of Information Systems and Project Management* is the dissemination of new scientific knowledge on information systems management and project management, encouraging further progress in theory and practice.

It is our great pleasure to bring you the second number of the fifth volume of IJISPM. In this issue readers will find important contributions on business intelligence systems acceptance, self-service technology adoption, methods for decision support and use of cloud computing services.

The first article, "An extension of the technology acceptance model for business intelligence systems: project management maturity perspective", is authored by Mirjana Pejić Bach, Jovana Zoroja and Amer Čeljo. Business intelligence systems (BIS) refer to a wide range of technologies and applications useful for retrieving and analyzing a large amount of information with the goal to generate knowledge useful for making effective business decisions. In order to investigate adoption of BIS in companies, the authors propose a model based on the technology acceptance model (TAM) that is expanded with variables representing the concept of project management maturity (PMM). Results show that TAM expanded with the notion of PMM is useful for increasing the understanding of BIS adoption in companies.

As Eoghan Considine and Kathryn Cormican state in the second article "The rise of the prosumer: an analysis of self-service technology adoption in a corporate context", the adoption of self-service technology (SST) has been well researched in consumer contexts but, despite the existing body of work, few studies have investigated in detail the specific determinants for user satisfaction in a corporate context. This paper addresses that deficit. The goal of this work is to examine employees' perception of SST. To do this, four dimensions of the SSTQUAL quality scale were adapted to collect data from knowledge workers in a financial services multi-national organization. The study expands the discussion on SST adoption by focusing on the corporate context and the findings can help service providers to create effective user driven solutions.

The third article "Are project managers ready for the 21th challenges? A review of problem structuring methods for decision support" is authored by José Ramón San Cristóbal Mateo, Emma Diaz Ruiz de Navamuel and María Antonia González Villa. Numerous contemporary problems that project managers face today can be considered as unstructured decision problems. In this paper, it is presented a family of methods for decision support aimed at assisting project managers in tackling complex problems.

As Patrick Kanyi Wamuyu states in the fourth article "Use of cloud computing services in micro and small enterprises: a fit perspective", Micro and Small Enterprises (MSE) require the right Organizational Information and Communication Technology Infrastructure (OICTI) to provide them with the essential functionalities to support their business processes. The purpose of this study was to assess the fit between the MSE OICTI needs and the information processing capabilities of Cloud Computing Services (CCS) and how this fit influences CCS adoption in MSE.

We would like to take this opportunity to express our gratitude to the distinguished members of the Editorial Board, for their commitment and for sharing their knowledge and experience in supporting the IJISPM.

Finally, we would like to express our gratitude to all the authors who submitted their work, for their insightful visions and valuable contributions.

We hope that you, the readers, find the International Journal of Information Systems and Project Management an interesting and valuable source of information for your continued work.

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João Varajão is currently professor of information systems and project management at the *University of Minho*. He is also a researcher of the *Centro Algoritmi* at the *University of Minho*. Born and raised in Portugal, he attended the *University of Minho*, earning his Undergraduate (1995), Masters (1997) and Doctorate (2003) degrees in Technologies and Information Systems. In 2012, he received his Habilitation from the *University of Trás-os-Montes e Alto Douro*. His current main research interests are in Information Systems Management and Information Systems Project Management. Before joining academia, he worked as an IT/IS consultant, project manager, information systems analyst and software developer, for private companies and public institutions. He has supervised more than 80 Masters and Doctoral dissertations in the Information Systems field. He has published over 300 works, including refereed publications, authored books, edited books, as well as book chapters and communications at international conferences. He serves as editor-in-chief, associate editor and member of the editorial board for international journals and has served in numerous committees of international conferences and workshops. He is co-founder of CENTERIS – Conference on ENTERprise Information Systems and of ProjMAN – International Conference on Project MANagement.

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An extension of the technology acceptance model for business intelligence systems: project management maturity perspective

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An extension of the technology acceptance model for business intelligence systems: project management maturity perspective

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Abstract:
Business intelligence systems (BISs) refer to a wide range of technologies and applications useful for retrieving and analyzing a large amount of information with the goal to generate knowledge useful for making effective business decision. In order to investigate adoption of BISs in companies, we propose a model based on the technology acceptance model (TAM) that is expanded by variables representing the concept of a project management maturity (PMM). The survey on the sample of USA companies has been conducted with the chief information officer (CIO) as the main informant. A structural equation model has been developed in order to test the research model. Results indicate that TAM expanded with the notion of PMM is useful in increasing understanding of BISs adoption in companies.

Keywords:
business intelligence systems; technology acceptance model; project management maturity, chief information office.

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1. Introduction

Business intelligence systems (BISs) are used to analyze information with the goal to acquire valuable data, information and knowledge which could improve the quality of management decision making across different business processes [1]. BISs include different software solutions for collecting, analyzing, and reporting information to managers [2]. Importance of BISs is related to the generation of timely, relevant and easy to use information which will have positive impact on making better and faster decisions at different management levels. Their growing strategic importance lies in tactical and operational process improvements, supply chain, production and customer service [3], which enable companies to gain competitive advantage [4].

Current research on the BISs adoption is scarce, and one of the rare examples is a study conducted by Hou [5], which focuses on the adoption of BIS at the employee level. Other examples focus on parts of the BISs, such as data mining, and the online-analytical processing (OLAP) [6, 7, 8]. However, the research on the BISs adoption, as perceived by the chief information officer (CIO) has not been conducted, although CIO plays one of the most important roles in the decision making on the information system (IS) adoption [9, 10]. Therefore, the goal of this paper is to present and empirically test a framework for investigating the determinants of the BISs implementation in companies, by expanding the TAM with the PM, using the CIO as the main informant. The original TAM is based on the theory of reasoned action, and explores the relationship between perceived usefulness, perceived ease of implementation, intentions to implement and the actual system implementation. Our goal is to propose a normative model that expands the basic TAM model by incorporating variables representing the concept of a project management maturity in companies. This paper extends the research framework presented at the PROJMAN 2016 conference [11].

After the introductory part, the paper presents the review of relevant literature on the BIS and the TAM. The third part of the paper focuses on the conceptual framework, investigating the TAM related research propositions, and project management maturity related research propositions. The fourth part of the paper overviews the used methodology, and the fifth part presents the research results. Finally, conclusion remarks are presented in the sixth part of the paper.

2. Literature review

2.1 Business Intelligence Systems

Modern organizations generate a huge amount of information, which has become a major competitive factor in today's business world [12]. Providing the right persons with the information which is complete, correct, relevant and in-time is important to support strategic, operative and tactical decision making [13]. Therefore, transformation of useful information into knowledge leads to a higher competitive advantage. Business intelligence (BI) refers to the set of methods for knowledge discovery from data using a set of analytical techniques, e.g. data mining [5]. Analyzing performance of an organization, the BI enables organizations to increase revenue and competitiveness, to formulate new strategies and to make effective decisions [14]. The concept "business intelligence systems" (BIS) refers to the data-driven decision support system that combines information technology (IT) used for data collecting, data storage and data analysis, and the main goal of the BIS is to provide information that is business-driven and results-oriented [15]. BIS comprises a set of tools to transform data into information to support decision-making [16].

2.2 Project Management Maturity

Project management presents a complex activity with many factors and participants which often lead to unpredictable obstacles and uncertainty. According to Varajão [17] project management refers to planning and organizing available resources to accomplish predetermined goals. In other words, project management plays a critical role in planning and managing execution of project dealing with available resources, time and budget and at the same time satisfying requirements of company [18]. In addition, clear mission, vision and strategy should be defined in order to complete project.

In project management, there are several interrelated goals that should be satisfied and achieved in order to have successfully completed project: scope management, time management, cost management, quality management, human resources management, communications management, risk management, procurement management, integration and success management [17]. However, it is important to highlight three main goals which should be met, and which are the most often used in project evaluation: scope, time and cost [18]. When aforementioned goals have not been achieved and are not aligned, project failure is likely to occur. In order to prevent this to happen, project manager must be aware of all possible problems and constraints in the organization related to the project. In a case, where pre-defined time is very tight and goal of the project is demanding in terms of the workload, it become challenging to complete project successfully. Hence, primary function of project management refers to successfully balancing time, cost and performance in all projects, large and small, IT or non-IT [19].

The importance of project management is recognized in different sectors. Construction projects are mostly criticized for ineffective trade-offs between time, cost and scope, mainly due to the impact of several different stakeholders with the opposite goals [9]. Another example of critical role of project management can be found in IT projects, specifically in managing software development. The most of software development projects are not completely developed or are cancelled during the planned period of time, besides the fact that the project has not achieved its goal [9]. According to research conducted, only 16% of US IT projects are completed on time and on budget [20]. Besides three main goals which have to be align (scope, time and cost), human factor is of critical concern in software development projects, taking into account that technology related and soft-skills, as well as senior management support are also important [21, 22]. In addition, communication plays an important role in successful IT project management [23]. There are two significant issues regarding communication. First, open communication enables project managers to be effective. Second, open communication among all project actors prevents conflicts. In other words, lack of information exchange among project actors lead towards many problems, e. g. strategic goals are at risk, resources are not used optimally and clients' expectations are unfulfilled [9].

Project maturity refers to integration and improvement of project management activities. In other words, project maturity improves project management ability to execute projects successfully [20]. Project management maturity can be defined as a process which enable codification, measurement and control of project management activities which at the same time estimate integration of project and organizational processes in companies [24]. Research results of the study conducted by Price Waterhouse Consulting showed that companies with greater project management maturity have in the same time overall better project performance [20]. Another significant issue regarding project management maturity is its role in strategic planning and approach to measurement and benchmarking. Growing importance in project maturity management lies in the following benefits: strategic planning of project management structures, improvements in time, cost and quality of project management, improvements in customer relationship management, minimization of project risk and increase in profit [25].

2.3 Technology Acceptance Model

Adoption of IS has been studied using different theoretical approaches. The theory of reasoned action, proposed by Fishbein and Ajzen [26], and the theory of planned behavior proposed by Ajzen [27] have roots in cognitive psychology [28]. Even though other models have been used in IS research, the TAM has captured the most attention of the IS community [29]. TAM has evolved from the theory of reasoned action and it has been updated several times.

TAM proposes three major factors as a motivation for a potential adopter to actually use a system: perceived ease of use (PEU), perceived usefulness (PU) and attention to use. Davis [30] used the first refined version of TAM and found that both the PEU and the PU have a direct influence on intention to use which eliminated the previous attention to use factor. PU is defined by Davis [20] as "the degree to which an individual believes that using a particular system would enhance his or her productivity", while PEU is defined as "the degree to which an individual believes that using a particular system would be free of effort". Another refined version of the TAM known as the TAM2 came out in 1996 [31] and 2000 [32].

The adoption of enterprise resources planning systems is often investigated using the TAM approach via numerous studies. Pasaoglu [33] performed the research in Turkey using demographics, knowledge about the enterprise resources planning (ERP), organizational culture, PEU and actual use of the ERP system. Main findings indicated that the ERP is also a social system in addition to being a technical one and that Turkish company in general wants to implement the ERP. Kwak et al. [34] used TAM in the project-based sector and found out that the consultant support during the implementation of the IS had negative impact of the PU. They extended the TAM in terms of implementation projects, internal and external support and functionality selection. Money and Turner [35] have used the TAM approach to study adoption of knowledge management systems and found that relationships between PEU, PU and system usage were consistent with earlier findings. Despite the vast support for the TAM, researchers also explores whether there are other factors relevant for the adoption and usage of the technology, and often explore whether the external variables are mediators of the TAM belief variables [36], and if so, which external variables are important, such as project management maturity.

2.4 Technology Acceptance Model for Business Intelligence Systems

Several studies have investigated the adoption of BISs in companies using the TAM approach. The first group of authors is focused on the adoption of the OLAP. Hart et al. [37] have researched acceptance and perceptions of the OLAP software among college students. Hart et al. [8] have also investigated the role of cognitive and other factors in the PU of the OLAP. Sharoupim [39] has also focused on the perception of OLAP usefulness, taking into account the impact of culture and human elements. The second group of authors is focused on the adoption of data mining. Huang et al. [6] have investigated factors that influence the adoption of data mining tools. Huang et al. [7] are further focusing on the use continuance of data mining tools. Wook et al. [39] have researched the acceptance of educational data mining technology among students in public institutions.

Research on the BISs adoption is scarce. One of the examples is the study conducted by Hou [5], which examines the user satisfaction with the BISs usage and individual performance related to the BISs. However, this research is focused on the determinants of the BISs usage among individual employees in Taiwan's electronics industry. The main limitation of the previous research is the emphasis on adoption of individual technologies, such as data mining and the OLAP, while the BIS adoption research is scarce. To our knowledge there is no research that would investigate the BISs usage from the CIO perspective, although CIO plays a critical role in the IS adoption [9, 10], and that would also take into account the impact of project management maturity, as one of the most important factors for the successful IT adoption [20].

3. Research prepositions

In this part of the paper, is presented the conceptual framework. The main constructs of the model as well as the hypothetical relationship between the main constructs are elaborated, based on the previous research. The conceptual framework investigates the TAM related research propositions and project management related research propositions. The research model is presented in Fig. 1.

3.1 Technology adoption model related research propositions

The two most important determinants of system usage and intention of usage are PU and PEU [40]. Previous research has indicated that both the PU and the PEOU have a direct impact on the adoption of IS in general, such as ERP [33], as well as on the modules of the BIS, such as the OLAP [37] and data mining [39]. Our research focuses to the CIO perspective of the BIS adoption, and we are investigating the organizations with different levels of BISs implementation. Therefore, we do not take into account the intention to use BISs, but we focus directly to the BIS implementation. In addition, instead of using the perceived ease of usage, we focus to the perceived ease of implementation, since we investigate the adoption from the CIO perspective, who is the person most involved in the IS

implementation. That approach is taken in other similar research [41]. Since we measure different levels of BIS adoption, we use the notion of BIS implementation in the model. Based on this approach, the following research propositions are refined from the original TAM model:

- RP1: Perceived usefulness of the BIS positively influences the BIS implementation;
- RP2: Perceived ease of implementation of the BIS positively influences the BIS implementation;
- RP3: Perceived ease of implementation of the BIS positively influences Perceived usefulness of the BIS.

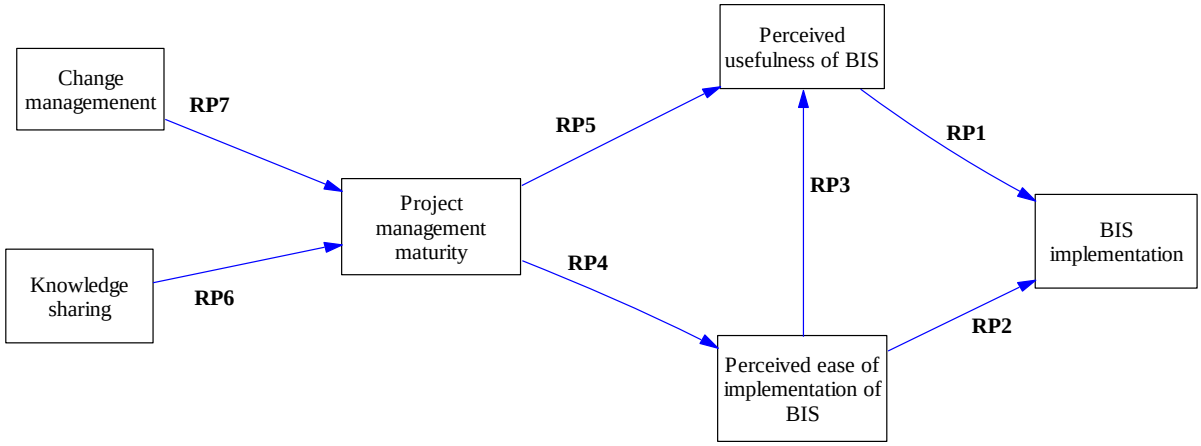

Fig. 1. Proposed Research model

3.2 Project Management Maturity related research propositions

Gyampah and Salam [42] have extended the TAM in the areas of project communications and training and shared beliefs. Their findings suggest that training and communication in the aspect of project communication could be used for extending the TAM, since effective project management is likely to positively impact the PU and PEU. This leads us to the following research proposition that emerges from the impact of project management maturity on the PEU and PU:

- RP4: Project management maturity positively influences Perceived ease of implementation of the BIS;
- RP5: Project management maturity positively influences Perceived usefulness of the BIS.

Project management is also influenced in organizations by different factors. Law and Ngai [43] suggest a successful business process change, user support and involvement, and expertise of vendors as critical success factors in the ERP projects. Markus [44] and Gu [45] suggest that managing organizational change is critical for a successful IT project implementation. Al-Zayyat et al. [46] concluded that knowledge sharing enables a project team to reduce doing rework and compresses the time that it takes to plan projects. They also stated that providing the "right knowledge" to the "right person(s)" at the "right time" allows for greater control over the project throughout the project's lifecycle by reducing uncertainty. Therefore, in our work we presume that project management is driven by the change management and knowledge sharing in companies. Research propositions that emerge from these relationships are:

- RP6: Change management positively influences Project management maturity;
- RP7: Knowledge sharing positively influences Project management maturity.

4. Research Methodology

4.1 Sample description

In order to test the research propositions, a questionnaire survey method was used. Questionnaires were sent to companies with more than 50 employees in June and July 2015. Purposive sampling was used in order to target companies that implemented BIS at least to some extent. The initial list of the 500 companies was developed by collecting the contacts of the companies at various business intelligence social media groups, such as "Big Data, Analytics, Business Intelligence & Visualization Experts Community" at LinkedIn.

An invitation to fulfill the questionnaire was sent to the CIOs who are supposed to be the business experts that are the most familiar and involved in BIS implementation in the companies. The invitation was sent to 500 USA large and medium sized manufacturing and service companies. Final data sample consists of 87 completed questionnaires, which represents a response rate of 17.4%. Dilman [47] propose that response rate attained in our survey is comparable with similar research which were using mail surveys.

Most of the companies from the sample are from banking, insurance, and financial services (18.4%), telecommunications (19.5%) and tourism and leisure (12.6%). Around 8% of companies are involved in manufacturing, mining and energy sector following. IT companies comprise 6.9% of the sample, while 4.6% companies are providing consulting services. Only 3.4% are public institutions, and 1.1% of companies are focused on media and communication services. Most of the companies have more than 500 employees (71.26%), while 28.74% companies have less than 500 employees.

CIO of the company was selected as the informant in the study, since IS implementation is one of the major focuses of their work. Almost all respondents are full time employees (90.8%), while 9.2% of respondents are part time employees. There is approximately the same percentage of respondents who are working in the company for 10 and more years (26.4%), from three to five years (23%) and from five to ten years (25.3%). Only 5.7% of respondents are working for more than twenty years in the same company. Around fifth of the respondents (19.5%) are employed from one to three years in the company. Regarding education level, most of the respondents have master (43.7%) or university degree (39.1%), followed by those who have doctoral degree (10.3%). Only 1.1% of respondents finished college or high school while 4.6% respondents finished 2 years college degree (junior college).

4.2 Research instrument

Table 1 presents the research instrument, which consists on the following constructs: perceived usefulness of the BIS, perceived ease of implementation of BIS (PEU), BIS implementation (BISI), project management maturity, change management, and knowledge sharing. The constructs were selected based on the presented conceptual model and research propositions. Survey questions were prepared as closed questions. Likert scale was used for measuring the respondents' level of agreement with specific statements from 1 to 7 (1-do not agree at all, 7-completely agree).

Perceived usefulness of BIS and *perceived ease of implementation of BIS* constructs were developed using the original constructs used in Davies [11]. The construct measuring *BIS implementation* was developed based on the notions of the data integration [15], decision making using information [16], and the usage of BIS across the organization [14].

Project management maturity was measured using the PMM model developed by PM Solutions [48]: project integration management, project scope management, project time management, project cost management, project quality management, project human resource management, project communications management, project risk management, and project procurement management. However, the project procurement management was not taken into account since BIS implementation was examined in privately owned companies in which procurement management does not take the crucial role, as is the case in public companies. Statements that describe different aspects of the project management were used as the items in the construct. For example, IT project managers have an influence over project costs during the total project time, taking into account the project budget was used in order to measure the project cost management.

Table 1. Research instrument

Construct	Code	Indicators
Perceived usefulness of BIS (PU) Source:[30]	PU1	Using the BIS improves company performance.
	PU2	Using the BIS increases company work productivity.
	PU3	I would find the BIS useful in my company.
Perceived ease of implementation of BIS (PEU) Source:[30]	PEU1	Implementation process of BIS is understandable.
	PEU2	Company has adequate financial resources for BIS implementation.
	PEU3	IT department has adequate knowledge for BIS implementation.
	PEU4	It is easy to integrate BIS with the existing solutions.
	PEU5	I find BIS in my company easy to use.
BIS implementation (BISI) Sources:[14, 15, 16]	BISI1	BIS is used in all organizational units, and hierarchical levels.
	BISI2	Internal (both structured and unstructured) and external data are integrated, and requirements (e.g. data quality) are met in BIS.
	BISI3	BIS is a base for all decisions, and has a critical impact on organizational performance.
Project management maturity (PMM) Source: [48]	PMM1	IT projects are strongly connected with the enterprise strategy (project integration management).
	PMM2	Implementation goals for the IT projects are clearly defined (project scope management).
	PMM3	Schedules for IT projects in the company are detailed and understandable (project time management).
	PMM4	IT project managers have an influence over project costs during the total project time, taking into account the project budget (project cost management).
	PMM5	IT project manager has influence over project team member (project human resource management).
	PMM6	If I have to use new features (modules) of the IS my progress is monitored by IT project managers and I am asked for feedback (project quality management).
	PMM7	IT project manager can easily communicate the risk issues with the top-level manager that is the "sponsor" of the project in order to minimize the risk of the project (project risk management).
	PMM8	If I am not satisfied with a new feature (module) of the IS I have procedure on how to communicate to IT Project Manager (project communications management).
Change management (CM) Sources: [44,45]	CM1	If new features of the IS are introduced, written procedures on how to do it are available.
	CM2	Coaching or trainings are available when new features of the IS are introduced.
	CM3	When new features (modules) of the IS are introduced, change managers are available.
	CM4	When new features (modules) of the IS are introduced, all necessary documentation is available.
	CM5	When I need to use new features (modules) of the IS I have support from other employees.
	CM6	When I need to use new features (modules) of the IS I receive all necessary documentation on time.
	CM7	When I need to use new features (modules) of the IS I know exactly where to find all necessary documentation or who will provide these documents to me.
Knowledge sharing (KS) Source: [46]	KS1	Employees are able to communicate and share knowledge with other employees.
	KS2	Top management encourage employees to meet and share knowledge about job activities.
	KS3	Company has an incentive and rewards system to encourage employees to share knowledge.
	KS4	Company has written (stored) policies, procedures or guidelines to support knowledge sharing.
	KS5	Employees are able to use knowledge or information from the IS related to their activities.
	KS6	Collaborative tools or knowledge portals are available to learn or to share knowledge.

Change management construct was developed using the approach of Markus [44] and Gu [45], while *knowledge sharing* construct was developed using the approach of Al-Zayyat et al. [46].

4.3 Statistical methods

Data were collected by the questionnaire survey method and were analyzed in five steps using the following statistical methods: (i) content validity analysis, (ii) reliability analysis, (iii) descriptive data analysis, (iv) path model fit and (v) path model analysis:

- First, content validity has been confirmed by using the items adapted from the literature in conjunction with the pilot study.
- Second, Cronbach's alpha coefficients that indicate internal consistency of the items used for calculating scales were used to conduct reliability analysis [49].
- Third, descriptive data analysis and non-parametric correlation analysis were conducted in order to check for negative or low correlations which could indicate some data validity problems [50].
- Fourth, in order to test the path model fit, following indices were used: Chi-square index, goodness of fit statistics (GFI), adjusted goodness-of-fit statistics (AGFI), normed-fit index (NFI), non-normed-fit index (NNFI), comparative-fit index (CFI) and root-mean-square-error (RMSEA) [51].
- In the last step, the path model was used for statistical testing of the research propositions paying attention on the signs and statistical significance of the parameters, as well as on the amount of variance of endogenous constructs accounted by independent constructs variation. The significance level of 5% was used as a threshold for the research proposition testing.

5. Results

5.1 Content validity and reliability analysis

Since the research instrument in Table 1 was developed based on the previous research, the pilot research was conducted, in order to assess the internal validity. The pilot research was conducted using in-depth interviews with 5 CIOs, and based on their positive comments it was concluded that questions are understandable and relevant. Reliability analysis was conducted using Cronbach's alpha coefficients. According to Feldt and Kim [49] internal consistency coefficients of 0.70 or higher are considered to indicate adequate reliability. In our research, all Cronbach's alpha coefficients were above the cut-off value (0.70), which propossed that the item scales were internally consistent (Table 2). Therefore, the average values of items in the construct were calculated: PU, PEU, BISI, PMM, CM, and KS, and are presented in Table 3.

5.2 Primary data analysis

In order to understand better given results, we have conducted descriptive data analysis and correlation analysis. Spearman's correlation coefficients have not revealed negative neither very low (near-zero) correlations between examined items, and all of them were statistically significant, mostly at level 0.01 (Table 3). Most correlation coefficients show strong correlation especially among following independent variables: BIS and PU (ρ=0.917, $p<0.01$), and PEOU and PU (ρ=0.700, $p<0.01$), BIS and PEOU (ρ=0744, p<001), CM and PMC (ρ=0.782, $p<0.01$). There is positive linkage between two constructs which is confirmed by determined correlation values. The medium positive correlations were found in the following cases: PMC and PU (ρ=0.437, $p<0.01$), KS and PU (ρ=0.409, $p<0.01$), PMC and PEU (ρ=0.537, $p<0.01$), KS and PEOU (ρ=0.450, $p<0.01$), PMC and BIS (ρ=0.500, $p<0.01$), KS and BIS (ρ=0.402, $p<0.01$), KS and PMC (ρ=0.628, $p<0.01$), and KS and CM (ρ=0.666, $p<0.01$). The results clearly emphasized that elements of TAM were positively related and had an significant influence on the adoption of BIS. Additionally, project management commitment they have also led towards the adoption of BIS. The lower positive correlations were found in

the following cases: CM and PU (ρ=0.259, p<0.05), CM and PEOU (ρ=0.372, p<0.01), and CM and BIS (ρ=0.284, p<0.01). However, these correlations were still statistically significant.

Table 2. Descriptive statistics and Cronbach's alpha

	N	Minimum	Maximum	Mean	Std. Deviation	Cronabch's alpha
PU1	87	3	7	5.966	0.994	0.971
PU2	87	3	7	6.011	1.029	
PU3	87	3	7	6.011	1.017	
PEU1	87	3	7	5.690	0.968	0.951
PEU2	87	2	7	5.471	1.109	
PEU3	87	2	7	5.540	1.139	
PEU4	87	2	7	5.494	1.109	
PEU5	87	2	7	5.506	1.033	
BISI1	87	3	7	5.966	1.005	0.991
BISI2	87	3	7	5.977	1.011	
BISI3	87	3	7	5.989	1.029	
PMM1	87	1	7	5.586	1.106	0.936
PMM2	87	2	7	5.253	1.081	
PMM3	87	2	7	5.126	1.149	
PMM4	87	1	7	5.345	1.150	
PMM5	87	1	7	5.161	1.328	
PMM6	87	1	7	4.851	1.498	
PMM7	87	2	7	5.218	1.125	
PMM8	87	1	7	5.115	1.233	
CM1	87	2	7	4.897	1.230	0.889
CM2	87	2	7	5.080	1.133	
CM3	87	2	7	5.034	1.280	
CM4	87	1	7	4.931	1.388	
CM5	87	1	7	5.172	1.153	
CM6	87	1	7	4.920	1.269	
CM7	87	1	7	4.931	1.179	
KS1	87	3	7	5.701	0.823	0.821
KS2	87	1	7	5.517	1.066	
KS3	87	1	7	4.586	1.808	
KS4	87	1	7	4.517	1.791	
KS5	87	1	7	5.460	1.054	
KS6	87	1	7	5.287	1.275	

Table 3. Descriptive statistics and correlation coefficients

	Mean	**σ**	PU	PEOU	BIS	PMC	CM	KS
PU	5.992	0.984	1					
PEOU	5.540	0.981	0.700**	1				
BIS	5.977	1.006	0.917**	0.744**	1			
PMC	5.207	1.011	0.437**	0.537**	0.500**	1		
CM	4.995	0.957	0.259*	0.372**	0.284*	0.782**	1	
KS	5.178	0.985	0.409**	0.450**	0.402**	0.628**	0.666**	1

*Note: ** p-value <0 .01, * < 0.05*

5.3 Assessment of model fit

In our study we used fit indices proposed by Hooper *et al.* [51] and Bentler and Bonnet [52]. The proposed conceptual model was tested using Lisrel software and it yielded a Chi-square of 13.938 with 7 degrees of freedom. The ratio of Chi-square and degrees of freedom was lower than 2, which is considered as a very good result, according to Hooper et al. [51]. In order to confirm given results and while Chi-square is usually sensitive to sample size, some other indices were also used to assess the overall model fit (Table 4):

- The value of Goodness-of-fit (GFI) was 0.951 indicating a very good result. Adjusted goodness-of-fit statistic (AGFI) was 0.853 indicating a good result [51, 52].
- The values of Normed-fit index (NFI) and Non-Normed-fit index (NNFI) were higher than 0.90 which is also very good result [51, 52].
- Value of comparative-fit index (CFI) was higher than 0.95, also considered as good result [51, 52].
- The Root-mean-square-error (RMSEA) is 0.107, which is slightly higher than 0.10 recommended threshold [51, 52]. However, number of other studies reports similar values as an acceptable result [42].

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Table 4 summarizes the fit indices for the hypothesized model, and regarding given results, we may conclude that our conceptual model correspond with explained requirements.

Table 4. Fit indices for the hypothesized model

Fitness indicator	Model estimated	Explanations
Chi-square (χ^2)	13.938	χ^2 is not significant
Degrees of freedom (df)	7	
p-value	0.053	
χ^2/df	1.991	Very good, close to 2
GFI	0.951	Very good result
AGFI	0.853	Good
NFI	0.966	Very good result
NNFI	0.963	Very good result
CFI	0.983	Very good result
RMSEA	0.107	close to 0.100, fairly good result
90% confidence interval of RMSEA	(0.005 ; 0.189)	Upper limit <.20, fairly good result

5.4 Research proposition testing

Conceptual model showed a good fit, which lead us to examine the structural part of the model (Fig. 2). Therefore, we want to investigate whether proposed theoretical relationships are supported in specific research context. In the path analysis, we pay attention on the following: (i) the signs of the parameters, (ii) statistical significance of parameters (measured by t-value) and the amount of variance of endogenous constructs (measured by the squared multiple correlation coefficient – R^2).

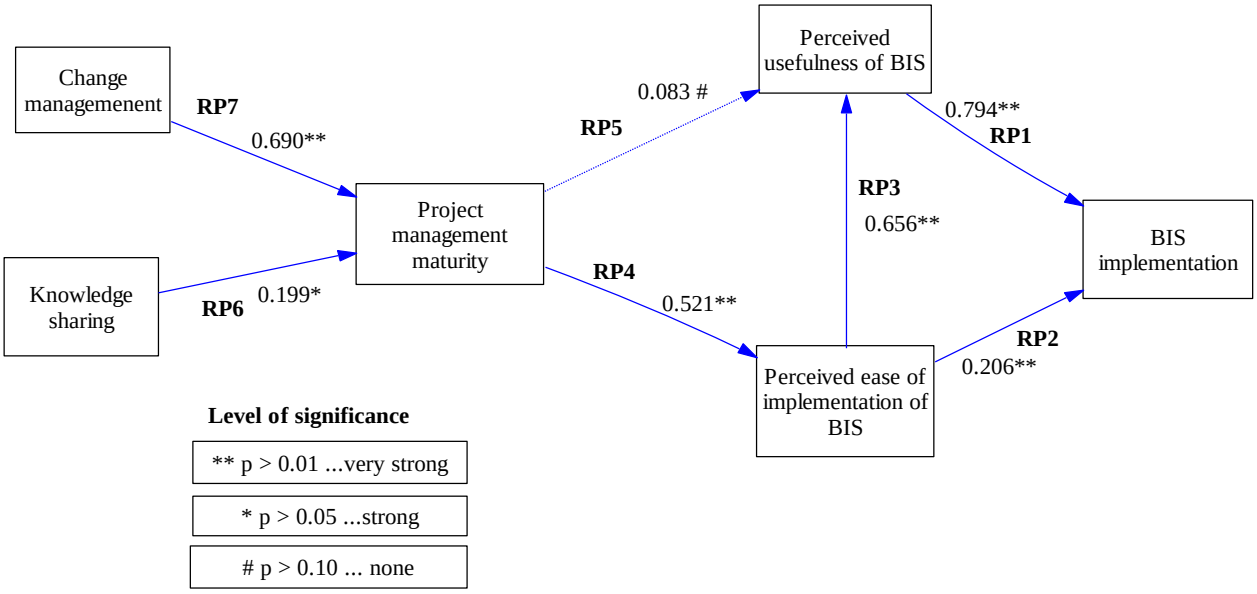

Fig. 2. Path diagram

In Fig. 2 path diagram is shown. The path coefficient for the RP5 had a low statistical significance (lower than the cut-off value of 0.5) which mean that the research proposition RP5 is rejected. Other research propositions were supported with the path coefficients higher than cut-off value and with statistical significance present at the 1% level (RP1, RP2, RP3, RP4 and RP7) while RP6 was supported with statistical significance present at the 5% level, which mean that these research propositions should be accepted.

The first research proposition (RQ1), proposing that *Perceived usefulness of BIS* is positively related to *BIS implementation*, was accepted. The standard solution of path coefficient estimate was 0.794 with the t-value of 13.728. The second research proposition (RQ2), indicating that *Perceived ease of use of BIS* is positively related to *BIS implemenation*, was also accpted, with the standard solution of path coefficient estimate of 0.206 with the t-value of 3.552. R^2 value for both RQ1 and RQ2 was 0.861 indicating that the 86.1% of variations in BIS implementation could be explained by the variations in PU and PEU.

	BISI =	0.794*PU +	0.206*PEOU,	Errorvar.= 0.140;	R = 0.861	(1)
Stand.err		(0.0578)	(0.0580)	(0.0215)		
Z-values		13.728	3.552	6.519		
P-values		0.000	0.000	0.000		

The third research proposition (RQ3), proposing that PEU is positively related to PU, was accepted, with the standard solution of path coefficient estimate of 0.656 with the t-value of 7.152. The fourth research proposition (RQ4), indicating that PMM is positively related to PEU, was not accepted, with the standard solution of path coefficient estimate of 0.083 with the t-value of 0.936. R^2 value for both RQ3 and RQ4 was .495 indicating that the 49.5% of variations in PU could be explained by the variations in PEU.

	PU =	0.656*PEOU +	0.0832*PPM,	Errorvar.= 0.490	R = 0.495 (2)
Stand.err		(0.0917)	(0.0890)	(0.0751)	
t-values		7.152	0.936	6.519	
P-values		0.000	0.350	0.000	

The fifth research proposition (RQ5), proposing that PPM is positively related to PEU, was accepted, with the standard solution of path coefficient estimate of 0.521 with the t-value of 5.872. However, R^2 value for RQ5 was 0.289 indicating that the 28.9% of variations in PEU could be explained by the variations in PPM.

	PEOU = 0.521*PPM,	Errorvar.= 0.684	R = 0.289	(3)
Stand.err	(0.0887)	(0.105)		
Z-values	5.872	6.519		
P-values	0.000	0.000		

The sixth research proposition (RQ6), proposing that KM is positively related to PPM, was accepted, with the standard solution of path coefficient estimate of 0.199 with the t-value of 2.194. The sevent research proposition (RQ7), indicating that CM is positively related to PPM, was also accepted, with the standard solution of path coefficient estimate of 0.690 with the t-value of 7.403. R^2 value for both RQ6 and RQ7 was 0.632 indicating that the 63.5% of variations in PPM could be explained by the variations in KM and CM.

	ITPM = 0.690*CM	+ 0.199*KSC,	Errorvar.= 0.376	R = 0.632	(4)
Stand.err	(0.0932)	(0.0906)	(0.0577)		
Z-values	7.403	2.194	6.519		
P-values	0.000	0.028	0.000		

To summarize, path model confirmed the hypothetical model with the adequate goodness of fit. Path model was interpreted in order to test the conceptual model. Most of the research propositions were proven, indicating the following relationships: (i) BIS implementation is positively interrelated with the perceived usefulness and perceived ease of use of BIS; (ii) Project management maturity positively impacts the perceived ease of use of BIS, but do not have a statistically significant interrelation with the perceived usefulness of BIS, and (iii) Project management maturity is positively interrelated with the change management and knowledge sharing practices in the companies.

6. Conclusion

From the academic perspective, the contributions are following. First, Factors that influence the acceptance of the BIS in companies were examined in order to enrich scientific literature in the area of BIS adoption, and we confirm the significant impact of the TAM core variables (PU and PEU) to the IS adoption, as indicated in number of previous research studies [40, 33]. Second, TAM model was refined in order to be used for the implementation of the BISs, using the CIO as the informant, thus extending the research of Varajão et al. [9] and Portela et al. [10] who investigate the role of CIO in organizations. Third, we expand the TAM model, thus following the proposed approach of Venkatesh et al. [36], with the construct measuring project management maturity based on the Grant et al. [48]. Fourth, we confirm the significant impact of change management and knowledge management to the project management maturity, as indicated as previous research [44, 45, 46].

Findings and results could have future practical implications for the IT project management teams, management strategies towards future implementations of the BIS and end users' perspective on the usage of the BISs. In the sense of the BISs development, the study could also have practical implications for future planning and design of the BISs solutions, with regard to the major determinants of their adoption in organizations. The practical recommendations are following for the implementation of external BISs. First, the PU and PEU are of the highest importance for the BISs implementation, and software companies selling BISs solutions should focus their effort toward the education of CIO about the ease-of-implementation and usefulness of their applications, possibly in the manner that can be understandably presented to other C-level managers. Second, software companies selling BISs solutions should also take into account the importance of project management maturity in the targeted companies. Third, assessment of the change management and knowledge management practices would be also recommended before the project for the BIS implementation is launched.

Limitations of the paper stem mainly from the sample characteristics. First, although we consider that purposive sampling was useful for targeting companies that have already implemented BISs, the potential readers should take that into account. Second, the research was conducted on the sample of US companies, and the results of the research studies conducted in other countries could be impacted by country-related cultural issues, since the previous research indicated that project management is prone to be different across different country-cultures [53]. Third, our research was of cross-sectional nature, thus allowing us to focus on the state of BISs adoption in the particular period, while not allowing the assessment of dynamic aspect of technology adoption. Further research stems from the abovementioned limitations in two directions. First, the research of the larger scale on different national samples could greatly enhance the knowledge about the impact of project management maturity to technology in general. Second, the longitudinal research would provide insight into the impact of project management in different stages of BISs adoption. Such studies would be of high complexity on large sample, multi-case longitudinal studies would be welcome in the research area of BISs adoption.

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References

[1] M.C. Elbashir, P.A. Collier and M.J. Davern, "Measuring the Effects of Business Intelligence Systems: The Relationship between Business Process and Organizational Performance," International Journal of Accounting Information Systems, vol. 9, no. 3, pp. 135-153, 2008.

[2] M. Hannula and V. Pirttimaki, "Business intelligence empirical study on the top 50 Finnish companies," Journal of American Academy of Busines, vol. 2, no. 2, pp. 593-599, 2003.

[3] N. Williams and S. Williams, "The business value of business intelligence". Business Intelligence Journal, vol. 8, no.3, pp. 30-39, 2003.

[4] H. Wang and S. Wang, "A Knowledge management approach to data mining process for business intelligence" Industrial management and data systems, vol. 108, no. 5, pp. 622-634, 2008.

[5] C.K. Hou, "Examining the effect of user satisfaction on system usage and individual performance with business intelligence systems: An empirical study of Taiwan's electronics industry," International Journal of Information Management, vol. 32, no. 6, pp. 560-573, 2012.

[6] T.C.K. Huang, C.C. Liu, and D.C. Chang "An empirical investigation of factors influencing the adoption of data mining tools. International Journal of Information Management, vol. 32, no. 3, pp. 257-270, 2012.

[7] T.C.K. Huang, L. Wu and C.C. Chou, "Investigating use continuance of data mining tools," International Journal of Information Management, vol. 33, no. 5, 791-801, 2013.

[8] M. Hart, F. Esat, M.Rocha and Z. Khatieb, "Introducing students to business intelligence: acceptance and perceptions of OLAP software," Informing Science: International Journal of an Emerging Transdiscipline, no. 1, pp.105-123, 2007.

[9] J. Varajão, A. Trigo and J. Barroso, "Motivations and trends for it/is adoption: insights from Portuguese companies," International Journal of Enterprise Information Systems (IJEIS), vol. 5, no. 4, pp. 34-52, 2009.

[10] L. Portela, R. Carvalho R., J. Varajão and L. Magalhães, (2010) "A Review of Chief Information Officer' Main Skills". In Lytras M.D., Ordonez de Pablos P., Ziderman A., Roulstone A., Maurer H., Imber J.B. (eds) *Organizational, Business, and Technological Aspects of the Knowledge Society. WSKS 2010. Communications in Computer and Information Science*, vol. 112, Berlin, Springer, pp. 387-392, 2010.

[11] M. Pejić-Bach, J. Zoroja and A. Čeljo, "Technology Acceptance Model for Business Intelligence Systems: Preliminary Research," Procedia Computer Science, vol. 100, pp. 995-1001, 2016.

[12] A. Popovič, R. Hackney, P.S. Coelho and J. Jaklič, "Towards business intelligence systems success: Effects of maturity and culture on analytical decision making," Decision Support Systems, vol. 54, no. 1, pp. 729-739, 2012.

[13] T. Bucher, A. Gerick and S. Sigg, "Process-centric business intelligence," Business Process Management Journal, vol. 15, no. 3, pp.408-429, 2009.

[14] M. Bahrami, S.M. Arabzad and M. Ghorbani, "Innovation in market management by utilizing business intelligence: introducing proposed framework," Procedia-Social and Behavioral Sciences, vol. 41, pp. 160-167, 2012.

[15] T. Ishaya and M. Folarin, "A service oriented approach to Business Intelligence in Telecoms industry," Telematics and Informatics, vol. 29, no. 3, pp.273-285, 2012.

[16] M. Aruldoss, M.L. Travis and V.P.Venkatesan, "A survey on recent research in business intelligence," Journal of Enterprise Information Management, vol. 27, no. 6, pp.831-866, 2014.

[17] J. Varajão, C. Dominguez, P. Ribeiro and A. Paiva, "Critical Success Aspects in Project Management: Similarities and Differences between the Construction and Software Industry," Tehnički vjesnik, vol. 21, no. 3, pp.583-589, 2014.

[18] R. Abu-Hussein, M. Hyassat, R. Sweis, A. Alawneh and M. Al-Debei, "Project Management Factors affecting the Enterprise Resource Planning Projects' Performance in Jordan," Journal of Systems and Information Technology, vol. 18, no. 3, pp. 230-254, 2016.

[19] E. W. Larson and C.F. Gray, *Project management: The managerial process*. Ney York, USA, McGraw-Hill, 2011.

[20] H.J. Yazici, "The Role of Project Management Maturity and Organizational Culture in Perceived Performance," Project Management Journal, vol. 40, no. 3, pp. 14-33, 2009.

[21] A. Belout and C. Gauvreau, "Factors influencing project success: the impact of human resource management," International journal of project management, vol. 22, no. 1, pp. 1-11, 2004.

[22] D. White and J. Fortune, "Current practice of project management- an empirical study," International journal of project management, vol. 20, no.1, pp. 1-11, 2002.

[23] P. Ziek and J.D. Anderson, "Communication, Dialogue and Project Management," International Journal of Managing Projects in Business, vol. 8, no. 4, pp. 788-803, 2015.

[24] N. Williams, N.P. Ferdinand and R. Croft, "Project management maturity in the age of big data," International Journal for Managing Projects in Business, vol. 7, no. 2, pp. 311-317, 2014.

[25] J.C. Albrecht and K. Spang, "Linking the Benefits of Project Management Maturity to Project Complexity: Insights from a Multiple Case Study," International Journal of Managing Projects in Business, vol. 7, no. 2, pp. 285-301, 2014.

[26] M. Fishbein and I. Ajzen, *Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research*. Boston, USA, Addison-Wesley, 1975.

[27] I. Ajzen, "The Theory of Planned Behaviour: Reactions and Reflections," Psychology & Health, vol. 26, pp. 1113-1127, 2011.

[28] C. Nico López-Nicolás, F.J. Molina-Castillo and H. Bouwman, "An assessment of advanced mobile services acceptance: Contributions from TAM and diffusion theory models," Information & Management, vol. 45, no. 6, pp. 359-364, 2008.

[29] M.Y. Chuttur, "Overview of the technology acceptance model: Origins, developments and future directions," Working Papers on Information Systems, vol. 9, no. 37, pp. 9-37, 2009.

[30] F.D. Davis, "Perceived Usefulness, Perceived Ease Of Use, and User Acceptance of Information Technology," MIS Quarterly, vol. 13, no. 3, pp. 319-340, 1989.

[31] V. Venkatesh and F.D. Davis, "A Model of the Antecedents of Perceived Ease of Use: Development and Test," Decision sciences, vol. 27, no. 3, pp. 451-481, 1996.

[32] V. Venkatesh and F.D. Davis, "A theoretical extension of the technology acceptance model: Four longitudinal field studies," Management science, vol. 46, no. 2, pp. 186-204, 2000.

[33] D. Pasaoglu, "Analysis of ERP Usage with Technology Acceptance Model," Global Business and Management Research, vol. 3, no. 2, pp. 157-165, 2011.

[34] Y.H. Kwak, J. Park, B.Y. Chung and S. Ghosh, "Understanding End-Users' Acceptance of Enterprise Resource Planning (ERP) System in Project-Based Sectors," IEEE Transactions on Engineering Management, vol. 59, no. 2, pp. 266-277, 2012.

[35] W.Money and A. Turner, "Assessing knowledge management system user acceptance with the technology acceptance model," International Journal of Knowledge Management (IJKM), vol. 1, no. 1, pp. 8-26, 2005.

[36] V. Venkatesh and S.A. Brown, "A longitudinal investigation of personal computers in homes: adoption determinants and emerging challenges". MIS quarterly, vol. 25, no. 1, pp. 71-102, 2001.

[37] M. Hart and G. Porter, "The impact of cognitive and other factors on the perceived usefulness of OLAP," Journal of Computer Information Systems, vol. 45, no. 1, pp. 47-56, 2004.

[38] M. S. Sharoupim, *Examining the Impact of Culture and Human Elements on OLAP Tools Usefulness*. Ph.D. Dissertation, Ann Arbor, USA, Northcentral University.

[39] M. Wook, Z.M. Yusof and M.Z.A. Nazri, "The Acceptance of Educational Data Mining Technology among Students in Public Institutions of Higher Learning in Malaysia," International Journal of Future Computer and Communication, vol. 4, no. 2, pp. 112, 2015.

[40] J. Wu and S. Wang, "What drives mobile commerce? An empirical evaluation of the revised technology acceptance," Information & management, vol. 42, no.5, pp. 719-729, 2005.

[41] P. Godoe and T. Johansen, "Understanding adoption of new technologies: Technology readiness and technology acceptance as an integrated concept," Journal of European Psychology Students, vol. 3, no. 1, 2012. Available at: http://jeps.efpsa.org/articles/10.5334/jeps.aq/

[42] K. Amoako-Gyampah and A.F. Salam, "An extension of the technology acceptance model in an ERP implementation environment," Information & management, vol. 41, no. 6, pp. 731-745, 2004.

[43] C.C. Law and E.W. Ngai, "ERP systems adoption: An exploratory study of the organizational factors and impacts of ERP success," Information & Management, vol. 44, no. 4, pp. 418-432, 2007.

[44] M.L. Markus, "Techno-change management: using IT to drive organizational change," Journal of Information technology, vol. 19, no. 1, pp. 4-20, 2004.

[45] V.C. Gu, J.J. Hoffman, Q. Cao and M.J. Schniederjans, "The effects of organizational culture and environmental pressures on IT project performance: A moderation perspective," International Journal of Project Management, vol. 32, no. 7, pp. 1170-1181, 2014.

[46] N.A. Al-Zayyat, F. Al-Khaldi, I. Tadros and G. Al-Edwan, "The Effect of Knowledge Management Processes on Project Management," IBIMA Business Review, vol. 3, no. 1, pp.47-52, 2010.

[47] D.A. Dilman, *Mail and Internet Surveys: The Tailored Design Method*, Chichester, USA, Wiley, 1999.

[48] K.P. Grant and J.S. Pennypacker, "Project management maturity: An assessment of project management capabilities among and between selected industries," IEEE Transactions on engineering management, vol. 53, no. 1, pp. 59-68, 2006.

[49] S. Kim and L.S. Feldt, "A Comparison of Tests for Equality of Two or More Independent Alpha Coefficients," Journal of Educational Measurement, vol. 45, no. 2, pp. 179-193, 2008.

[50] D. de Vaus, *Research Design in Social Research*, London, UK, Sage Publications, 2001.

[51] D. Hooper, J. Coughlan and M.R. Mullen, "Structural equation modelling: guidelines for determining model fit," Electronic Journal of Business Research Methods, vol. 6, no. 1, pp. 53-60, 2008.

[52] P.M. Bentler and D.C. Bonnet, (1980), "Significance Tests and Goodness of Fit in the Analysis of Covariance Structures," Psychological Bulletin, vol. 88, no. 3, pp. 588-606, 1980.

[53] M. M. de Carvalho, L.A. Patah and D. de Souza Bido, (2015). "Project management and its effects on project success: Cross-country and cross-industry comparisons," International Journal of Project Management, vol. 33, no. 7, pp. 1509-1522, 2015.

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The rise of the prosumer: an analysis of self-service technology adoption in a corporate context

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Abstract:
The adoption of self-service technology (SST) has been well researched in consumer contexts but, despite the existing body of work, few studies have investigated in detail the specific determinants for user satisfaction in a corporate context. This study attempts to address this deficit. The goal of our work is to examine employees' perception of SST. To do this, four dimensions of the SSTQUAL quality scale (namely (a) functionality; (b) security; (c) design and (d) customization) were adapted to collect data from 182 knowledge workers in a financial services multi-national organization. The findings lead to the following insights. First respondents believe that SSTs can perform the task required in a timely and straightforward manner. They also feel that transactions are safe and secure. However, we learned that, although essential to user satisfaction, respondents have concerns regarding the design and customization of the technology. They believe that the technology employed is not user centric. Furthermore, respondents are not pleased with the layouts or aesthetics of the technology and they feel that the features are not personalized for their specific requirements. The study is important for many reasons. First, it expands the discussion on SST adoption by focusing on the corporate context thus contributing to the body of knowledge in the domain. Second, it captures and analyses real world empirical data and helps bridge the gap between theory and practice. Finally, the findings can help service providers to create effective user driven solutions.

Keywords:
self-service technologies; technology adoption; satisfaction; SSTQUAL quality scale.

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1. Introduction: The rise of the prosumer

It is widely accepted that recent technological advancements have led to enhanced business practices. This impact is especially profound in the service based industry where providers are continuously introducing innovative methods to deliver service options to their clients. Increasingly service providers are employing technology based solutions to encourage, and oftentimes to compel, consumers to use their services autonomously.

Consumers are now taking more control of their service consumption. This is evident in many industries such banking (e.g. on-line payments and account management); retail (e.g. self-scanning tills) and airline (e.g. on-line booking and check in). Toffler [1], a founding scholar on the self-service concept, coined the term "*prosumer*" which means "*production by consumers*" to express the blurring of boundaries between the producer and the consumer. According to Prahalad and Ramaswamy [2], prosumers are "*co-creators of value*" as they not only engage with but also control the service delivery process to meet their specific needs. To this end, we notice that interpersonal or face to face interactions between providers and consumers are being replaced with self-service technologies (SSTs). Self-service technologies, or automated service delivery systems, enables customers to interact with technology to produce their own outcome independent of human involvement (e.g. service representative) [3], [4].

Dabholkar and Richard [5] contend that self-service technologies can be categorized into two cohorts. The first cohort refers to "on-site" options which may include technologies such as self-scanning in retail stores and libraries; touch screens in airports and information kiosks in tourist information outlets. The second cohort refers to "off-site" options which may include technologies such as online banking and shopping on the Internet.

Previous research has shown that the adoption of self-service technology has been studied from many perspectives in many different contexts. For example, recent research has been conducted in contexts such as banking [6], [7], television [8], air travel [9] and hospitality [10]. We observe that all these studies have focused on SST adoption in consumer markets. However, knowledge workers in general and technology based knowledge workers increasingly use self-service technology (SST) within their organizations to obtain services. Surprisingly, to the best of our knowledge, little attention has been paid to understanding SST adoption in the business or corporate context. There is a dearth of empirical studies in this domain that clearly should be addressed. Thus, to close this gap our research aims to ascertain whether the move towards service capabilities, based on a self-service technology approach caters for technology knowledge workers' evolving demands. Specifically, we aim to assess the level of satisfaction with an organizations SST in a business context. To do this our study adapted the SSTQUAL measurement scale developed by Lin and Hsieh [11] which is acknowledged as the de-facto SST quality measurement scale [6], [12]. We adapt four constructs namely (a) functionality, (b) security, (c) design and (d) customization as these were most relevant to our requirements and context. The target group for this study included approximately 400 knowledge workers comprising software engineers, software quality assurance engineers, system administrators, software architects and technical managers. The group was geographically distributed across multisite boundaries. Data was collected from 182 people in January and February 2015 and key findings of our analysis are presented in this paper.

This study is important to both academics and to practitioners. Our findings advance theory in an important way. To this end, we answer calls for research by extending the discussion on SST and analyzing empirical data in a real world corporate context. Additionally, our findings have interesting implications for service practitioners. We expect that the results of our analysis will help practitioners with their decision on whether to invest in SST as an alternative to service representative services. These findings can also provide valuable insights to designers of such technologies.

2. Understanding self-service technologies

2.1 Cognate studies

The literature on SST is rather varied. A review of the extant literature reveals that many empirical studies have focused on consumers' attitude towards SST. Most notably Dabholkar and Richard's [5] seminal study examined the moderating effects of consumer traits and situational factors on the relationships within an attitudinal model for SSTs. Collier et al.'s [13] work explored the situational influences on customers' self-service technology decisions. Other studies have examined customer preferences between the use of service representatives and SSTs [14], [15], [16], [17]. A considerable part of the literature on SSTs examines determinants of SST adoption and use. Previous research has shown that consumer adoption and continuance behavior is influenced by different factors [18]. In particular, Curran et al. [19] examined the factors that influence consumer attitudes toward, and adoption of, self-service technologies (SSTs). Curran and Meuter [20] also examined self-service technology adoption. Meuter et al. [21] explored the influence of technology anxiety on consumer use and experiences with self-service technologies. Elliott et al. [22] investigated consumers' intentions to use self-scanning technology while Eriksson and Nilsson [23] studied the determinants of the continued use of self-service technology. Lee and Allaway's [4] work focused on the effects of personal control on adoption of self-service technologies. This study investigates whether the provision of increased consumer control can reduce their perceived risk, enhance the perceived value of the SST, and induce greater adoption intention associated with a technology. In addition, there have been some empirical studies that examined customer satisfaction with SSTs. For example, Meurer et al. [3] investigated the sources of satisfaction and dissatisfaction with SSTs. Whilst Yen [24] examined the attributes important for consumer satisfaction with Internet-based self-service technology.

2.2 Drivers and benefits

Research has shown that advancements in technology coupled with increased labour costs and are key drivers for service organizations to offer SST to consumers [5], [20], [25]. Arguably the biggest motivation for the creation of SST is the elimination of the service representative which enables a cost-effective mechanism for organizations to deliver services to consumers anytime anywhere [4], [26]. An analysis of the extant literature shows that although fixed costs are high in the development process there are many benefits to using SST from the perspective of the service provider and also the consumer. These benefits are summarised in table 1. As you can see previous research studies have found that SST adoption has been proven to improve operations, decrease costs and increase efficiencies for the service provider. Much of the benefits attributed to the consumer centre around the customer experience. Indeed, prior research has found that some consumers may prefer to use SST rather than engaging with a service representative because they find the system easy to use, or because it allows them to avoid interaction with people [3].

However, it must be acknowledged that the shift towards SST undoubtedly requires increased effort on the part of the customer. For example, Lee and Alloway [4] ascertain that the replacement of human service representatives by a technology usually requires more customer participation and responsibility in the production of the service. Arguably some customers will consider the costs of learning the new technology and the behavioural changes required to be too great to be worthwhile [27]. Many research studies have found that consumers still prefer the consumer-to-representative interaction over SSTs. For example, Beatson et al. [17] empirically examined the impact of SST on customer satisfaction by assessing both SST attributes and personal service attributes in a hotel context. The results of the study show that consumers prefer the consumer-to-representative interaction over self-service technology. Indeed, Kokkinou and Cranage [28] demonstrated that under certain conditions, the introduction of SST does not provide satisfaction for consumers. Having more choice for interaction can lead to increased anxiety and complexity for both the consumer and producer over traditional systems [29]. Research into passenger behaviour at Spanish airports examined the factors that influence a passenger's decision to use an SST option [29]. These findings show that demographics have an impact on consumer behaviour and that younger consumers preferred SST options over a traditional service representative interaction at airports [29]. Researchers have also studied the behavioural intentions of

consumers where they were forced to use SST. Results indicate that technology anxiety and technology trust directly affect consumer behaviour and therefore consumer satisfaction [30]. These findings show that, although at times conflicting, consumers feel less anxious and trust organizations more when choice of service options are offered.

Table 1. Benefits to self-service technologies

Stakeholder	Benefit	Empirical study
Service provider	Greater control over the service delivery	Meuter et al. [3]
	Enables standardized service delivery	Curran and Meuter [20]; Hsieh et al. [31]
	Smooths demand fluctuations	Curran et al. [19]
	Expands the options for delivery	Curran and Meuter [20]
	Reduces labor costs	Meuter et al. [3]; Curran and Meuter [20]; Guthridge [25]
	Removes service personnel from routine tasks	Lee and Alloway [4]
Consumer	Improved customer experience	Guthridge, [25]
	Ease of use	Meuter et al. [3]; Dabholkar [32]
	Improves convenience	Meuter et al. [3]; Kauffman and Lally [33] ; Bitner et al.[34]
	Increased customization	Meuter et al. [3]
	Reduced waiting time	Meuter et al. [3]; Bitner et al.[34]
	Avoids interaction with employees	Bitner et al. [34]; Meuter et al. [3]; Dabholkar[32]
	Reduced anxiety	Bitner et al. [34]
	Improved enjoyment	Dabholkar [32]

It is clear that SSTs must be accepted by consumers in order to succeed. To this end the strategies used to encourage consumers to embrace these technologies must address the real needs of the user and must consider the perceived benefits in the minds of the consumer [20]. Therefore, it is imperative that we understand how to best design, develop and deploy new SSTs in order to increase the probability of user acceptance. Prior research indicates that SST users were satisfied when a specific need was met (i.e. a need for cash was satisfied by an ATM machine), the SST was better than an alternative service option (i.e. the SST was easy to use, the consumer wanted to avoid service personnel, the SST saved them time, the SST was available when they wanted it, the SST provided what they wanted, the SST saved them money) and the SST did its job. Technology failure, process failure, poor design or customer driven failures were all classified as dissatisfying incidents for consumers [3].

3. Measurement scales for consumer-to-technology interactions

Considering the previous discussion, a cogent development plan should incorporate key determinants of satisfaction and ensure they are designed in an effective way. However, the design and implementation of SST is not straightforward since users often present conflicting demands on a system. Thus, in this section, we present an overview of the measurement scales pertaining to the salient determinants of SST design which will be used to elucidate our research question.

A number of measurement scales exist which can be used to measure specific service dimensions. Most notably SERVQUAL measures consumer-to-service-representative quality [35]. The technology assessment model (TAM) measures the potential drivers and inhibitors of technology acceptance [36]. Work has been conducted in the area of technology readiness (TR) to assess consumer readiness to adopt new technology [37]. Lin and Hsieh's SSTQUAL scale measures the service quality of a SST [11]. Many researchers have adopted SSTQUAL and it is acknowledged to be the foremost scale for measuring the quality of consumer-to-technology interactions [7], [12].

A synthesis of the extant literature reveals similar or cognate studies that have been conducted in this space. For example, Oh et al. [10] studied tourist adoption and intention to use SST in a resort hotel context citing extrinsic motivations as a key motivator to adoption. This study developed a conceptual framework using dimensions of perceived ease-of-use, privacy, autonomy and efficiency coupled with the human desire for interaction. The scale used, based on TAM, found that these dimensions most positively affected customer adoption of SST in a hotel context. Choi and Park's [9] study investigated the adoption of a smart entry service SST in an airport context. An alternative model for testing SST service quality was developed to assess the intention to use i.e. functionality, security, perceived enjoyment, perceived ease-of-us and perceived usefulness. Jang and Noh's [8] work examined SST service quality in the internet protocol television (IPTV) sector. These researchers created a model extending the TAM scale. This study examined intention to use of SST by examining the correlation between functionality (including ease-of-use), design, enjoyment and security. The study concluded that service quality had an influence on perceived usefulness, ease of use and enjoyment. All three of these studies used a version or an extended version of TAM with some including or excluding dimensions of the SSTQUAL. Table 2 attempts to compare and contrast the various constructs used in each of these studies relative to the SSTQUAL scale [11] and to each other. We can see that Oh et al. [10] excluded constructs such as enjoyment, security, assurance, design, convenience and customization. Choi and Park [9] excluded assurance, design, convenience and customization while Jang and Noh [8] excluded assurance, convenience and customization. We note that Radomir and Nistor [6] used all the SSTQUAL constructs in their study.

Table 2. Comparative analysis of constructs used to measure service quality in cognate studies

Dimension	Description	Lin and Hsieh [11]	Oh et al. [10]	Choi and Park [9]	Jang and Noh [8]	Radomir and Nistor [6]
Functionality	Represents functional aspects of SST including reliability, perceived ease of use and responsiveness.	✓	✓	✓	✓	✓
Enjoyment	Tests perceptions of perceived enjoyment during SST delivery and the outcomes of use.	✓	-	✓	✓	✓
Security/Privacy	Examines perceived security including fraud and general safety and loss of personal data.	✓	-	✓	✓	✓
Assurance	Portrays the confidence of the consumer in the competence of the SST provider.	✓	-	-	-	✓
Design	Tests the overall design of the SST service system.	✓	-	-	✓	✓
Convenience	How accessible and convenient to use is the SST service.	✓	-	-	-	✓
Customization	Tests how customizable the SST is and if it can be adapted to meet the individual customers' needs and historic transactions.	✓	-	-	-	✓

4. Research methodology

A quantitative data collection method following the positivist approach was chosen for this study as it was deemed the most suitable mechanism to collect the required data. In this instance, the research problem is well-defined, and the dependent and independent variables are clearly articulated therefore empirical analysis is warranted. This approach allows for large amounts of data to be collected within a short period of time. According to Johnson and Harris [38] this method has a high level of reliability and consistency and it is easily replicated, provided the researcher uses a systematic research approach. Hildreth [39] contends that the users of a system are the best evaluators of that system.

Therefore, only technology based employees were targeted for this study. 400 Knowledge workers employed in a large multi-national financial services organization were included in the data collection process. The sample comprised software engineers, software quality assurance engineers, system administrators, software architects and technical managers. Overhead functions such as finance, human resources and administration staff were deemed out of scope and consequently excluded. The sample was geographically distributed across multisite boundaries.

As replication logic was deemed important to the data collection process, a purposive, non-probability strategy was used to select the sample elements. This ensured that rich and meaningful data was collected. Tansey [40] contents that a non-probability sample is effective when, as in this study, the research is exploring what is occurring while Patton [41] suggests that a purposive sample "*has a logic and power - and provides rich information"*. Through the process of snowballing or "*response cascading*" [42], we encouraged first contact respondents to invite their relevant colleagues to participate in the study.

The survey which adapted the original SSTQUAL scale was developed following best practice [43] to examine participant's perception of SST. The SSTQUAL scale comprises 20 quality items categorized into 7 dimensions including functionality, security, design, enjoyment, assurance and customization. This study focused on 4 dimensions of the scale (e.g. functionality, security, design and customization), as they are most appropriate to measure SST service quality in a business context. The remaining 3 dimensions, enjoyment, assurance and convenience are considered out of scope for this study because SST use in a corporate context is mandatory and so these dimensions are irrelevant. A seven point Likert scale, codified from 0 through 6, containing bipolar ranges from strongly disagree to strongly agree was used to measure negative or positive responses to statements (see table 3). Every attempt was made to ensure internal validity (i.e. that the research is done right and is free from bias). The instrument was pre-tested (n=3) and piloted (n=8) in order to establish its face validity, accuracy and acceptability. The instrument was revised and amended following feedback from this activity. The final questionnaire was distributed using email and included a blog post to educate participants on the nature of the research. Anonymity and confidentiality was assured. The survey was open for one month straddling January and February 2015. A reminder email was sent to direct contacts on day ten. The overall response rate was 45.5% (n = 182).

Table 3. Likert Scale and Kruskal-Wallis

Likert Code	Likert Scale	Kruskal-Wallis*
0	Strongly Disagree	Disagree
1	Disagree	Disagree
2	Somewhat Disagree	Disagree
3	Neutral	Neither Agree or Disagree
4	Somewhat Agree	Agree
5	Agree	Agree
6	Strongly Agree	Agree

*The distribution of higher and lower responses using the Kruskal-Wallis non-parametric technique

5. Results

5.1 Sample and rater consistency

In total 182 responses to the questionnaire was received of which 69% came from male respondent and 31% came from female. The age profile of respondents is illustrated in table 4.

Table 4. Age profile of sample

Age	Count	Percent
18-29	31	17%
30-39	68	37%
40-49	53	29%
50-59	25	14%
60 and over	5	3%
	182	100%

Cronbach's α (alpha) was used to assess the internal reliability, consistency and therefore trustworthiness of the data for each construct namely functionality, security, design and customization (see table 5). Overall the results indicate very good reliability according to best practice [44], [45].

Table 5. Rater consistency

	Functionality	Security	Design	Customization
Cronbach's α*	0.91782	0.684036	0.8264138	0.83194

*Good Reliability is measured > 0.8

*Acceptable Reliability is measured > 0.6

5.2 Functionality

Four items from the extended SSTQUAL scale were adapted and used to examine the functionality of the SST in the case organization. These were:

- I can get my service done with the organization's SST in a short time;
- SSTs already in place at the organization are simple and easy to use;
- Using the organization's SST requires little effort;
- I can get my service done smoothly with the organization's SST.

A Likert scale ranging from 0 to 6 where 0 is "strongly disagree" and 6 is "strongly agree" was used to assess these items. The responses, illustrated in table 6 indicate a mean within the central tendency while more interestingly a median and mode above the central tendency. The standard deviation is 1.7 which indicates a good variation in responses.

Table 6. Descriptive statistics for functionality

Mean	Median	Mode	Standard Deviation
3.359341	4	4	1.704681

Table 7 summarizes the aggregated responses for all the items relating to functionality. The data indicates that 461 or 50.66% of responses agreed with the items to measure the level of functionality of the organizations SSTs. We found that in our sample respondents believe that SSTs in the organizations can help them get their services completed in a short time they are easy to use and little effort is required to operate the technology. We also learned that while the sample group is positive in general to the functionality of SSTs in the organization, they do not agree that the experience is error-free.

Table 7. Aggregated responses for all the items relating to functionality

Response	Count	Percent
Disagree	285	31.21%
Neither Agree or Disagree	155	0.13%
Agree	461	50.66%
Total	910	100%

5.3 Security

Two items from the extended SSTQUAL scale were adapted and used to address the level of security of the organization's SSTs. The questions posed on the survey to capture this data are as follows:

- I feel that my transactions with the organization SST are safe;
- A clear privacy policy is stated when I use the organization SST.

A Likert scale ranging from 0 to 6 where 0 is "strongly disagree" and 6 is "strongly agree" was used to assess these items. The responses indicate a mean above the central tendency while the median and mode are also above the central tendency (see table 8). The standard deviation is 1.6 which indicates a good variation in responses.

Table 8. Descriptive statistics for security

Mean	Median	Mode	Standard Deviation
4.0164835	4	5	1.6056899

The aggregated data of responses for security related items indicate that 229 or 62.91% of responses were positive showing overall agreement with questions dealing with the security (see table 9). In particular, we found that our sample strongly believes that the level of safety when executing transactions with SST within the organization is high (74%). However, only 52% of respondents agree that the organisation has clear policies in place for using SSTs.

Table 9. Aggregated data of responses for security

Response	Count	Percent
Disagree	55	15.11%
Neither Agree or Disagree	80	21.98%
Agree	229	62.91%
Total	364	100%

5.4 Design

Two questions from the original SSTQUAL scale were adapted and used to assess the nature of design for the organization's SSTs. There are:

- The layout of the organization SSTs are aesthetically appealing;
- The organization's SSTs appears to use up-to-date technology.

A Likert scale ranging from 0 to 6 where 0 is "strongly disagree" and 6 is "strongly agree" was used to assess these items. The responses, illustrated in table 10 indicate a mean below the central tendency while the median and mode are also neutral indicating neither a positive or negative response. The standard deviation was 1.44 which indicates a good variation in responses.

Table 10. Descriptive statistics for design

Mean	Median	Mode	Standard Deviation
3.359341	4	4	1.704681

Table 11 summarizes the aggregated responses for all the items relating to design. This illustrates that only 176 or 48.35% of respondents agreed with the questions relating to the design construct. This is somewhat lower than the scores for the functionality (50.66%) and security (62.91%) constructs. The aggregation of negative (22.53%) and neutral distributions (29.12%) also exceeds the positive distribution (48.35%). This indicates that the sample group has concerns with the design of SSTs within the organization. We found that only 42% of respondents are happy with the layouts and the aesthetics of the organization's SST and 55% of respondents believe that the organization's SSTs employ up to date technology.

Table 11. Aggregated responses for all the items relating to design

Response	Count	Percent
Disagree	82	22.53%
Neither Agree or Disagree	106	29.12%
Agree	176	48.35%
Total	364	100%

5.5 Customization

Three questions were adapted from the SSTQUAL scale and used to assess customization. They are:

- The organization's SST understands my specific needs;
- The organization's unit SST has my best interests at heart;
- The organization's SST has features that are personalized for me.

These questions aimed to assess respondents' attitudes towards user centered design, and personalization. The responses, illustrated in table 12, indicate a mean below the central tendency with the median and mode also below the central tendency. The standard deviation was 1.56, which indicates a good variation in responses.

Table 12. Descriptive statistics for customization

Mean	Median	Mode	Standard Deviation
3.245421	3	3	1.565168

The aggregated data of responses (see table 13) indicates that 239 or 43.77% of responses were in agreement with the questions relating to customization. This result is lower than the functionality (50.66%), security (62.91) and design (48.35%) scores. The aggregation of negative (28.39%) and neutral distributions (27.84%) also exceeds the positive distribution (43.77%). This suggests that the sample does not agree that the nature of customization provided by SSTs is adequate within the case organization.

Table 13. Aggregated responses for all the items relating to customization

Response	Count	Percent
Disagree	155	28.39%
Neither Agree or Disagree	152	27.84%
Agree	239	43.77%
Total	364	100%

5.6 Correlation analysis

A correlation analysis among functionality, security, design, customization of organization's SSTs, and user satisfaction was conducted in this research. Accordingly, we calculated the mean values of functionality, security, design, and customization for each respondent and then summed these averages to get the value for user satisfaction. Then, we employed a one-tailed test as it helps to predict whether a relationship exists and if so it can help us to determine the direction of that relationship [46]. The results of our correlation analysis are presented below (see table 14).

Table 14. Results of correlation analysis

Constructs	Functionality	Security	Design	Customization	Uses' satisfaction
Functionality	N/A				
Security	0.57**	N/A			
Design	0.66**	0.48**	N/A		
Customization	0.63**	0.62**	0.72**	N/A	
User satisfaction	0.86**	0.79**	0.85**	0.88**	N/A

Note:
Control variable: gender and age.
**p<.01

Here we find that these variables (functionality, security, design, and customization) have positive associations with user satisfaction. The strongest correlation exits between customization of the organization's SSTs and users' satisfaction ($r = .88$, $p < .01$), while the weakest correlation lies in security ($r = .79$, $p < .01$). It means that for respondents in our survey, customization, functionality and design of SSTs are very important.

6. Discussion

Lin and Hsieh [11] contend that the delivery of high quality services is a primary source of competitive advantage for contemporary organizations. In recent years, we have witnessed a shift from the use of personal service representatives towards self-service technology adoption in many contexts. To date there have been many empirical investigations of SST adoption in the consumer market but there is a dearth of studies in the corporate or business environment. Given that the extant literature has focused almost exclusively on consumers, there is much to be learned about how employees engage with technology-based self-service delivery options in a corporate context. As self-service technology (SST) adoption is lauded to help organizations to control costs and improve efficiencies it makes sense to advance our understanding of how the service quality is perceived by the end users. SST service quality can be measured by examining many dimensions including functionality, enjoyment, security, assurance, design, customization and convenience [19], [34]. However, four key dimensions namely (a) functionality; (b) security; (c) design and (d) customization are the most relevant to the business environment. Consequently, the focus of our research is to empirically assess how employees in a corporate context perceive SSTs in terms of these service quality dimensions.

We found that in our sample, respondents believe that SSTs in their specific organization can help them get their services completed in a short time; they are easy to use and little effort is required to operate the technology. However, respondents do not believe that the experience is error-free. We learned that the respondents in our sample strongly believe that the level of security when executing transactions with SST within the organization is high. In other words, they are confident that their transactions are safe and secure. However, only half of respondents agree that the organization has clear policies in place for using SSTs which suggests that this issue needs to be addressed. The introduction of SSTs changes the way services are introduced and consequently this has an impact on user behaviour. In light of this, it seems prudent that organizations should support this change with clear operating procedures.

The study highlighted an issue with the design and customization of the SSTs in the organization. We found that customization, functionality and design of SSTs are critical to user satisfaction. This finding supports the work conducted by Hillegersberg and Koenen [47] who examined the reasons for the relatively slow adoption of group based decision support systems and concluded that user interface design was essential for user acceptance and should be prioritized. Wolfinbarger and Gilly [48] also report that design is the most important facet of SST quality albeit in the consumer context. They found that design has the strongest influence on customers' overall quality perceptions and behavioural intentions. However, we find that user centered design and customization is an issue for the respondents of our study. We found that the level of agreement with items that measured user centred design, and personalization of the organizations SST was not high. In fact, this construct received the lowest scores of all. This suggests that service providers must place extra emphasis on these dimensions in order to ensure that SSTs are user centric.

Although our findings broadly support those of cognate studies [11], [6] there is still a great deal unknown about self-service technology in general and user satisfaction in particular. While this research was successful at increasing our understanding of the relationship between SST and user satisfaction in a corporate context, it is also imperative to acknowledge that there are many external factors that can influence a user's perception of a system [49]. Generic SST quality measurement, such as SSTQUAL, simply does not transcend industries and contexts. What is critical to SST adoption in finance is not critical to adoption in retail, finance or technology. Contextual factors must be carefully assessed before implementing SST; there can be savings for both organizations and consumers of the SST but careful analysis of the desirability and feasibility of the SST should be assessed before implementation.

7. Conclusion

This study has shown that the replacement of service capabilities with SST is broadly acceptable to technology based knowledge workers. We found that functionality, design and customization are strongly associated with user satisfaction. Our sample seemed happy with the levels of functionality and security in the case organization's SSTs. However, the study highlighted an issue with the design and customization of the SSTs in the organization. These results accentuate the need for service providers to place extra emphasis on these dimensions. In other words, future technologies must be more user-centric.

It is clear from the results of this study, when compared to previous studies, that contextual or environmental factors influence SST adoption. Generic SST quality measurement, such as SSTQUAL, simply does not transcend all industries and contexts. What is critical to SST adoption in finance is not critical to adoption in retail, finance or technology. While there are some service dimensions that should be considered baseline factors to adoption, it is clear that some service dimensions are more important than others depending on the specific culture and environment.

In light of this, future research might expand beyond the single context of the current research to multiple contexts. An extension of the sample is required to further improve the quality of results. Future research should consider broadening the scope to include more organizations within the knowledge worker or technology sector. Data from different settings, and indeed national contexts, may also be used to ensure external validity of the measures and the generalizability of the findings in this study. This study, like previous studies, employed deductive reasoning methods assuming no cultural differences existed between environments. Future studies might consider inductive methods in an attempt to isolate some of these issues. Finally, it is important to highlight that SST quality measurement is not the only factor relevant to adoption of SST within the business context. Orchestration of SST, or the streamlining and integration of applications, is also important to consider.

References

[1] A.Toffler, *The third wave*, New York, USA: Bantam books, 1980.

[2] C. K. Prahalad, and V. Ramaswamy, "Co-opting customer competence," *Harvard business review*, vol. *78*, no. *1*, pp. *79-90*, Jan, 2000.

[3] M. L. Meuter, A. L. Ostrom, R. I. Roundtree, and M. J. Bitner, "Self-service technologies: understanding customer satisfaction with technology-based service encounters," *Journal of marketing*, vol. *64*, no. *3*, pp. *50-64*, Jul, 2000.

[4] J. Lee, and A. Allaway, "Effects of personal control on adoption of self-service technology innovations," *Journal of Services Marketing*, vol. *16*, no. *6*, pp. *553-572*, Nov, 2002.

[5] P. A. Dabholkar, and P. B. Richard, "An attitudinal model of technology-based self-service: moderating effects of consumer traits and situational factors," *Journal of the academy of marketing science*, vol. *30*, no. *3*, pp. *184-201*, Jul, 2002.

[6] L. Radomir, and C. V. Nistor, "High-educated consumer perceptions of service quality: An assessment of the SSTQUAL scale in the Romanian banking industry," *Procedia Economics and Finance*, vol. *3*, pp. *858-864*, Jan, 2012.

[7] L. Radomir, and C. V. Nistor, "Comparing the original and the revised SSTQUAL scale among high-educated consumers in Romania," *Procedia Economics and Finance*, vol. *15*, pp. *926-934*, Jan, 2014.

[8] H. Y. Jang, and M. J. Noh, "Customer acceptance of IPTV service quality," *International Journal of Information Management*, vol. *31*, no. *6*, pp. *582-592*, Dec, 2011.

[9] J. H. Choi, and J. W. Park, "Investigating the factors influencing the usage of smart entry service: Incheon International Airport case study," *International Business Research*, vol. *7*, no. *1*, pp. *74*, Jan, 2014.

[10] H. Oh, M. Jeong, and S. Baloglu, "Tourists adoption of self-service technologies at resort hotels," *Journal of Business Research*, vol. *66*, no. *6*, pp. *692-699*, Jan, 2013.

[11] J. S. Lin, and P. L. Hsieh, "Assessing the self-service technology encounters: Development and validation of SSTQUAL scale," *Journal of Retailing*, vol. *87*, no. *2*, pp.*194-206*, Jun. 2011.

[12] F. D. Orel, and A. Kara, "Supermarket self-checkout service quality, customer satisfaction, and loyalty: Empirical evidence from an emerging market," *Journal of Retailing and Consumer Services*, vol. *21*, no. *2*, pp. *118-129*, Mar, 2014.

[13] J. E. Collier, R. S. Moore, A. Horky, and M. L. Moore, "Why the little things matter: Exploring situational influences on customers' self-service technology decisions," *Journal of Business Research*, vol. *68*, no. *3*, pp. *703-710*, Mar, 2015.

[14] C. H. Ko, "Exploring how hotel guests choose self-service technologies over service staff," *International Journal of Organizational Innovation*, vol. *9*, no.*2*, pp. *16B*, Jan, 2017.

[15] F. Simon and J. C. Usunier, "Cognitive, demographic, and situational determinants of service customer preference for personnel-in-contact over self-service technology," *International Journal of Research in Marketing*, vol. *24*, no. *2*, pp. *163–173*, June 2007.

[16] J. Ganesh, M. J. Arnold, and K. E. Reynolds, "Understanding the customer base of service providers: an examination of the differences between switchers and stayers," *Journal of marketing*, vol. *64*, no. *6*, pp. *65-87*, Jul, 2000.

[17] A. Beatson, L. V. Coote, and J. M. Rudd, "Determining consumer satisfaction and commitment through self-service technology and personal service usage," *Journal of Marketing Management*, vol. *22*, no. *7-8*, pp. *835-882*, Aug, 2006.

[18] C. Wang, J. Harris, and P. G. Patterson, "Customer choice of self-service technology: the roles of situational influences and past experience," *Journal of Service Management*, vol. *23*, no. *1*, pp. *54-78*, Mar, 2012.

[19] J.M. Curran, M.L. Meuter, and C. F. Surprenant, "Intentions to use self-service technologies: a confluence of multiple attitudes," *Journal of Service Research*, vol. *5*, no. *3*, pp. *209-24*, Feb, 2003.

[20] J.M. Curran, and M.L, Meuter, "Self-service technology adoption: comparing three technologies," *Journal of Services Marketing*, vol. *19*, no. *2*, pp. *103-13*, Mar 2005.

[21] M. L. Meuter, A. L. Ostromb, M. J. Bitnerb, and R. Roundtreec, "The influence of technology anxiety on consumer use and experiences with self-service technologies," *Journal of Business Research*, vol. *56*, no. *11*, pp. *899-906*, Nov, 2003.

[22] K. M. Elliott, M. C. Hall, and J. G. Meng, "Consumers' intention to use self-scanning technology: the role of technology readiness and perceptions toward self-service technology," *Academy of Marketing Studies Journal*, vol. *17*, no. *1*, pp. *129*, Jan 2013.

[23] K. Eriksson, and D. Nilsson, "Determinants of the continued use of self-service technology: The case of Internet banking," *Technovation*, vol. *27*, no. *4*, pp. *159-67*, Apr, 2007.

[24] H. R. Yen, "An attribute-based model of quality satisfaction for internet self-service technology," *The Service Industries Journal*, vol. *25*, no. *5*, pp. *641-59*, Jul, 2005.

[25] G. Guthridge, 2014, *Driving self-service adoption* [Online]. Available at: http://www.accenture.com/us-en/blogs/accenture-u-blog-utilities-forum/archive/2014/02/28/driving-self-service-adoption.aspx

[26] L. F. Cunningham, C. E. Young, and J. Gerlach, (2009), "A comparison of consumer view of traditional services and self-service technologies," *Journal of Services Marketing*, vol. *31*, no. *1*, pp. *11-23*, 2009

[27] H. Gatignon, and T. S. Robertson, "Innovative decision processes," *Handbook of consumer behaviour*, vol. *316*, no. *8*, 1991.

[28] A. Kokkinou, and D. A. Cranage, "Using self-service technology to reduce customer waiting times," *International Journal of Hospitality Management*, vol. *33*, pp. *435-445*, Jun, 2013.

[29] J. I. Castillo-Manzano, and L. López-Valpuesta, "Check-in services and passenger behaviour: Self service technologies in airport systems," *Computers in Human Behavior*, vol. *29*, no. *6*, pp. *2431-2437*, Nov, 2013.

[30] S. Liu, "The impact of forced use on customer adoption of self-service technologies," *Computers in Human Behavior*, vol. *28*, no. *4*, pp. *1194-1201*, Jul, 2012.

[31] A. T. Hsieh, C. H. Yen, and K. C. Chin, "Participative customers as partial employees and service provider workload," *International journal of service industry management*, vol. *15*, no. *2*, pp. *187-199*, Apr, 2004.

[32] P. A. Dabholkar, "Consumer evaluations of new technology-based self-service options: an investigation of alternative models of service quality," International Journal of research in Marketing, vol. *13*, no. *1*, pp. *29-51*, Feb, 1996.

[33] R. J. Kauffman, and L. Lally, "A value platform analysis perspective on customer access information technology," *Decision Sciences*, vol. *25*, no. *5-6*, pp. *767-794*, Feb, 1994.

[34] M. J. Bitner, A. L. Ostrom, and M. L. Meuter, "Implementing successful self-service technologies," *The Academy of Management Executive*, vol. *16*, no. *4*, pp. *96-108*, Nov, 2002.

[35] A. Parasuraman, V. A. Zeithaml, and L. L. Berry, "A conceptual model of service quality and its implications for future research," *The Journal of Marketing*, pp. *41-50*, Oct, 1985.

[36] F. D. Davis, "Perceived usefulness, perceived ease of use, and user acceptance of information technology," *MIS quarterly*, pp. *319-340*, Sep, 1989.

[37] A. Parasuraman, "Technology Readiness Index (TRI) a multiple-item scale to measure readiness to embrace new technologies," *Journal of service research*, vol. *2*, no. *4*, pp. *307-320*, May, 2000.

[38] P. Johnson, and D. Harris, *Essential skills for management research*, California, USA: Sage Publications, 2002.

[39] C. R. Hildreth, "Accounting for users' inflated assessments of on-line catalogue search performance and usefulness: an experimental study," *Information research*, vol. *6*, no. *2*, Jan, 2001.

[40] O. Tansey, "Process tracing and elite interviewing: a case for non-probability sampling," *Political Science & Politics*, vol. *40*, no. *4*, pp. *765-772*, 2007.

[41] M. Q. Patton, *Qualitative evaluation and research methods*, California, USA: Sage Publications, 1990.

[42] A. Fink, *How to conduct surveys: a step-by-step guide*, *5th* ed. Thousand Oaks, Calif: Sage Publications, 2013.

[43] J. E. Sale, L. H. Lohfeld, and K. Brazil, "Revisiting the quantitative-qualitative debate: Implications for mixed-methods research," *Quality and quantity*, vol. *36*, no. *1*, pp. *43-53*, Feb, 2002.

[44] R. F. DeVellis, *Scale development: Theory and applications*. Los Angeles, US: Sage, 2012.

[45] P. Kline, *The handbook of psychological testing*, London, UK: Routledge, 2000.

[46] J. Neter, M. H. Kutner, C. J. Nachtsheim, and W. Wasserman, *Applied linear statistical models*. Chicago, UAS: Irwin, 1996.

[47] J. Hillegersberg, and S. Koenen, "Adoption of web-based group decision support systems: experiences from the field and future developments," *International journal of information systems and project management*, vol. *4*, no. *1*, pp. *49-64*, 2006.

[48] M. Wolfinbarger, and M. C. Gilly, "eTailQ: dimensionalizing, measuring and predicting etail quality," *Journal of retailing*, vol. *79*, no. *3*, pp. *183-198*, Dec, 2003.

[49] S. S. Zabukovsek, and S. Bobek, "TAM-based external factors related to ERP solutions acceptance in organizations," *International Journal of Information Systems and Project Management*, vol. *1*, no. *4*, pp. *25-38*, 201.

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Abstract:
Numerous contemporary problems that project managers face can be considered as unstructured decision problems, characterized by multiple actors and perspectives, incommensurable and/or conflicting objectives, and important intangibles. This work environment demands that project managers to possess not only hard skills but also soft skills with the ability to take a management perspective and, above all, develop real leadership capabilities. In this paper, is presented a family of problem structured methods for decision support, aimed at assisting project managers in tackling complex problems. Problem structured methods are a family of soft operations research methods for decision support that assist groups of diverse composition to agree on a problem focus and make commitments to consequential action. Project management programs are challenged to implement these methodologies in such a way that it is organized around the key competences that a project manager needs in order to be more effective, work efficiently as members of interdisciplinary teams and successfully execute even a small project.

Keywords:
project management; problem structuring methods; hard methods; soft methods.

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1. Introduction

Nowadays project managers are asked to do more than just apply scientific knowledge to solve practical problems. Today's competitive global market and changing work environment demand that project managers possess not only hard skills but also soft skills and leadership which give them an advantage in the workplace. Whereas a leader can be the person who has the ability to inspire and motivate other to do what he or she wants them to do with a feeling they enjoy doing it, a manager can be the person who works effectively with others to accomplish set goals [1], [2]. For example, in the field of civil engineering, Acciszenwski [3] considered the lack of leadership as a crisis and urged civil engineers to use the present challenges to change the profession to meet the new demands.

Professional practice can be defined as the act of working fist hand by using a combination of highly specialized knowledge and skills that are obtained through study, training, and experience [4]. Future project managers must not only have this technical knowledge, but also be better prepared in communication**,** with the ability to take a management perspective and develop real leadership capabilities [1], [5]. It is time to change the way we approach project management programs. Project management courses should change accordingly by re-designing it in such a way that it is organized around the key competences that a project manager needs in order to be more effective and work efficiently as members of interdisciplinary teams [6]. In this context, we need pedagogies and approaches that help project managers develop soft skills and sufficient confidence along with required technical competence to independently planning, managing, and successfully execute even a small project [1].

This paper begins showing the evolution from the hard to the soft paradigm in Management Science. Next, are presented problem structured methods, a family of soft operations research methods for decision support aimed at assisting project managers in tackling complex problems. Finally, there is a concluding section with the main findings of the paper.

2. Hard methods versus Soft methods

Within Management Science, it is usual to distinguish between hard and soft paradigms [7], [10]. The terms hard and soft constitute two broad tendencies for thought which have had a strong influence on the development of a variety of practical and academic disciplines. Each of these terms refers to two distinct paradigms involving particular values, ways of viewing the world and approaches to practice [11]. Hard methods are rooted in positivist and realist philosophies, emphasizing the search for objective knowledge, while the soft approaches stem from interpretivist and constructive schools of thought, emphasizing the inter-subjective creation of knowledge [12]. Soft issues include community perception, safety, environmental impacts, legal acceptability, political and social impacts, benefits, stakeholders, value management, and communication [13], [14].

The differences between the hard and soft approaches have varying implications at the level of theory and practice. These differences, which include general classification schemes, differences based on project output tangibility and the degree of definition of project goals and objectives can influence project success [13], [15]-[18]. Wateridge [19] considered that projects have often been perceived to have failed due to project managers not paying due attention to soft criteria. Yeo [20] remarked that product acceptance goes beyond technical quality, extending into soft criteria, while Williams [21] showed the value of soft ideas in project models.

The willingness to optimize operations locates the emergence of what Checkland [22] termed "hard" systems thinking in the late 1950s-1960s. It has been associated with the so-called classical operations research and the belief that organizations can be seen as objective worlds. These approaches relied on the assumption that the decision maker acts in full possession of rationality or bounded rationality and the ability to choose between alternatives generated in full knowledge of what the problem is and when she/he wants to be [23]. The hard paradigm is commonly associated with deductive reasoning and quantitative or reductionist techniques, attributes which are often associated with rigour and objectivity. It has also been referred to as the rationalistic, positivistic, scientific, reductionist [24] or quantitative

paradigm [25]. Practice based on the hard paradigm tends to emphasize efficient, expert-led delivery, control against predetermined goals and an interest in underlying structure [11]. Examples of hard methods include Systems Engineering [26], [27], Systems Analysis [28] and early Systems Dynamics [29]. The hard paradigm promotes an understanding of the world as an objective reality, to which all people have equal and unvarying access. Systems are mechanistic processes, with stable, or predictable varying, relationships between the relevant variables [30]. Systems are interpreted through functional analysis, the attempt to understand a system in terms of its purpose [31].

During the 1960s and 1970s, a number of Soft Systems Thinking methodologies emerged in the UK, amongst the most influential were Checkland's soft systems methodology [32], [33] and cognitive mapping [34]. Ackoff [35] called this paradigm the "design approach" because these methods attempts to dissolve systems of problems or messes as opposed to the "research approach" that aims to tackle the context where the mess takes place. This paradigm, usually taken as the one representing soft operations research, is probably the most well-known and populated in terms of the number of methodologies adhering to it, methodologies such as: soft systems methodology; interactive planning, strategic assumption surfacing and testing, systems intervention strategy, strategic choice approach, social system design, cognitive mapping, etc. The soft paradigm is commonly associated with an interpretative epistemology, inductive reasoning, and exploratory, qualitative techniques, which emphasize contextual relevance rather than objectivity. Practice based on the soft paradigm emphasize learning, participation, the facilitated exploration of projects, and typically demonstrates an interest in underlying social process [11].

Hard and soft issues require different management approaches and skill sets which need not be mutually exclusive and can be applied in a complementary way [36]. Table 1 shows the differences between the hard and soft paradigm regarding management activity, methodological orientation, research intention and methodologies associated. Table 2 shows the seven dimensions, identified by Crawford and Pollack [18] as encapsulating the key issues in the analysis of hard and soft aspects of projects, namely, goal clarity, goal tangibility, success measures, project permeability, number of solution options, degree of participation, and stakeholder expectations.

Table 1. Differences between the Hard and Soft paradigm

Problem Structuring Methods	**Hard paradigm**	**Soft paradigm**
Management activity	Rational process of decision making. Decision-makers act in full possession of bounded rationality	Effort to maintain relations through metaphors and evaluating different courses of action
Methodological orientation	Oriented to seek (discover) law relations amongst variables, 'deep' structures and patterns	Learn from the intervention and understand perception and people purposes
Research intentions	Optimization, problem solving	Look for consensus or accommodation between stakeholders' interest
Methodologies associated	Linear programming, simulation, PERT-network analysis, forecasting, decision trees, queuing theory, Markov analysis, integer programming	Soft systems methodology, interactive programming, strategic assumption surfacing and testing, systems intervention strategy, Strategic choice approach, Social system design, cognitive mapping, SODA, Problem structuring methods

Table 2. Dimensions encapsulating the key issues in the analysis of Hard and Soft aspects of projects

	Hard methods	**Soft methods**
Goal clarity	Well-defined technical problems where goals and constraints are previously defined with emphasis on the delivery of a solution to a predetermined problem	Fuzzy, ill-defined project situations involving human beings and cultural considerations, focusing on learning, exploration and problem definition
Goal tangibility	Engineering and/or construction projects where tangible goals can be defined in clear measurable terms	Organizational change projects with intangible goals having to rely on subjective interpretation and judgment
Success measures	Quantitative measures (EVM, PERT, etc.)	Qualitative measures (morale, meaning, attitude, etc.)
Project permeability	Projects of short-, or medium- term duration in stable environments and well developed fields	Research projects, organizational change projects, bureaucratic projects, or projects where the determination of a clear boundary between what will and will not affect the project is more problematic
Number of solution options	Solutions, which are culturally desirable and technically feasible, are handed down without room for discussion, focusing on the optimization of predetermined solutions, without undue examination of its intrinsic value or alternatives	Learning, debate, participation, exploration and questioning of alternative options and innovative solutions about the situation. Solution are culturally feasible and technically desirable
Degree or participation	Team members are seen as experts in their individual fields with clearly defined roles, where everyone clearly understands the boundaries between the tasks that they and others have to complete	Participative, collaborative, facilitative approach where multiple perspectives and views are sought on many issues and people are encouraged to cross professional boundaries
Stakeholder expectations	Minor degree of interactions between stakeholders. People are seen as interchangeable, are assumed to act in predictable ways with their actions being determined by the environment. The organization can be viewed as a machine that can be engineered	Greater degree of interaction between stakeholders. The emphasis is on the people who will take the action to improve the situation. People are understood to be part of complex cultures with individual expectations, desires, values, rules and norms of action

Source: Crawford and Pollack [18].

Understanding and modeling interactions between individuals, groups or organizations should inevitably be a major concern for project managers. While sophisticated tools and techniques have been devised to represent and understand the interactions which take place in designed mechanical systems, other multi-actor situations whose evolution is dependent upon the whims, prejudices, beliefs, interests and power to act of a rabble of disparate characters have been some neglected by modelers [37].

Existing methods of teaching and learning favour individuals whose cognitive styles are analytical. Intuitive styles of thinking tend to take a broad perspective on a problem before reaching a conclusion whereas analytic styles of thinking tend to take a more logical, step-by-step approach before deciding. In a work context, an intuitive project manager prefers rapid, open-ended approaches to decision-making, relying on random methods of exploration and work best on problems favouring a holistic or "big picture" approach. On the other side, analytic project managers work best on problems favouring a detailed rather than a holistic approach and prefer a structured approach to decision-making, applying systematic methods of investigation [6]. Some authors have linked the intuitive and analytic cognitive styles to the right-left cerebral hemisphere. According to Mintzberg [38], the left cerebral hemisphere is believed to be specialized for primarily analytical, rational, and sequential information processing, whereas the right hemisphere is believed to be specialized for primarily intuitive, holistic and simultaneous information processing. Thus, important

policy and strategy level processes required to manage an organization rely to a considerable extent on the faculties identified with the brain's right hemisphere such as hunch, synthesis and intuition, whereas at the middle operational levels the analytical community is more suited [6],[38]. Teaching and learning methods should, at least, ensure that equal amounts of analysis and intuition are assessed during the learning process [6].

Traditionally, courses have been taught in a straightforward way, starting with a lot of definitions, basic concepts and methods for solving well defined problems, which in most cases are simplified and idealized [39]. Whereas this approach is necessary to teach students basic principles and formulas needed to make judgments, this way of teaching may not be sufficient to produce leader project managers [40]. Traditional classes prepare undergraduate and graduate students to master their technical skills in a specific engineering field without much time allotted for leadership practice and with little emphasis on the management discipline [1]. Project Management programs are challenged to come up with innovative ways to teach classes so that graduates are prepared to take over the challenges facing twenty-first century. Effective project management must cover not only fundamental and complex topics with an excellent aptitude in applying mathematics, physics, and general science, but also incorporate strategy and problem solving, administration, and a myriad of soft skills [5]. Implementation of these methodologies in project management is the most effective way to prepare project managers for the twenty-first century [1].

3. Problem Structuring Methods

Problems are constructs created by the perceptions of those affected by them and defined by different and equally valid worldviews. Numerous contemporary problems related to public policy, organizational strategy and change can be considered as unstructured decision problems [41]. Such problems are characterized by multiple actors, multiple perspectives, incommensurable and/or conflicting interests, and important intangibles [42]. Traditional operational research methods have serious limitations for dealing with this type of problems as generally ignore the typical complexities of unstructured decision problems. In response, a variety of Problem Structured Methods (PSMs) have been developed.

PSMs are a family of soft operations research methods for decision support that assist groups of diverse composition to agree a problem focus and make commitments to consequential action [42], [43]. Their characteristic feature is the use of a model to represent alternative versions of the complex situation of common interest, combined with facilitation to help group members make constructive mutual adjustments [44]. PSMs may be applied for descriptive and normative purposes. Whereas descriptive studies aim at framing a decision problem-explaining the situation, normative studies aim at finding prescriptive solutions to a decision problem. The most common reason stated to apply PSMs is that these methods allow for a way of modeling that has not been done before or deviates from current practice [41]. PSMs aim at helping an actor or a group of actors that is confronted with an unstructured decision problem to come to a shared understanding of the problem situation or help to decide on a joint course of action. According to Mingers and Rosenhead [45], PSMs should be able to account for different perspectives and bring them together, be understandable for the users, be able to accommodate changes in actors' perceptions, and come to partial solutions.

Generally speaking, PSMs can be applied to three types of situations [41]: (*i*) a deadlock situation that is not progressing any longer and where actors are looking for a way out. The purpose is to get new information that might help the debate or explain why the situation it is; (*ii*) a conflict situation where the actors are opposed to each other and want to win the fight instead of coming to a shared solution. The purpose is to provide strategic advice to the parties or provide an explanation for the situation; (*iii*) a situation that can be characterized by actors willing to negotiate. The purpose is to get people to reach some kind of resolution or insight into possible outcomes.

What constitutes a quantitative or qualitative PSMs is a gliding scale. On this scale, game theory can be placed at the quantitative extreme followed by metagames/conflict analysis, hypergames, drama theory, Q-methodology, and transactional analysis. Softer methods like soft systems methodology [46] and strategic option development and analysis [47] can be placed on the qualitative side with anthropological and ethnographic methods at its most extreme

[48]. Examples of well-established PSMs also include *strategic choice approach* (SCA) [49], *group model building* [50] and *decision conferencing* [51].

According to the type of information that is used as input for the PSMs, van der Lei and Thissen [41] distinguish two different modeling approaches: desk research or intervention. With an intervention, the analyst usually facilitates the decision-makers and the decision-makers learn about the decision environment in the form of a workshop. With desk research the information usually comes from publicly available reports sometimes supplemented with interviews. In this case, the analyst primarily learns about the decision environment and then communicates the results of the study. Table 3 shows the benefits obtained from the application of the PSMs presented in the next section.

Table 3. Benefits obtained from the application of PSMs

PSMs	**Benefits obtained from the application**
Metagames	More insight into possible strategic behavior, finding counter intuitive outcomes, a compromise, and simulation of the course of events
Drama theory	More insight into mutual dependencies of actors, reduction of conflicts and more collaboration among the parties involved
Hypergames	More insight into different perspectives, allow for a logical choice to be made, help to provide hypothesis about people, and model interactions in a helpful way
Q-methodology	Better ability to make informed policy decisions, understanding of different discourses that take place, and help framing a problem
Transactional analysis	More insight into mutual dependencies, control of actors and simulation of real-world events
Soft Systems Methodology	More insights into organizational and cultural issues and information flows within the organization and the way relationships in the company enhance this flow
Strategic Options Development and Analysis	Arrive at a negotiated agreement exploring different options and ramifications through a graphical representation of the situation.
Strategic Choice Approach	It provides a comprehensive and logical framework for evaluating alternatives understanding the relationship between strategy and outcomes.
Cognitive mapping	It provides a way to visualize the relationships between concepts through the use of a network of variables
Group model building	It provides a way to combine the different views of a group of actors ensuring their commitment with the insights generated during the modeling process.
Decision Conferencing	It helps participants to understand their beliefs, judgments and preferences in the context of the decision making problem and the different options facing them.

Source: van der Lei and Thissen [41].

3.1 Quantitative Problem Structuring Methods

3.1.1 Metagames/Conflict Analysis

The objective of Metagames/conflict analysis is to analyze the strategic power of different actors in a decision-making situation. The concept of Metagames, developed by Howard [52], has its roots in game theory. However, whereas in a classic game theory model the outcomes for the players need to be known in advance, in Metagames the outcomes are

constructed from the options of the different actors. These outcomes are all possible combinations of the options minus the infeasible outcomes removed by the analyst [41]. Conflict analysis extends the concept of metagames by adding several solution concepts, which resemble different types of possible behavior (rationality) of the actors involved for solving the game [53].

3.1.2 Drama Theory

Drama theory [54] is a PSM based on game theory which adapts the use of games to complex organisational situations, accounting for emotional responses that can provoke irrational reactions and lead the players to redefine the game. The objective of drama theory is to come to a resolution of a problem situation through allowed preference and option changes [55],[56]. Drama theory takes the concept of metagames further, because irrational behavior, that is, preference changes induced by the emotions of actors and option changes are allowed under the pressure of pre-play negotiations [41],[57]. In a drama, emotions trigger rationalizations that create changes in the game, and so change follows change until either all conflicts are resolved or action becomes necessary. The game as redefined is then played [57]. The transformations that the game suffers result from pressures that players place upon each other during pre-play negotiations, as they exchange threats, promises, emotional persuasion and rational argument. The conflict that is studied is presented with vignettes that resemble the lay out of the analysis of options method [58]. That is, the options outcomes and preferences of the actors involved are stated. With these vignettes, the actors start the negotiations. The way to resolution of the problem can be hampered through six different dilemmas an actor can be confronted with. Dilemmas are situations that represent "a tension between the use of the position and fallback adopted and the dictates of rationality (in the sense of choosing in accordance with present preferences)" [59]. A conflict is resolved when all dilemmas for all actors have been overcome.

3.1.3 Hypergames

The objective of Hypergames is to show how different perceptions of actors determine the outcome of a problem situation [60],[61]. Hypergames also start from the basic idea of game theory, however, by taking the different perspectives of the actors into account and solving the problem from the perspective of each individual actor. Hypergames allow for the study of the influence of individual perspectives on the outcomes of the problem.

3.1.4 Q-Methodology

Q-methodology is a statistical tool whose purpose is to detect shared views and/or preferences in group of actors [62]-[64]. The shared preferences of the actors are found through, first, identifying individual actor's perceptions and preferences by a survey and/or interviews and, second, applying an inverted factor analysis to the gathered individual perceptions. The method has been useful in detecting the alternative frames actors have on policy problems [65].

3.1.5 Transactional Analysis

Transactional analysis is based upon Coleman's social theory [66] which takes micro economic thought as a starting point and translates it to social systems. The idea is that actors exchange power and control over issues instead of money for products. The objective of transactional analysis is to calculate what the best collective decision in a problem situation will be. With this aim, transactional analysis calculates the optimal division of control and interest over the issues in a problem situation for all parties. This optimal division of control and interest is a clearing of all excess control that actors have over certain issues. This excess control is traded for more control over issues that interest actors.

3.2 Qualitative Problem Structuring Methods

3.2.1 Soft Systems Methodology

Soft Systems Methodology (SSM) [33] attempts to foster learning and appreciation of the problem situation between a group of stakeholders rather than set out to solve a pre-defined problem. SSM provides a framework for tackling many real-world situations where there are divergent views about the definition of the problem. Thus, the real problem is defining the problem. There are two main modes within SSM, real world activities and systems thinking about the real

world. Initial work involves interviews and meetings to gain an understanding of the problem situation. Systems thinking uses concepts of hierarchy, communication, control, and emergent properties to identify relevant systems. These relevant systems are logically defined by constructing root definitions which are then used to generate conceptual models of the selected systems. Different conceptual models representing different viewpoints are then used as the basis of a debate, which can lead to feasible and desirable change and then to action.

3.2.2 Strategic Options Development Analysis

Strategic Options Development and Analysis (SODA) [47] is a method for working on complex and messy problems with individuality and subjectivity as the basis for problem definition and creativity. SODA uses interview and cognitive mapping to capture individual views of an issue. Group maps constructed through the aggregation of individual cognitive maps are used to facilitate negotiation about value/goal systems, key strategic issues, and option portfolios. Rather than move towards abstraction or simplicity, SODA sees strategic management in terms of changing thinking and action rather than planning [67].

3.2.3 Strategic Choice Approach

The Strategic Choice Approach (SCA) is used in face to face workshops of a decision making group as a framework for communication and collaboration between people with different backgrounds and skills [67]. SCA is viewed as an ongoing process in which the planned management of uncertainties which surround the decisions to be addressed play a crucial role. Rather than looking towards an end product of a determined strategy at some future point in time, SCA focuses on decisions to be made in a particular situation, whatever their timescale and whatever their substance. An explicit balance is agreed between decisions to be made now and those to be left open until specified time horizons in the future.

3.2.4 Cognitive Mapping

Cognitive mapping helps managers reach a collective judgment about issues that are ambiguous, complex and often of a contested nature [68]. The process of cognitive mapping enables those groups of managers to model the complexity of the problem sharing views and perspectives and exchanging opinions. It is the realization of differences between individuals and the following discussion which proves most useful by giving prominence to distinctions and making connections that might otherwise be overlooked [69].

3.2.5 Group Model Building

Group Model Building was initially developed in the 1980s by leaders in the field of systems dynamics who recognized the potential of developing computer models and simulations with participants that leveraged the diagramming conventions of systems dynamics [50],[70],[71]. The design of group model building varies along four dimensions [72]:

- Who is defining the initial issue or problem? Initially, this will often start with someone with training in systems dynamics until community members start to gain experience in group model building.
- Do projects start with some initial model structure or with a blank slate? Unstructured group process generally requires high levels of systems dynamics and group model building training to be successful.
- What type of model is going to be developed? Will the focus of the project be to develop an informal causal map or a formal computer simulation model? Informal causal maps are frequently used at early stage of a modeling process to help conceptualize the system and define the problem, as well as at the end of a project to communicate the results from analyzing a simulation model.
- Do projects start with some initial model structure or with a blank slate? If the project starts with some initial model structure, a concept model to introduce the language of systems dynamics can be used [73]. In the blank slate approach the project starts with some type of exercise that elicits the main issues and variables related to the project.

3.2.6 Decision Conferencing

Decision conferencing process is a way of helping a group of actors to resolve important issues in their organization under the guidance of an impartial facilitator with the aid of a decision analysis model of participants' perspectives on the issues. The facilitator serves as a process consultant, guiding the group through the stages of discussing the issues, developing a model and exploring the results. Exploration generates new insights and stimulates creative thinking, resulting in changes to the model and to intuitions. Rather than providing an optimal solution, the model serves as a tool for thinking [74].

4. Conclusion

Project Managers must not be limited to monitoring and controlling of projects. They must have the skills needed to make sound decisions with the possibility and authority to effectively influence the direction and course of a project. In this paper, is presented a family of quantitative and qualitative soft methods, aimed at assisting project managers in tackling complex problems, as well as the benefits of its application. Traditional operations research methods have serious limitations for dealing with these type of problems that today's competitive global market and changing work environment is increasingly facing. These methods can help project managers to be better prepared in communication**,** with the ability to take a management perspective and develop the real leadership capabilities and skills that project managers need in order to be more effective, work efficiently as members of interdisciplinary teams and successfully execute even a small project. Project Management programs are challenged to implement these methodologies in project management courses as the effective way to encourage growth and development of young professionals, and to prepare them to take over the challenges facing the twenty-first century. In future research, the application of the methods presented in this paper may contribute to a better understanding of the relationships of the different actors involved in a project and the impacts of the project managers' decisions on project performance.

References

[1] S. Kumar and J. K. Hsiao, "Engineers learn soft skills the hard way: Planting a seed of leadership in engineering classes," *Leadership and Management in Engineering*, vol. 7, no. 1, pp. 18-23, 2007.

[2] Accreditation Board for Engineering and Technology, Inc. (ABET), *Engineering Criteria 2000*, ABET, Baltimore, USA, 1998.

[3] Acciszenwski, "Civil engineering crisis," *Leadership and Management in Engineering*, vol. 6, no. 1, pp. 26–30, 2006.

[4] D. M. Aldridge, "Professional practice: A topic for engineering research and instruction," *Journal of Engineering Education*, vol. 83, no. 3, pp. 231–236, 1994.

[5] E. Custovic, "Engineering Management: Old story, new demands," *IEEE Engineering Management Review*, vol. 43, no. 2, pp. 21-23, 2015.

[6] S. J. Armstrong, "Re-thinking Management Education: From cognition, to action, to learning," Inaugural lecture. Centre for Management and Organizational learning. University of Hull, 2007.

[7] M. Archer, R. Bhaskar, A. Collier, T. Lawson, and A. Norrie (Eds), *Critical Realism: Essential Readings*, London, UK: Routledge, 1998.

[8] R. Bhaskar, *A Realist Theory of Science*, *1*st ed. Hemel Hempstead, UK: Harvester Press, 1978.

[9] R. Bhaskar, *The Possibility of Naturalism*, *1*st ed. Sussex, UK: Harvester Press, 1979

[10] J. Mingers, "The contribution of critical realism as an underpinning philosophy for OR/MS and systems," *Journal of the Operations Research Society*, vol. 51, pp. 1256–1270, 2000.

[11] J. Pollack, "The changing paradigms of project management," *International Journal of Project Management*, vol. 25, pp. 266-274, 2007.

[12] G. Midgley, *Systemic intervention: philosophy, methodology, and practice*, *1*st ed. New York, USA: Plenum, 2000.

[13] A. Jaafari, "Management of risks, uncertainties and opportunities on projects: time for a fundamental shift," *International Journal of Project Management*, vol. 19, pp. 89–101, 2001.

[14] M. Thiry, "Combining value and project management into an effective program management model," *International Journal of Project Management*, vol. 20, no. 3, pp. 221-227, 2002.

[15] K. T. Yeo, "Systems thinking and project management-time to reunite," *International Journal of Project Management*, vol. 11, pp. 111-117, 1993

[16] W. McElroy, "Implementing strategic change through projects," *International Journal of Project Management*, vol. 74, no. 6, pp. 325-329, 1996

[17] T. Williams and D. Hillson, Editorial – PMI Europe 2001, *International Journal of Project Management*, vol. 20, no. 3, pp. 183–184, 2002.

[18] L. Crawford and J. Pollack, "Hard and Soft projects: a framework for analysis," *International Journal of Project Management*, vol. 22, pp. 645-653, 2004.

[19] J. Wateridge, "The role of configuration management in the development and management of Information systems/Technology (IS/IT) projects," *International Journal of Project Management*, vol. 17, no. 4, pp. 237–241, 1999.

[20] K. T. Yeo, "Critical failure factors in information system projects," *International Journal of Project Management*, vol. 20, no. 3, pp. 241–246, 2002.

[21] L. Williams, "The need for new paradigms for complex projects," *International Journal of Project Management*, vol. 77, no. 5, pp.269-273. 1999.

[22] P. B. Checkland, *Systems thinking, systems practice*, *1*st ed. New York, USA: Wiley, 1981.

[23] H. A. Simon, *Administrative behavior*, *1*st ed. New York, USA: MacMillan, 1947.

[24] P. Oakley, "How the name date (Harvard) reference style in papers shows an underlying interpretivist paradigm whilst numeric references show a functional paradigm?," *Systemist*, vol. 25, no. 1, pp.25–30, 2003.

[25] J. Higgs, "Charting standpoints in qualitative research," in *Critical moments in qualitative research*; H. Byrne-Armstrong, J. Higgs and D. Horsfall, Eds., Thousand Oaks, CA, USA: Corwin Press, 2001, pp.44-67.

[26] A. D. A. Hall, *Methodology for systems engineering*. Princeton, USA: Van Nostrand, 1962

[27] G. M. Jenkins, "The systems approach," *Journal of Systems Engineering*, vol. 1, no. 1, pp. 3–49, 1969.

[28] E. S. Quade and W. I. Boucher, *Systems Analysis and Policy Planning: Applications in Defense*. New York, USA: Elsevier. 1968.

[29] J. W. Forrester, *Industrial Dynamics*. Cambridge, USA: MIT Press. 1961.

[30] F. Wilson, "Flogging a dead horse: the implications of epistemological relativism within information systems methodological practice," *European Journal of Information Systems*, vol. 8, pp. 161–169, 1999.

[31] S. Clarke B. and Lehaney, "Information systems strategic planning: a model for implementation in changing organizations," *Systems Research and Behavioral Sciences*, vol. 14, pp. 129–136, 1997.

[32] P. Checkland, "Soft systems methodology: a 30-year retrospective," in *Soft systems methodology in action*, P. Checkland and J. Scholes, Eds., Chichester, USA: Wiley, 1999, pp. A1–A65.

[33] P. B. Checkland and J. Scholes, *Soft systems methodology in actions*. New York, USA: Wiley, 1990.

[34] C. Eden, S. Jones and D. Sims, *Messing about problems*. Oxford, UK: Pergamon, 1983.

[35] R. Ackoff, "The art and science of mess management," in *Managing change*, C. Mabey and B. Mayon-White, Eds., London, UK: Paul Chapman Publishing, 1993.

[36] K. T. Yeo and R .L. K. Tiong, "Positive management of differences for risk reduction in BOT projects," *International Journal of Project Management*, vol. 18, no. 4, pp. 257–2 65, 2000.

[37] J. Bryant, "The plot of thickens: Understanding interaction through the metaphor of Drama," *Omega*, vol. 25, no. 3, pp. 255-266, 1997.

[38] H. Mintzberg, *Mintzberg on Management: Inside our strange world of organizations*, New York, USA: Free Press/Collier Macmillan, 1989.

[39] L. L. Sallfors and G. B. Sallfors, "Focus on real life problems facilitating learning and understanding," *Proc., 1st Int. Conf. on Geotechnical Engineering Education and Training*, Bucarest, Romania, 2000, pp. 425-431.

[40] S. Kumar, "Teaching geotechnical engineering using professional practice," *Proc., Int. Conf. on Engineering Education, International Network for Engineering Education and Research*, Arlington, Canada. 2004, pp. 229-234.

[41] T. van der Lei and W. Thissen, "Quantitative problem structuring methods for multi-actor problems: an analysis of reported applications," *Journal of the Operations Research Society*, vol. 60, no. 9, pp. 1198-1206, 2009.

[42] J. Rosenhead and J. Mingers, *Rational Analysis for a Problematic World Revisited, Problem Structuring Methods for Complexity, Uncertainty and Conflict*. Chinchester, UK: John Wiley & Sons Ltd, 2001.

[43] J. Rosenhead, "What' s the problem? An introduction to Problem Structuring Methods," *Interfaces*, vol. 26, no. 6, 117–131, 1996.

[44] L. A. Franco, M. Cushman and J. Rosenhead, "Project review and learning in the construction industry: Embedding a problem structuring method within a partnership context," *European Journal of Operations Research*, vol. 152, pp. 586-601, 2004.

[45] J. Mingers and J. Rosenhead, "Problem structuring methods in action," *European Journal of Operations Research*, vol. 152, pp. 530-554, 2004.

[46] P. Checkland, "Soft systems methodology: a 30-year retrospective," in *Soft systems methodology in action*, P. Checkland and J. Scholes, Eds., Chichester, UK: Wiley, 1999, pp. A1–A65.

[47] C. Eden and F. Ackerman, "SODA: the principles," in *Rational analysis for a problematic world revisited: Problem structuring methods for complexity uncertainty and conflict*, J. Rosenhead and J. Mingers, Eds., Chichester, UK: Wiley, 2001, pp. 21–41.

[48] T. Horlick-Jones and J. Rosenhead, "The uses of observation: Combining problem structuring methods and ethnography," *Journal of the Operations Research Society*, vol. 58, pp. 588-601, 2007.

[49] J. Friend and A. Hickling, *Planning under pressure: the strategic choice approach*, 3rd ed., Netherlands: Elsevier, 2005.

[50] J. A. M. Vennix, *Group model building: facilitating team learning using system dynamics*, Chichester, UK: John Wiley & Sons, 1996.

[51] L. D. Phillips, "Decision analysis for group decision support," in *Tackling strategic problems: the role of group decision support*, C. Eden and J. Radford, Eds., London, UK: Sage, 1990, pp. 142–150.

[52] N. Howard, *Paradoxes of rationality: Theory of Metagames and political behavior*, Massachusetts, USA, MIT Press: 1971.

[53] L. Fang, K. W. Hipel and D. M. Kilgour, *Interactive decision making, the graph model for conflict resolution*, New York, USA: John Wiley & Sons Inc, 1993.

[54] J. Bryant, *The six dilemmas of collaboration*, Chichester, UK: Wiley, 2003.

[55] N. Howard, "Drama theory and its relation to game theory. Part 1: Dramatic resolution vs. rational solution," *Group Decision and Negotiation*, vol. 3, pp. 187-206, 1994.

[56] N. Howard, "Drama theory and its relation to game theory. Part 2: Formal model of the resolution process," *Group Decision and Negotiation*, vol. 3, pp. 207-235, 1994.

[57] H. Nigel, "Drama Theory and Its Relationship to the Theory of Games," *Group Decision and Negotiation*, vol. 3, pp. 187-206, 1994.

[58] J. Bryant, "Confrontations in health service management: Insights from drama theory," *European Journal of Operations Research*, vol. 142, pp. 610-624, 2002.

[59] P. G. Bennett, "Confrontation analysis as a diagnostic tool," *European Journal of Operations Research*, vol. 109, pp. 465-482, 1998.

[60] P. G. Bennett, "Bidders and dispenser: Manipulative Hypergames in a multinational context," *European Journal of Operations Research*, vol. 4, pp. 293-306, 1980.

[61] P. G. Bennett M. R. Dando. "Complex strategic analysis: A Hypergame study of the fall of France," *Journal of the Operations Research Society*, vol. 30, no. 1, pp. 23-32, 1979.

[62] W. Stephenson, *The study of behavior: Q-technique and its methodology*, Chicago, USA: University of Chicago Press, 1953.

[63] S. R. Brown, *Political subjectivity: Applications of Q-methodology in Political science*, New Haven, USA: Yale University Press, 1980.

[64] B. McKeown and D. Thomas, *Q-methodology*. California, USA: Sage Publications, 1988.

[65] M. J. G. van Eeten, "Recasting intractable policy issues: The wider implications of the Netherlands civil aviation controversy," *Journal of Policy Analysis and Management*, vol. 20, no. 3, pp. 391-414. 2001.

[66] J. S. Coleman, *Foundations of Social Theory*, Cambridge, Massachusetts, USA; The Belknap Press of Harvard University Press, 1990.

[67] Management Technology Policy (2017, January). Decision Support Tools [Online], Available: http://www.ifm.eng.cam.ac.uk.

[68] D. Holman and R. Thorpe, *Management and Language: The manager as a practical author*, New York, USA: SAGE Publications, 2002.

[69] C. Eden and F. Ackermann, *Making Strategy: The Journey of Strategic Management*, London, UK: Sage. 1998.

[70] G. P. Richardson and D. F. Andersen. "Teamwork in Group Model Building," *Systems Dynamics Review*, vol. 11, no. 2, pp. 113-137, 1995.

[71] B. M. Richmond, "The Strategic Forum: Aligning Objectives Strategy and Process," *Systems Dynamics Review*, vol. 13, no. 2, pp. 131-148. 1997.

[72] P. S. Hovmand. *Community Based System Dynamics*, DOI 10.1007/978-1-4614-8763-0_2, 17, New York, USA: Springer Science Business Media, 2014.

[73] G. P. Richardson, "Concept models in group model building," *Systems Dynamics Review*, vol. 29, pp. 42–55, 2013.

[74] L. D. Phillips, The London School of Economics and Political Science, London, UK, 2006.

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Use of cloud computing services in micro and small enterprises: a fit perspective

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Use of cloud computing services in micro and small enterprises: a fit perspective

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Abstract:
Micro and Small Enterprises (MSEs) require the right Organizational Information and Communication Technology Infrastructure (OICTI) to provide them with the essential functionalities to support their business processes. In order to have the right OICTI, MSEs are expected to make huge investments in financial and human resources, to purchase, deploy and maintain Information and Communications Technologies (ICTs). Cloud Computing Services (CCS) avail OICTI, for a fraction of the resources required to own private ICT infrastructure. The purpose of this study was to assess the fit between the MSEs' OICTI needs and the information processing capabilities of CCS and how this fit influences CCS adoption in the Kenyan MSEs. The research was quantitative in nature, in which, a theory-based model grounded on the task technology fit, organization information processing and technology-organization-environment theories, was developed and validated. Study findings suggest strong correlations between MSEs' tasks and CCS and between MSEs' information processing needs and CCS information processing capabilities. Other factors identified as influencing CCS procurement are affordability and the relationship between the CCS providers and the MSEs. The study contributes to the academic literature on technology adoption in MSEs by showing that there exists a multidimensional fit between CCS and MSEs' OICTI requirements.

Keywords:
cloud computing; MSEs; ICT acquisition; organizational information and communication technology infrastructure.

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1. Introduction

Micro and Small Enterprises (MSEs) require the right organizational Information and Communication Technology Infrastructure to provide them with the essential functionalities to support their business processes. Organizational ICT infrastructure enables MSEs to process, store, secure and manage information so that it is available for decision making. MSEs that align their organizational ICT infrastructure with their business goals are able to improve their performance in strategic areas such as customer service, productivity and cost reduction. An organizational ICT infrastructure supports these improvements by making it easier for MSEs to communicate, share information, and to streamline business processes. The Kenyan MSEs (sample of this article) are categorized by the number of employees in the firms and their annual turnover. The Kenya's Micro and Small Enterprises Act 2012 [1] defines MSEs as a firm, trade, service, industry or business activity in both formal and informal sectors employing 1-50 workers and whose annual turnover does not exceed Kenya Shillings 5 Million (approx. 43,000€). For Micro-enterprises, these are the firms which employ 10 or less workers and whose annual turnover does not exceed Kenya Shillings five hundred thousand (Approx. 4,300€), while small enterprises are the companies that employ between 11-50 workers and has an annual turnover of between Kenya Shillings 5 hundred thousand (Approx. 4,300€) to 5 Million (approx. 43,000€). Kenya's Vision 2030 [2] recognizes MSEs as an important component of the Kenyan economy. Successful adoption of cloud computing by the Kenyan MSEs could enhance their development and in the achievement of the Vision 2030 project. Kenya Vision 2030 is the Kenya's national long-term development blue-print aiming to transform Kenya into an industrialized, middle-income country that can provide high quality of life to all. Kirori and Achieng [3] indicates that Kenyan MSEs are also considered as a base of entrepreneurial development and the seedbed for inculcating an entrepreneurial culture and supporting rural industrialization and industrial development. The MSEs sector is also considered important to the Kenyan economy by driving industrialization, generating employment and raising household income, hence the need to identify the factors that contribute to successful ICT infrastructure adoption processes in these businesses.

In order to have the right organizational ICT infrastructure, MSEs are expected to make huge investments in financial and human resources, to purchase, deploy and maintain the ICTs. Unlike most MSEs, which have limited financial and human resources, big corporates have the necessary resources to make huge investments in organizational ICT infrastructures. Nevertheless, these organizations tend to explore ways of reducing their organizational computing costs by doing away with the circle of "buy once, fix when required and upgrade where necessary". In today's ICT landscape, organizations can obtain their organizational ICT infrastructure services from a broader range of sources and acquisition models. One such source of organizational ICT infrastructure is the availability of cloud computing services. Cloud computing services avail organizational ICT infrastructure, for a fraction of the resource commitment required if an organization was to acquire its own ICT infrastructure.

Haag and Cummings [4] defines cloud computing as a technology model in which ICT resources including application software, processing power, data storage, backup facilities, and development tools are delivered as a set of services via internet. Cloud computing services provide reliable, customized and Quality of Service (QoS) guaranteed dynamic computing environments for end-users [5]. Hosseini et al. [6] indicates that most organizations are attracted to cloud computing services that are superior to in-house data centres in terms of financial and technological dimensions. By using cloud computing services, MSEs make huge financial savings, and gain access to ICT expertise that may not be readily available internally. The costs for replacement and maintenance of the ICT infrastructure make cloud computing a more appropriate solution to MSEs' ICT needs, as cloud computing services offer affordable ICT resources, creating opportunities for the MSEs to improve on their ICT related capabilities.

The objective of this study was to assess the fit between the MSE's organizational ICT infrastructure needs and the cloud computing services and how this fit influences the adoption of cloud computing services to support the MSEs' business objectives. This study proposed a model to explore the factors influencing acquisition and integration of cloud computing services by MSEs in developing countries. The study posits that there should be a good fit between the MSEs' ICT needs and the cloud computing services for the MSEs to adopt the cloud computing services for their ICT infrastructure. The central research proposition of this paper is as follows: Greater correlation between information

processing needs of the MSEs and the information processing capabilities of cloud computing services is associated with the adoption of cloud computing services by the MSEs. Task Technology Fit model (TTF), Organization Information Processing Theory (OIPT) and the Technology, Organization, and Environment (TOE) framework serve as the theoretical basis for this study. An instrument to measure the proposed model and related propositions was developed and validated. The proposed research model was analyzed using the Partial Least Squares (PLS) approach. The next section has the literature review. Section 3 describes the study methodology, section 4 gives the study results, and section 5 discusses the study findings while section 6 reflects on the success of the study, its conclusion and directions for further studies.

2. Literature review

2.1 The fit perspective

Literature on technology adoption tends to suggest the existence of a strong correlation between task and technology [7], information processing needs and information processing capabilities [8], source of the technology and recipient of the technology [9] and task type and technology [10]. The study adopts the word fit as defined by Venkatraman [9] to be the match between two related variables.

The main aim of the Task-Technology Fit (TTF) model by Goodhue and Thompson [7] is to match the capabilities of the technology to the demands of a particular task. TTF is defined as the degree to which features of a technology match the requirements of the task and the abilities of the individuals performing the task. TTF suggests that information systems will have a positive impact on individual or organizational performance only when technology functionality is appropriately matched to user task requirements. Information Technology is more likely to have a positive impact on individual performance and be used if the capabilities of the Information Technology match the tasks that the user must perform [7]. Therefore, MSEs use of cloud computing services is dependent on whether the capabilities of the cloud computing services match the information processing tasks' requirements that need to be performed. That is, there must be a fit between the features of cloud computing services and the information processing tasks' requirements within the MSEs. A good task-technology fit will lead to technology usage, while a poor task-technology fit will decrease users' intention to use the technology [12], [13], [14]. MSEs will not use cloud computing services if there is a poor fit between the CCS and their ICT related tasks. For the MSEs to acquire and integrate the cloud computing services, cloud computing characteristics (technology functionalities) should fit the MSEs' task characteristics (task demands, needs or requirements). Hence, the following is proposed:

Proposition 1: The greater the fit between the MSEs' information processing tasks' requirements and the cloud computing functionalities, the greater the potential for adoption of the cloud-based services by the MSEs.

Zabukovsek and Bobek [15] posits that organizations will deploy a technology to facilitate organizational work rather than to match user's personal preferences. Zabukovsek and Bobek [15] concludes that the perception of fit between information technology and MSEs' mandatory work will motivate the employees to use the system. This implies that if the cloud computing services fits the MSEs' required tasks, the employees will be motivated to use the technology to perform the required tasks. Zabukovsek and Bobek [13] refers to this fit as work compatibility. Therefore, in the context of cloud computing services, the more compatible with the MSEs' mandatory tasks, the cloud computing services are, the higher the degree of adoption. This leads to the following proposition:

Proposition 2: The greater the work compatibility between the cloud-based services and MSEs' mandatory tasks, the greater the potential for adoption of the cloud-based services by the MSEs.

The Organizational Information Processing Theory (OIPT) identifies information processing needs, information processing capability and the fit between the two to obtain optimal performance [8]. From the OIPT point of view, cloud computing services can be conceptualized as a particular type of information processing capability. Information processing is the purposeful generation, aggregation, transformation and dissemination of information associated with accomplishing some organizational task [8]. Cloud computing information processing capability could be defined as

ICT-related capacity to support essential ICT requiring tasks such as computing, storage, data backups and financial management. MSEs' ICT related activities such as data processing, storage, backups and financial management are the organizations' information processing needs. Although it has been argued that there is no relationship between security and cloud adoption [16], data security has been quoted as one of the highest risk elements in the adoption of cloud computing [17], [18], and [19]. Cloud computing services information processing capability should also take into consideration the MSEs' data security management. Therefore, technology must fit the operating practices of an adopting organization [15]. This is defined as the fit between the technology and the organization' business processes. The question is whether the cloud computing information processing capabilities fit the MSEs' business processes. Thus, the following is proposed:

Proposition 3: The higher the fit between the MSEs' business processes and the cloud computing services capabilities, the greater the potential for the adoption of the cloud-based services by the MSEs.

The Technology-Organization-Environment (TOE) framework [20] indicates that organizational adoption of technology is influenced by organizational, environmental, and technological contexts. Organizational factors include the enterprise's business scope, the quality of human resource, and the firm size. For the MSEs, the quality of human resource, and the firm size are key characteristics that would influence the desire to acquire and integrate cloud computing services. Environmental factors include vendor support and readiness, government support, and technology support infrastructures. Environment factors such as government support are a significant motivator of Small and Medium Enterprises (SMEs') technology adoption [21]. Technological context defines the availability of internal and external technologies pertinent to the MSE, such as the availability of community and public cloud computing services. Tornatzky and Fleischer [20] indicates that one of the key factor influencing technology adoption at organization level is vendor support and readiness. This implies that the the nature of inter-organizational relationship between the cloud computing vendors and the MSEs should focus on their mutual interests. The vendor should address any issues relating to lack of knowledge on how to acquire and implement cloud computing services in the MSEs and be ready to guide the organization in the process of acquiring and integrating the technology. The desire of any MSEs' management is to have the cloud computing services vendors to tailor their support contracts to fit the organization's ICT infrastructure support needs. Adequate technical and user support by the cloud computing vendors to the MSEs is paramount for the adoption of the cloud computing services. Vendor support is determined by the inter-organizational relationship between the vendor and the consumer of the cloud computing services. Even though it takes just connectivity and payments to use the cloud-based resources, vendor lock-in has been identified as possible barrier to the adoption of cloud computing [22]. Vendor lock-in occurs when an organization gets "trapped" in a public cloud vendor services and is forced to stay with a provider that does not meet its needs, just to avoid the cumbersome and risky process of moving. To avoid the problems associated with vendor lock-in, MSEs should choose vendors who are using the Cloud Data Management Interface (CDMI) standard created by the Storage Networking Industry Association or to run a "multicloud" by using services from two or more public cloud vendors. Trust and long-term partnerships between the vendor and consumer influences cloud computing services adoption. Therefore, the study proposes the following:

Proposition 4: The greater the degree of the inter-organizational relationship, the more likely the MSEs will adopt the cloud-based services.

2.2 Cloud computing services

National Institute of Standards and Technology (NIST) defined "cloud computing as a model for enabling ubiquitous, 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 [23]. Cloud computing has five essential characteristics (on demand self-service, broad network access, resource pooling, rapid elasticity and measured service), three service models (software as a service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS), and four deployment models (Public cloud, private cloud, hybrid cloud and community cloud) [24]. Hybrid cloud is a combination of private and public clouds and it is the deployment model of cloud computing which is generally adopted by many organizations [25]. The adoption of

cloud computing is essentially driven by trading partners, their requirements and the facilitation of the cloud service providers [26].

2.3 Cloud computing adoption in organizations

Cloud computing adoption is dependent upon organizational infrastructure and expertise related to the technology within the enterprise [26]. Smaller firms are less likely to have successful system implementations owing to scarcity of financial and human resources, limited information systems knowledge, and a lack of information technology competence [27]. But Carcary et al. [28] suggests that micro firms are adopting cloud computing in order to compete more effectively. Trong [29] also indicates that small businesses could use customizable cloud computing services to enhance their competitive advantage. To gain these benefits, Elson and Howell [30] posits that when adopting cloud computing, organizations and their top management should make an effort to access and analyse possible changes in organizational culture, process and work relationships. Large organizations which have made huge investments in ICT infrastructure experience difficulties related to integrating cloud computing services with the existing on-premise applications [31]. While citing Banerjee [32] and Goscinski and Brock [25], Gangwar et al. [26] concludes that cloud computing adoption rate is not growing as fast as expected even though the technology provides several strategic and operational advantages to organizations. This study is an analysis of how cloud computing fit the MSEs' business processes, employee tasks demands and organizational information processing needs, all which determines the extent of any information technology adoption at the firm level.

Individual consumers have over the years adopted cloud computing services such as the free email services and the data storage facilities available online. The Kenyan consumers of ICT services are also known for their unprecedented uptake of the mobile money and mobile internet. Consequently, examining cloud computing adoption among the Kenyan MSEs would be of interest as any technology adoption is said to be guided by some contextual factors. Kshetri [33] recommended that there is a need to have studies that can elucidate organizations' cloud adoption decisions. One such study done to measure the level of implementation of Cloud Computing in Portuguese companies revealed that the firms were not only using the cloud services to save on costs but also to optimize the resources available in order to improve business processes [34]. Abubakar et al. [35] did a survey on high ranking Information Systems Journals and found minimal serious publishing on cloud computing adoption by Small and Medium Sized Enterprises (SMEs) in Sub-Saharan Africa between 2005 and 2013. This study is an endeavor to reduce the publication gap on cloud computing services in Sub-Saharan Africa as revealed by Abubakar et al. [35] and an attempt to explain the organizations' cloud adoption decisions as recommended by Kshetri [33]. Cloud computing technologies could also be attractive to MSEs as small business have interests in outsourcing their information technology services in order to concentrate more on their core businesses [36], [37].

2.4 Cloud computing affordability

Cloud computing services involves use of the vendor computing resources over the internet. This lowers the costs of purchasing the required on-premise ICT infrastructure and eliminates the technical complexities required to install, manage and maintain the infrastructure. It has been suggested that cost savings is one of the drivers of cloud computing services adoption. MSEs could benefit from use of cloud based applications as the cost advantages of cloud computing is said to be three to five times for business applications [23] as the organization just pays for use and not for ownership. Cloud computing also reduces organization's cost by reducing the amount of technical support required as opposed to the traditional setup where the ICT team is bogged down with installing, reinstalling, and troubleshooting the ICT infrastructure. Boss et al. [38] concludes that adoption of cloud computing reduce costs through improved utilization, reduced administration and infrastructure cost and faster deployment cycles. Cloud computing vendors use different costing models to bill their customers on pay per use basis [39]. This means that the customers can use the services on a short term basis when required and also release them when no longer required. For instance, Uhasibu [40] is a cloud-based accounting system for SMEs, build specifically for the Kenyan Small and Medium Enterprises. The company offers subscription for the business application as shown on Table 1.

Table 1. Uhasibu accounting package subscription rates for SMEs

Months / Product	Uhasibu (only)	Uhasibu + Payroll	Payroll (only)
1 month	1,000KES + VAT = 1,160KES Approx USD 10/mo	1,500KES + VAT = 1,740KES	1,000KES + VAT = 1,160KES
6 months (+ 1 free month)	6,000KES + VAT = 6,960KES Approx USD 60/mo	9,000KES + VAT = 10,440KES	6,000KES + VAT = 6,960KES
10 months (+ 2 free months)	10,000KES + VAT = 11,600KES Approx USD 100/mo	15,000KES + VAT = 17,400KES	10,000KES + VAT = 11,600KES

Legend: 1,000 KES =8.65EUR

The Angani [41] VAULT servers offers redundant datacenters, on subscription bases for fast, reliable and secure backup for business data as shown in Table 2. This kind of pricing allows the MSEs to enjoy scalability and the elasticity to add or remove resources at will, depending of the organizational resource requirement. This allows the MSEs to easily manage peak and off-peak schedules successfully. Armbrust et al. [42] suggests that organizations do not have to handle the peak times computing power demands by purchasing new equipment but instead, the peak computing demands should be handled by cloud servers.

Table 2. Subscription for Virtual Machines Services available from Angani

Tiny	Small	Medium
KES 0.69 /Hr. , Approx. USD 0.01 /Hr	KES 2.69 /Hr., Approx. USD 0.03 /Hr.	KES 7.41 /Hr., Approx. USD 0.07 /Hr.
KES 512 or USD 5.12 /Mo	KES 1,999 or USD 19.99 /Mo	KES 5,499 or USD 54.99 /Mo
RAM: 512 MB vCPUS: 1 Disk Space: 10GB 1GB/s unlimited traffic within Kenya 1TB international transfer	RAM: 1 GB vCPUS: 1 Disk Space: 20GB 1GB/s unlimited traffic within Kenya 1TB international transfer	RAM: 2 GB vCPUS: 2 Disk Space: 40GB 1GB/s unlimited traffic within Kenya 1TB international transfer

Legend: 1,000 KES =8.65EUR

The cost of buying hardware, storing and securing it, licensing and maintaining it is expensive. The cost of in-house data center is beyond the reach of most Kenyan MSEs as the energy costs are also high while administrative costs are prohibitive. Cloud computing pricing could be categorized either as tiered pricing, per-unit pricing and subscription-based pricing [43]. With the subscription model, there is a huge cost savings for small firms [44]. The per use revenue model provides an avenue for the small businesses to manage to pay for enterprise applications like CRM (Customer Relationship Management) or SCM (Supply Chain Management) tools [45], [46]. Use of cloud computing services such as the IaaS reduces the capital expenses and ICT costs [47]. Miller [48] indicates that cloud computing enables organizations to reduce their hardware costs. The cloud-based computing services pricing models allows the MSEs to choose the prices that fit their budget and their ICT infrastructure needs, leading to the following proposition:

Proposition 5: The greater the perceived match between the organizational ICT infrastructure budget and the cloud computing service costing models, the more likely the MSEs will adopt the cloud-based services.

2.5 Research model

The study research model presented in Fig. 1 is based on the premise of the fit between the information processing needs of the MSEs and information processing capabilities provided by the cloud computing services and its impact on

the acquisition and integration of the cloud computing services. The study identifies the information processing needs of the MSEs and the available cloud computing services offering the requisite information processing capabilities to support these MSEs' information processing requirements. In the conceptual model, the study posits that independent factors like Task Technology Fit, Work Compatibility Fit, Business Process Fit, Inter-organization Fit and Cost Fit will influence the adoption and use of cloud computing.

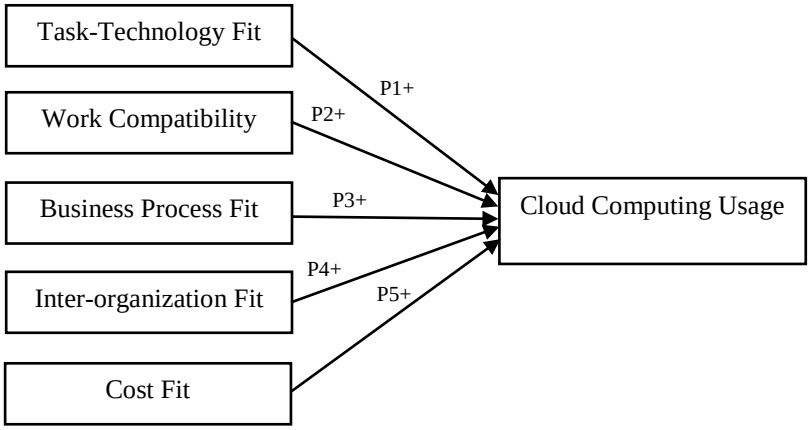

Fig. 1. Theoretical model and propositions

3. Research methodology

The study used a combined qualitative and quantitative research approach in two phases. An overview of the overall research design for this study is presented in Fig. 2. The qualitative phase of the study was used to examine the availability of commercial cloud computing services in Nairobi. To identify the commercial cloud computing services offered in Nairobi and especially those targeting MSEs, a review of cloud computing vendors' advertisements in the four Kenyan Daily Newspapers between April 2014 and January 2015 was done. In total, there were thirty-four advertisements placed to sell cloud computing services in the daily newspapers by eight different cloud computing vendors. Five of the advertising companies were randomly selected as study participants.

The study made arrangements to have in-depth semi-structured interviews with the participating cloud computing providers' Chief Operating Officers or any senior personnel who had any role in the management of the distribution of the organization's CCS. Using semi-structured, one-on-one interview, the respondent cloud computing providers' Chief Operating Officers were expected to provide details about their organizations' profiles, types of cloud services offered and their rates, the number of cloud computing customers and any concerns raised by their customers regarding adopting cloud-based services. Each interview lasted 30-60 minutes, and detailed notes were taken and analyzed later. In some instances, two of the five study participating CCS vendors' Chief Operating Officers (COOs) gave the interviewer a tour of their cloud computing facilities. The cloud computing providers' Chief Operating Officers were also requested to make available a list of their customers to be used for the cloud computing service users' survey phase of the study.

In the second phase of the study, a survey with either the MSEs Information Technology managers, managing directors or the owners was accomplished using a hand-delivered questionnaire. To enhance the validity of the questionnaire, a pilot study was conducted. During the pilot study, twenty clients were randomly selected from the customer lists provided by the CCS vendors. To get a representative pilot sample, four customers from each of the list provided by different CCS vendors were selected. A pre-tested survey questionnaire was hand-delivered to the customers' premises

for the pilot exercise. The questionnaire was based on the research model, Fig 1. Eighteen questionnaires out of the twenty delivered during the pilot study were filled out properly and were used for the purpose of piloting the questionnaire.

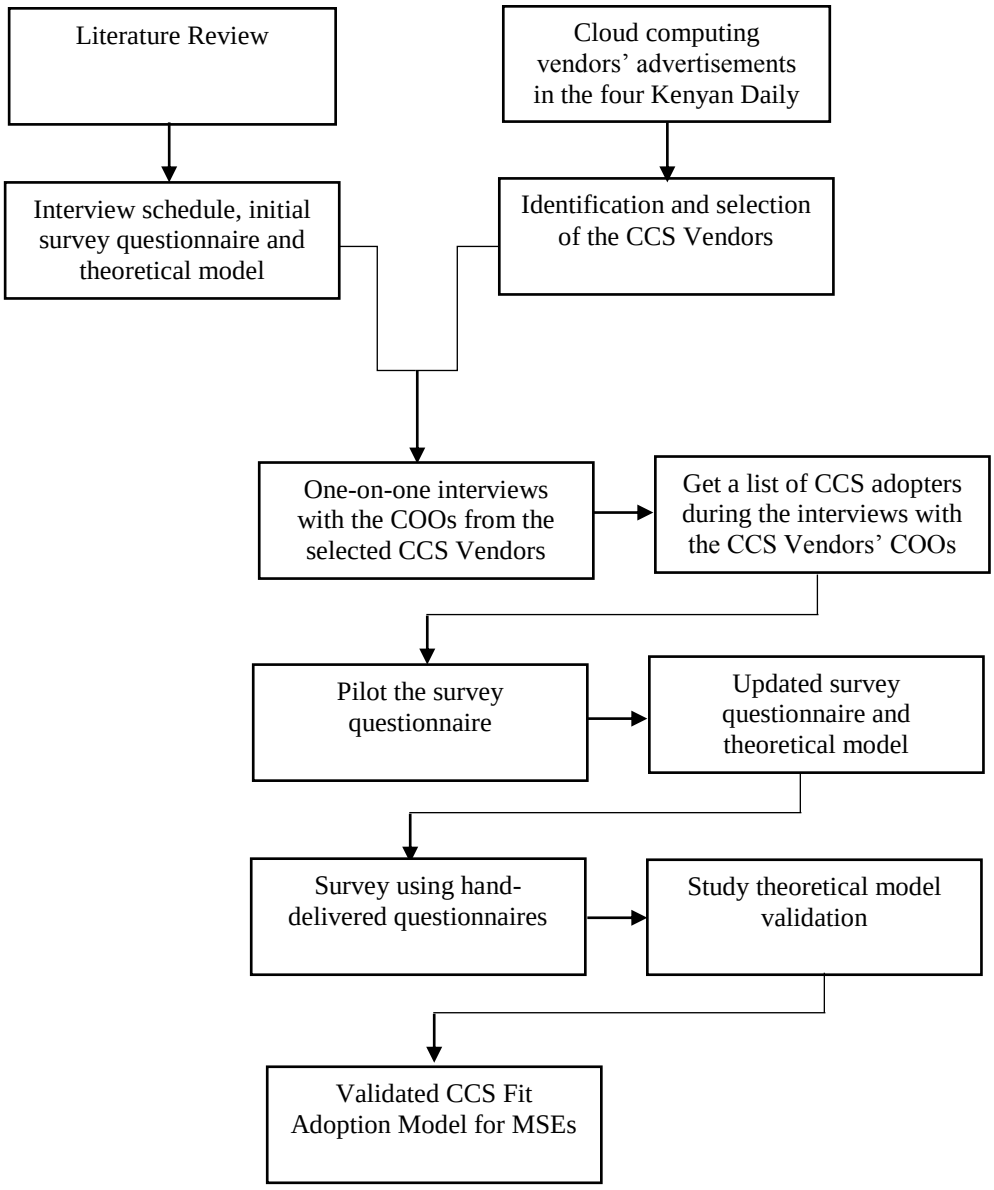

Fig. 2. Overall research design

Table 3 shows data pertaining to some of the commercial cloud computing services offered in Nairobi. This was deemed necessary, given that the services must be made available for the MSEs to procure them. Most of the Chief Operating Officers were happy with the CCS their organizations offered as evidenced by this comment from one of the interviewees, "*I don't know of any other business that offers the most reliable cloud and hosting services like us*".

Table 3: Cloud Computing Services available for the MSEs in Nairobi

Type of Cloud Service	**Available Cloud Computing Service in Nairobi**
Software as a service (Saas)	Email, Accounting, Payroll, virtual office, Mobile Sales Force Management and Mobile Fleet Management
Infrastructure as a service (Iaas)	Backup, Storage, Compute, Disaster Recovery as a Service, Virtual PABX, Managed Media Platform, Managed Host Services
Platform as a service (Paas)	Business process management (BPM PaaS), DBaaS

The list of the services in Table 3 includes the services provided by either the service providers themselves or the resellers. There are a number of organizations who are resellers of internationally recognized cloud computing services such as the Access Kenya [49] who do resell SEACOM's Cloud Services through their Pamoja Cloud Services. For an organization to qualify to resell a service, they need to meet certain technical and sales skills criteria [49].

The second phase of data collection was a survey using the pre-tested questionnaire. The questionnaire was administered to 250 randomly selected MSEs. The study MSEs were selected from the lists of customers provided by the cloud computing service providers. The characteristics of the selected MSEs are presented in Table 4.

Table 4: Sample Characteristics (the participating MSEs)

MSEs Sector	Number of participating Micro Enterprises	Number of participating Small Enterprises	**Total** (n=250)
Manufacturing	18	22	40
Construction	12	26	38
Trade (Wholesale and Retail)	29	47	76
Services	41	55	96

To ensure the validity of the study, the questionnaire measures were drawn from prior validated instruments in extant literature. All the items were measured using a five-point Likert scale, ranging from 'strongly disagree' to 'strongly agree'. The adopted constructs are presented in Table 5 and their measures are specified in appendix 1.

4. Results

The survey respondents were employees of enterprises that were already using cloud-based solutions. One hundred and eighty (180) questionnaires were properly filled out by the respondents, yielding a 72% response rate, and were used for the data analysis. The data analysis technique used was variance-base Partial Least Squares Structural Equation Modeling (PLS-SEM) using WarpPLS 5.0 software while SPSS AMOS (Analysis of Moment Structures) 23.0 software was used to define additional goodness-of-fit indices for the study model.

The aim of the study was to assess the fit between the MSE's organizational ICT needs and the cloud computing services and how this fit influences the adoption. PLS is considered as a soft modelling approach and a good alternative to covariance based SEM when predictive accuracy is paramount and the number of participants is limited [50]. For studies that seek to predict and explain the target constructs, PLS-SEM is a more appropriate as suggested by Hair et al. [51] and Wong [52]. In addition, PLS-SEM does not impose any normality requirements on the data. PLS-SEM is more suited for theory building (exploratory analysis) and it can also be used for theory confirmation (confirmatory analysis) [50]. Bates et al. [53, p. 200] suggests that CFA "is most appropriate when applied to measures that have been fully developed and with established and validated factor structures" and it is a hypothesis testing approach. The study elected to perform a Confirmatory Factor Analysis (CFA) rather that Exploratory Factor Analysis (EFA) as the study constructs were derived from well-developed and tested theories and the proposed study model was testing propositions.

Table 5. Adopted constructs for the study

Constructs	**Description of Construct**	**Construct category**	**Proposition**	**Literature references**	**Number of Scale Items**
Task Fit	A user's perception of a match between Task characteristics and Cloud Computing Characteristics	Predictor Variable	P1	[4], [5], [9], [10], [11], [12]	4
Work Compatibility Fit	A user's perception of a match between MSEs' mandatory tasks and cloud computing technology		P2	[13]	3
Business Process Fit	A user's perception of a match between MSEs' Information Processing needs and cloud computing information processing capabilities	Predictor Variable	P3	[4], [5], [13], [15], [16], [17]	6
Cost Fit	A user's perception of a match between MSEs' ICT infrastructure budget and cloud computing services pricing models	Predictor Variable	P4	[23], [24]	3
Inter-organization Fit	A user's perception of a match between the MSEs' ICT support requirement and cloud computing services provider support provision	Predictor Variable	P5	[12], [14], [18], [19]	3
Actual Cloud computing Services Use	A user's self-reported use of CCS	Criterion Variable		[4]	3

4.1 Cloud computing services usage among the MSEs

The study tried to find out the type of cloud computing services adopted by the MSEs. A host of the study MSEs were using multiple cloud-based services. Regarding the level of cloud computing adoption, it is noted that backup and recovery services has the highest level of implementation with 98% of the MSEs participating in the study using the service. Email and messaging services (94%) and office applications (74%) are also popular cloud computing implementations among the study MSEs. Virtual PABX (6%), ERPs (8%) and software development platforms (12%) have low levels of adoption among the study MSEs. Data storage services (44%) and business process management (36%) have moderate levels of adoption among the study MSEs as shown in Fig. 3.

4.2 Reliability and validity

Confirmatory factor analysis was used to test the measurement model for the reliability and the validity. The reliability and validity of the research measurement instrument was assessed using WarpPLS 5.0. Validity is the extent to which an instrument measures what it is supposed to measure and performs as it is designed to perform while reliability is the degree to which the instrument consistently measures what it is intended to measure.

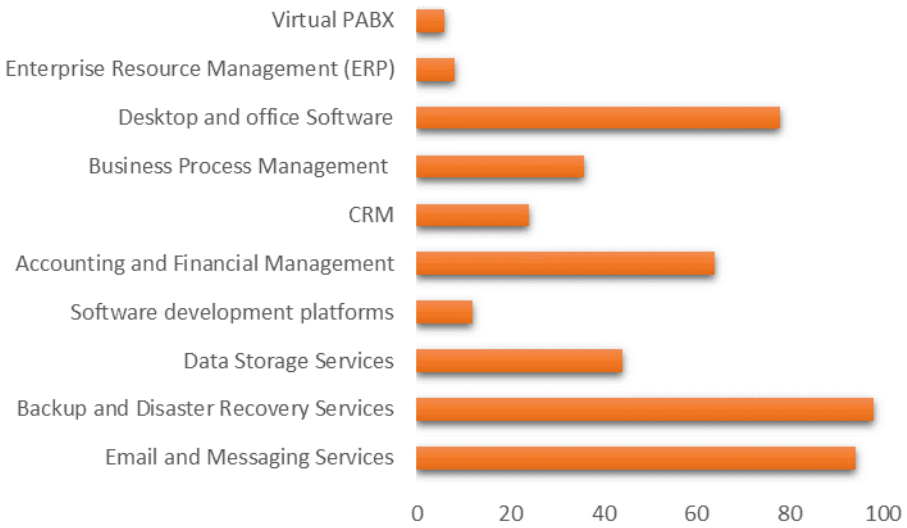

Fig. 3. Use of cloud-based services by the study MSEs

Constructs validity was analyzed using convergent validity and discriminant validity.

Convergent validity is defined as the extent to which a specified set of indicators for a construct converge or share a high proportion of variance in common. Convergent validity of the measures was assessed through calculating composite reliability. The Composite Reliability (CR) for items in each construct was 0.87 or higher, exceeding the 0.70 criterion proposed by Hair et al. [51]. Convergent validity is also assessed using factor loadings. Fornell and Larcker [54] indicates that higher factor loadings show excellent convergent validity. The study factor loadings, Table 7, range from 0.966 to 0.999, which exceeds the required threshold of 0.6 as suggested by Stevens [55], and Goffee, and G. Jones [56]. Fornell and Larcker [37] also recommends a value of 0.5 Average Variance Extracted (AVE) as an acceptable threshold for convergent validity. For this study, the AVEs ranges from 0.665 to 0.892 as indicated in Table 6. Therefore, the study has an acceptable convergent validity.

Discriminant validity is the extent to which the indicators of a construct represent a single construct and the construct's indicators are distinct from other constructs in the model. To measure discriminant validity, the study assessed this through the Average Variance Extracted (AVE). Fornell and Larcker [54] suggests that the square root of AVE should be higher than any correlation of that factor with any other measure. As shown in Table 6, the square root of the AVE (the bolded diagonal values) for each variable in the study is greater than correlations between the variable and all other latent variables which indicates an excellent discriminant validity.

Reliability is an assessment of the internal consistency of a measurement instrument and a measure of the degree of homogeneity among the measurement items in a given construct, an assessment of whether the study instrument would give similar results in different situations or under similar circumstances but at a different time. Composite reliability and Cronbach's alpha coefficients are used to assess a measurement model's acceptable reliability. Gofee and Jones [56] and Nunnally and Bernstein [57] set a more relaxed threshold of acceptable reliability as 0.6 Cronbach's alpha coefficient while Hair et al. [51], and Chin et al. [58] recommends a value of 0.7. From the figures in Table 6, the study Composite reliability and Cronbach's alpha coefficients are all well above the recommend thresholds, hence the study model exhibits adequate reliability and construct validity.

The results of Composite Reliability, Average Variance Extracted (AVEs), square root of AVEs, Chronbach's Alpha, and the correlations of the constructs are summarized in Table 6.

The results of confirmatory factor analysis show a conspicuous factor structure in which all measurement items loaded on the anticipated constructs and were significant at a value of 0.966 or higher. Higher factor loadings are an indication of possible multicollinearity and therefore multicollinearity statistical test was done. Knock [59] defines multicollinearity as a measure of the correlation between the predictors of a variable which falsely inflates the standard errors, and therefore certain model parameters may sometimes become unstable. Multicollinearity is assessed using the Variance Inflation Factors (VIFs). VIFs lower than 5 suggests no multicollinearity [51]. The current study VIFs values indicate nonexistence of multicollinearity as they meet the recommended threshold as shown in Table 7. The result of confirmatory factor analysis confirmed both convergent and discriminant validity.

4.3 Study model analysis

Structural Equation Modeling allows testing of different components of a study model. These are the measurement model and the structural model.

The measurement model tests the goodness-of-fit between the data and the proposed measurement model. WarpPLS provides several measures of model fit. Knock [59] provides the recommended interpretation of each measure. The results of the study measurement model analysis show statistically acceptable goodness of fit according to Knock [59] as shown in Table 8. Therefore, in accordance to Kock [59] the model has a good fit to the data.

SPSS AMOS 23.0 software was also used to determine additional goodness-of-fit indices for the study model as shown in Table 9. These indices include Chi-square (CMIN), Degrees-of-Freedom (df), Chi-square/Degrees-of-freedom (CMIN/DF), and Root mean square error of approximation (RMSEA) as indicated in Table 9. The study model fit indices in Table 9 indicate a good fit. Consequently, in accordance to Kock [59], Hair et al. [51], Bentler and Bonnet [60] and Hu and Bentler [61] the model has a good fit to the data.

The structural model analysis using PLS-SEM was used to examine the predictive capabilities of the model and the relationship between the constructs. The structural model output from WarpPLS is depicted in Fig. 4. Shown on the arrows are the path coefficients values and the path significance.

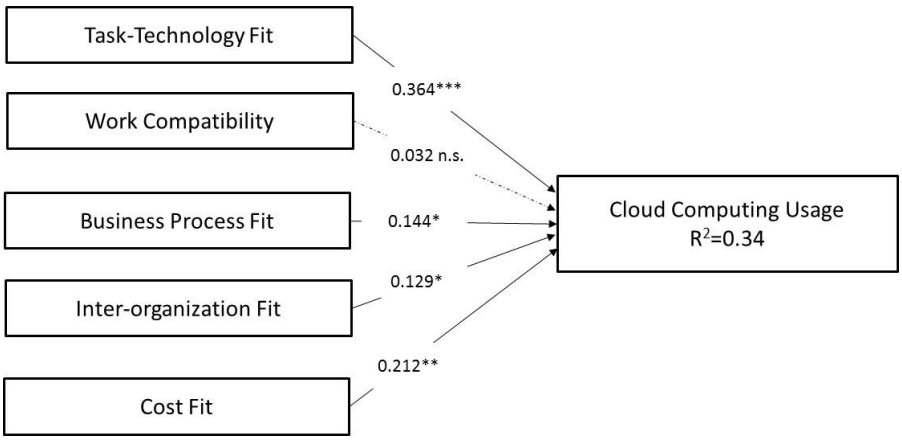

Fig. 4. PLS analysis of the structural model

Path significance: *** p<0.001, ** p<0.01, * p<0.05, n.s. not significant

Table 6. Analysis of reliability and validity

Constructs	**Chronbach's Alpha Coefficient**	**Composite Reliability**	**AVE**	**1**	**2**	**3**	**4**	**5**	**6**
Task Fit	0.832	0.888	0.665	**0.816**					
Business Process Fit	0.940	0.952	0.769	0.434	**0.877**				
Cost Fit	0.916	0.947	0.857	0.077	0.019	**0.926**			
Inter-organization Fit	0.938	0.961	0.892	0.309	0.347	-0.034	**0.944**		
Work Compatibility Fit	0.926	0.954	0.875	0.310	0.233	-0.009	0.261	**0.935**	
Actual Use	0.779	0.872	0.694	0.396	0.378	0.150	0.177	0.162	**0.833**

Note: Square roots of the AVE are the bolded diagonal values

Table 7. Confirmatory factor analysis and multicollinearity test

Scale Item	**Task**	**Process**	**Cost**	**InterOr**	**Work**	**Usage**	**VIFs**
TTF1	0.969						
TTF2	0.981						1.440
TTF3	0.966						
TTF4	0.983						
BP1		0.972					
BP2		0.989					
BP3		0.991					1.403
BP4		0.989					
BP5		0.993					
BP6		0.924					
CF1			0.988				
CF2			0.999				1.031
CF3			0.983				
IOF1				0.997			
IOF2				0.978			1.213
IOF3				0.997			
WC1					0.997		
WC2					0.997		1.152
WC3					0.98		
US1						0.986	
US2						0.988	1.290
US3						0.972	

Note: Results are presented as normalized pattern loadings and cross-loadings obtained using oblique rotation and Kaiser Normalization as reported by WarpPLS.

Table 8. Model fit and quality indices using WarpPLS

Measure	Value (Sig.)	Evaluation Criteria
Average path coefficient (APC)	0.176 (P=0.004)	Acceptable if p<0.05
Average R-squared (ARS)	0.337 (P<0.001)	Acceptable if p<0.05
Average adjusted R-squared (AARS)	0.318 (P<0.001)	Acceptable if p<0.05
Average block VIF (AVIF)	1.325	Acceptable if <= 5, ideally <= 3.3
Average full collinearity VIF (AFVIF)	1.255	Acceptable if <= 5, ideally <= 3.3
Tenenhaus GoF (GoF)	0.516	Small >= 0.1, Medium >= 0.25, Large >= 0.36
Sympson's paradox ratio (SPR)	1.000	Acceptable if >= 0.7, ideally = 1
R-squared contribution ratio (RSCR)	1.000	Acceptable if >= 0.9, ideally = 1
Statistical suppression ratio (SSR)	1.000	Acceptable if >= 0.7
Nonlinear bivariate causality direction ratio (NLBCDR)	0.800	Acceptable if >= 0.7

Benchmarks are those cited by Kock [59]

Table 9. Additional Model it indices using SPPS AMOS 23.0

Goodness of Fit Indices Measure	Recommended Value	The Study Model
Chi-Square CMIN	N/A	161.738
Degree of freedom	N/A	88
X2/d.f - chi-square to the degrees of freedom, Bentler and Bonnet (1980)[60]	<5 is preferred	1.838
Comparative Fit Index (CFI), Hair et al. (2014)[36]	>0.90 is desirable	0.952
Standardized Root Mean Square Residual (SRMR), Hu and Bentler, 1999[61]	<0.08 is desirable	0.044
Root Mean Square Error of Approximation (RMSEA), Hair et al. (2014)[36]	<0.08 is adequate	0.068

Fig. 4 presents the structural relationships between the study variables and the standardized path coefficients with their respective significance levels. The model accounts for 34% of the observed variance in cloud computing services usage. The path coefficients and path significance are also shown in Table 10. With the exception of the path from work compatibility (P2), all the other path coefficients in the model were significant.

Assessing the structural model using PLS-SEM uses four key components namely the significance of the path coefficients, the level of the R-squared (R2) values, the f^2 effect size and the predictive relevance Q-squared (Q2).

Table 10: Path estimates for the model relationships

Propositions	Path	Coefficient	p-value	f^2 Effect Size	Decision
P1	Task⇨Use	0.364	<0.001	0.181	Supported
P2	Work Compatibility⇨Use	0.032	0.334	0.006	Not Supported
P3	Processes⇨Use	0.144	0.024	0.056	Supported
P4	Inter-organization⇨Use	0.129	0.039	0.050	Supported
P5	Cost⇨Use	0.212	0.002	0.045	Supported

R-Squared value for the Actual Use of cloud computing services is 0.337. R-Squared values are considered substantial for values above 0.67, and moderate for values 0.33-0.67 [62], hence the model has reasonably explained the variance in Actual Use of cloud computing by the study MSEs. For predictive validity of a model, Stone-Geisser Q-Squared is considered an acceptable indicator. A value greater than zero indicates validity, and higher value indicates better predictive power [62], [63]. The current study model Q-Squared value of 0.336 indicates a good predictive validity for the study model.

5. Discussion

Cloud computing services are quickly changing the way small businesses use and adopt ICTs. The number of MSEs adopting cloud computing services is increasing every day as cloud-based services helps the MSEs to overcome the constraint of limited ICT infrastructure budget. MSEs have inadequate financial and human resources and their choice of cloud computing adoption could be dependent on a strong need to have a technology that can accomplish a specific business task. This made it necessary for this study not to investigate and test the study model using a single cloud computing service offering, such as IaaS or PaaS, but to assess the fit between the MSE's organizational ICT infrastructure needs and any cloud computing services the MSE have deployed and how this fit influences the adoption of that particular cloud computing service. Consequently, the study results could guide any MSE in making future decision on adoption of cloud computing services. The study findings indicate that cloud computing services fit the MSEs' information processing needs, tasks technology requirements, inter-organizational support requirements and their prices are within the existing MSEs' ICT budgets.

The results of the data analysis show that, Task Fit (Task Technology Fit) has a significant positive effect on utilization which supports prior findings by McCarthy and Claffey [64] where Task Technology Fit is shown to lead to Information Systems utilization. This result provide evidence that the study model proposition 1 holds. That is, if there is a fit between the MSEs' information processing tasks' requirements and the cloud computing functionalities, MSEs will adopt the cloud computing services. Therefore, MSEs use cloud computing because they match their task technology requirements. In contrast to Zabukovsek and Bobek [15], this study did not find any significant relationship between Work Compatibility and usage and hence proposition 2 is not supported by the study data. In this case, using cloud computing services in MSEs is not influenced by the employees' attitude towards the cloud computing services. This is usually noted in studies involving mandatory use of a technology in the work environment such as Chang et al. [65], Wright et al. [66], and Ward et al. [67] where the employee is required to use a specific technology to fulfill their employment obligations rather than to match their personal preferences or habits. The study findings are also consistent with Gribbins et al. [10], Zabukovsek and Bobek [15], Dasa and Narasimhan [68], and Nah et al. [69], by showing that the fit between the MSEs' business processes and the cloud computing functionalities have a notable influence upon cloud computing services usage. This confirms proposition 3, that when the cloud computing services capabilities fit the MSEs' business processes requirements, MSEs will certainly adopt the cloud service.

The study findings also collaborate the importance of inter-organization factors in technology adoption. As with Stock and Tatikonda [7], the findings show that inter-organization fit is very important to any organizational external technology integration success, thus validating proposition 4. That is, the level of inter-organizational relationship (the relationship between the cloud computing vendor and the customer MSE) determines acceptance of the cloud-based services. Based on the analytical results, the study also found that cost fit is an influential factor of cloud computing usage. This is consistent with the results of previous studies on ICTs and cloud computing adoption which show that cost is a factor influencing adoption of ICT services by individuals and organizations [38], [70], [71], [72] and [73]. Use of cloud computing services by the MSEs provides significant financial savings in the MSEs' ICT infrastructure budgets and hence there exists a fit between the financial resources available to procure the required MSEs' ICT infrastructure and the cost of acquiring cloud computing services. This validates proposition 5, that the match between the organizational ICT infrastructure budget and the cloud computing service costing models determines the MSEs choice to adopt the cloud-based services. The results of the study propositions testing provide the evidence that different "Fit" influence the use of cloud computing services in the Kenyan MSEs.

6. Conclusion

In this study, the primary focus was to assess the fit between the MSE's organizational ICT infrastructure needs and the cloud computing services and how this fit influences the adoption of cloud computing services to support the MSEs' business processes. This was validated using the study model which identified and tested five propositions on the suitability of cloud computing services in meeting MSEs' ICT needs and hence determining the adoption of cloud computing by MSEs. The propositions one and three indicate that MSEs will adopt a cloud-computing-based service if the provided cloud service has the requisite functionalities to perform the MSEs' information processing task. By matching the cloud computing capabilities to the MSEs' information processing tasks, MSEs can leverage the best of what the CCS providers has to offer to meet their ICT business needs. Cloud computing technical complexities can be very challenging because of the limited ICT skills in most of the MSEs. Therefore, most MSEs require guaranteed support by their CCS providers. Proposition 4 tested and validated the important role of inter-organizational relationship in the adoption of the CCS by the MSEs. Most MSEs have meagre financial resource and the process of budgeting capital expenses for additional hardware and software every eighteen months is not possible. But with cloud computing, the MSEs will only incur recurring and consistent operational expenses. Using proposition 5, the study established that the fit between the MSEs' ICT budget and the cloud computing costing models will lead to CCS adoption.

The study enhances both the practical and theoretical understanding of the fit dimensions between the MSE's organizational ICT infrastructure needs and the cloud computing services and how this fit influences the adoption of cloud computing services to support the MSEs' business objectives. As implied by the study model, the utilization of cloud computing services is related to the good fit between the MSEs' ICT infrastructure needs and how the cloud computing services fulfills this need. The study model provides good prediction of Actual Use of cloud computing services among the MSEs. The findings provide a foundation for further development and refinement of the model to study the fit between the MSE's organizational ICT needs and the cloud computing services and how this fit influences the adoption of cloud computing services to support the MSEs' business objectives. The study has also presented a picture of the current cloud computing services adopted by the MSEs in Kenya. Therefore, the study is a starting point for investigating fit between the MSE's organizational ICT needs and the cloud computing services.

From a practitioner standpoint, the study model will help the MSEs to leverage cloud computing services by identifying the match between the ICT needs and the cloud computing functionalities on offer. This will help the MSEs to maximise on the benefits of cloud computing services.

From an academic perspective, the study's contribution is in the development and testing of the fit model. This model could be integrated with other models or models' variables to improve on its exploratory power. The study also contributes to the understanding the use of cloud computing in small enterprises in developing countries. Further research is needed to test the presented model in empirical research to prove factors affecting adoption or intention to adopt or continuance intentions of cloud computing services in MSEs.

The study has certain limitations which provide opportunities for further study and research. As the study was a case of Kenya, the proposed model gives the most influential determinants of cloud computing usage by the Kenyan MSE's. Further studies in other developing countries could be used to test the validity of the proposed model and to provide a multi-case comparison of results. Future research should also examine the role of organization size and the years of operations on the adoption of cloud computing services among MSEs as these two variables have been studied in in the past and their impact on organizational ICT adoption documented. The study is also limited in that the study population was the MSEs in Nairobi. Therefore, there is a need to conduct similar study for the MSEs operating in rural areas where other factors such as lack of broadband connectivity could influence cloud computing services adoption. The study also considered cloud computing services as a whole and did not look at a specific service or model. Future studies could be done to validate the study model by testing the adoption of a specific cloud-based service, a service model or even a deployment model by the MSEs.

References

[1] Government of Kenya (GOK), "The Micro and Small Enterprises Act 2012," *Kenya Gazette Supplement No. 219 (Acts No.55)*, Government printer, Nairobi, Kenya, 2012.

[2] The National Economic and Social Council of Kenya (NESC) (2007, July 23). *Kenya Vision 2030, a competitive and prosperous nation* [Online]. Available http://www.nesc.go.ke.

[3] Z. Kirori, and M. Achieng, "Assessing the Readiness by SMEs and Financial Institutions in the Establishment of an Integrated ICT Infrastructure for Financial Transactions in Kenya," *International Journal of Intelligent Information Systems,* vol. 2, no. 2, pp. 40-45, 2013.

[4] S. Haag, and M. Cummings, *Management Information Systems for the Information Age* 8th Ed., New York, USA: McGraw-Hill/Irwin, 2010.

[5] L. Wang, G. Laszewski, A. Younge, X. He, M. Kunze, J. Tao, and C. Fu, "Cloud Computing: A Perspective Study," *New Generation Computing*, vol. 28, issue 2, pp. 137-146, 2010.

[6] A. K. Hosseini, D. Greenwood, and I. Sommerville, "A Case Study of Migrating an Enterprise IT System to IaaS," in *IEEE 3rd International Conference on Cloud Computing Cloud Migration*, Miami, Florida, USA, 2010, pp. 450-457.

[7] D. L. Goodhue, and R. L. Thompson, "Task-technology fit and individual performance," *MIS Quarterly*, vol. 19, no. 2, pp. 213-236, 1995.

[8] J. R. Galbraith, *Organization Design*, Reading, Massachusetts, USA: Addison Wesley Publishing Company, 1977.

[9] G.N. Stock, and M.V. Tatikonda, "The joint influence of technology uncertainty and interorganizational interaction on external technology integration success," *Journal of Operations Management*, vol. 26, no. 1, pp. 65-80, 2008.

[10] M. Gribbins, C. Subramaniam, and M. Shaw, "Process-Technology Fit: Extending Task-Technology Fit to Assess Enterprise Information Technologies," in *27th International Conference on Information Systems*, Milwaukee, Wisconsin, USA, 2006, pp. 61-70.

[11] N. Venkatraman, "The concept of fit in strategy research: Toward verbal and statistical correspondence," *Academy of Management Review,* vol. 14, no. 3, pp. 423-444, 1989.

[12] I. A. Junglas, and R.T. Watson, "Location-based services," *Communications of the ACM*, vol. 51 no. 3, pp. 65-69, 2008.

[13] C.C. Lee, H. K. Cheng, and H. H. Cheng, "An empirical study of mobile commerce in insurance industry: task-technology fit and individual differences," *Decision Support Systems*, vol. 43 no. 1, pp. 95-110, 2007.

[14] T.C. Lin, and C. C. Huang, "Understanding knowledge management system usage antecedents: an integration of social cognitive theory and task technology fit," *Information & Management*, vol. 45 no. 6, pp. 410-417, 2008.

[15] S. S. Zabukovsek, and S. Bobek, "TAM-based external factors related to ERP solutions acceptance in organizations," *International Journal of Information Systems and Project Management,* vol. 1, no. 4, 25-38, 2013.

[16] A. Rahimli, "Factors influencing organization adoption decision on cloud computing," *International Journal Cloud Computing Services Science*, vol. 2, no. 2, pp. 140-146, 2013.

[17] M. Carroll, A. Van der Merwe, and P. Kotze, "Secure cloud computing: Benefits, risks and controls," *Proceedings of the 2011 Information Security for South Africa* (ISSA 2011), Johannesburg, South Africa, August 15-17, 2011.

[18] G. Chao, A. Peng, A. Dutta, and A. Choudhary, "Exploring Critical Risks Associated with Enterprise Cloud Computing", in *Cloud Computing*, V. C. M. Leung and M. Chen, Eds. Cham, Switzerland: Springer International Publishing, 2014, vol. 133, pp. 132-141.

[19] H. Gangwar, H. Date, and R. Ramaswamy, "Understanding determinants of cloud computing adoption using an integrated TAM-TOE model," *Journal Enterprise Information Management*, vol. 28, no. 1, pp. 107-130, February, 2015.

[20] Tornatzky, and M. Fleischer, *The process of technology innovation*, Lexington, Massachusetts, USA: Lexington Books, 1990.

[21] H. C. Looi, "E-Commerce Adoption in Brunei Darussalam: A Quantitative Analysis of Factors influencing Its Adoption," *Communications of the Association for Information Systems*, vol. 55, pp. 61-81, 2005.

[22] N. Phaphoom, X. Wang, S. Samuel, S. Helmer, and P. Abrahamsson, "A Survey Study on Major Technical Barriers Affecting the Decision to Adopt Cloud Services," *Journal System Software*, vol. 103, pp. 167-181, 2015.

[23] M. Lynch. (2008, May 28). *The Cloud Wars: $100+ billion at stake* [Online]. Available: http://web2.sys-con.com/node/604936.

[24] Cloud Security Alliance. (2009, December). *Security Guidance for Critical Areas of Focus in Cloud Computing* [Online]. Available: https://cloudsecurityalliance.org/csaguide.pdf

[25] A. Goscinski and M. Brock, "Toward dynamic and attribute based publication, discovery and selection for cloud computing," *Future Generation Computer Systems*, vol. 26, no. 7, pp. 947-970, 2010.

[26] H. Gangwar, H. Date, and R Ramaswamy, "Understanding determinants of cloud computing adoption using an integrated TAM-TOE model," *Journal of Enterprise Information Management*, vol. 28, issue 1, pp.107-130, 2015.

[27] M. Haddara, and A. Elragal, "ERP adoption cost factors identification and classification: a study in SMEs," *International Journal of Information Systems and Project Management*, vol. 1, no. 2, 5-21, 2013.

[28] M. Carcary, E. Doherty, and G. Conway, "The Adoption of Cloud Computing by Irish SMEs – an Exploratory Study," *The Electronic Journal Information Systems Evaluation*, vol. 17, issue 1, pp. 3-14, 2014.

[29] D. Truong, "How Cloud Computing Enhances Competitive Advantages: A Research Model for Small Businesses," *The Business Review*, vol. 15, no.1, pp. 59-65, 2010.

[30] J. Elsonand, and J. Howell, "Refactoring Human Roles Solves Systems Problems," in *Workshop on Hot Topics in Cloud Computing*, HotCloud, USENIX Association, Berkeley, CA, 2009, pp. 100-107.

[31] G. Feuerlicht, and S. Govardhan, "Impact of cloud computing: beyond a technology trend," *The Proceedings of the International Conference on Systems Integration*, Oeconomica, Prague, Czech Republic, June 8-9, 2010, pp. 1-8.

[32] P. Banerjee, "An intelligent IT infrastructure for the future," Proceedings of 15th *International Symposium on High-Performance Computer Architecture*, HPCA, Raleigh, NC, USA, February 2009, pp. 14-18.

[33] N. Kshetri, "Cloud Computing in the Global South: Drivers, Effects and Policy Measures," *Third World Quarterly*, vol. 32, no. 6, pp. 997-1014, 2011.

[34] O. Ferreira, and F. Moreira, "Cloud Computing Implementation Level in Portuguese Companies," CENTERIS 2012-Conference on ENTERprise Information Systems/ HCIST 2012-*International Conference on Health and Social Care Information Systems and Technologies*, Procedia Technology 5, pp. 491-499, 2012.

[35] D. A. Abubakar, J. Bass and I. Allison, "Adoption Issues for Sub-Saharan African SMEs," *Electronic Journal of Information Systems in Developing Countries*, vol. 62, no. 1, pp. 1-17, 2014.

[36] R. Bose, and V. Sugumaran, "Challenges for Deploying Web Services-Based EBusiness Systems in SMEs," *International Journal of E-Business Research*, vol. 2, no. 1, pp. 1-18, 2006.

[37] J. Vijeikis, and A. Makstutis, "Small and Medium Sized Business Competitiveness in Lithuania," *Economy and Management: Issues and Perspectives*, vol. 2, no. 15, pp. 328-338, 2009.

[38] G. Boss, P. Malladi, D. Quan, L. Legregni, and H. Hall. (2007, June). *Cloud Computing* [Online]. Available: http://ww.ibm.com/developerworks/websphere/zones/hipods/

[39] A. Khajeh-Hosseini, I. Sommerville, and I. Sriram. (2010, May). *Research Challenges for Enterprise Cloud Computing* [Online]. Available: http://arxiv.org/ftp/arxiv/papers/1001/1001.3257.pdf

[40] Uhasibu [Online] Available: https://www.uhasibu.co.ke/

[41] Angani [Online] Available: https://www.angani.co/

[42] M. Armbrust, A. Fox, R. Griffith, A. D. Joseph, R. Katz, A. Konwinski, G. Lee, D. Patterson, A. Rabkin, I. Stoica, and M. Zaharia, "A view of cloud computing," *Communications of the ACM*, vol. 53, pp. 50-58, 2010.

[43] L. Youseff, M. Butrico, and D. da Silva, "Toward a Unified Ontology of Cloud Computing," in *Grid Computing Environments Workshop* (GCE '08), Austin, Texas, USA, November 2008, pp. 1-10.

[44] J. Ankeny, "Heads in the cloud," *Entrepreneur*, vol. 39, no. 10, pp. 50-51, 2011.

[45] L. Klie, "SMB hosted CRM market set to triple by 2015," *CRM Magazine*, vol. 15, no. 12, pp. 16, 2011.

[46] S. Mahesh, B. J. L. Landry, T. Sridhar, and K. R. Walsh. "A decision table for the cloud computing decision in small business," *Information Resources Management Journal*, vol. 24, no. 3, pp. 9-25, December, 2011.

[47] T. Voith, K. Oberle, and M. Stein, "Quality of service provisioning for distributed data center inter-connectivity enabled by network virtualization," *Future Generation Computer Systems*, vol. 28, no. 3, pp. 554-562, March, 2012.

[48] M. Miller, "*Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online*. Indianapolis, USA: Que Publishing, 2009.

[49] Access Kenya [Online]. Available: http://www.accesskenya.com/index.php/media-centre/news/156-accesskenya-to-resell-seacoms-cloud-services.html.

[50] K. K. K. Wong, "Partial least squares structural equation modeling (PLS-SEM) techniques using SmartPLS," *Marketing Bulletin*, vol. 24, pp. 1-32, 2013.

[51] J. F Hair, G. T. M. Hult, C. M. Ringle, and M. Sarstedt, A *Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)*. Thousand Oaks, CA, USA: Sage, 2014.

[52] W. W. Chin, "How to write up and report PLS analysesm," in *Handbook of partial least squares: Concepts, methods and applications*, V. V. Esposito, W. W. Chin, J. Henseler, and H. Wang (Eds.), Berlin, Germany, Springer-Verlag, 2010, pp. 655-690.

[53] R. Bates, S. Kauffeld, and E. F. III, Holton, "Examining the factor structure and predictive ability of the German-version of the learning transfer system inventory," *International Journal of Training and Development*, vol. 31, no. 3, pp. 195-211, 2007.

[54] C. Fornell, and D. F. Larcker, "Evaluating structural equation models with unobservable variables and measurement error," *Journal of Marketing Research*, vol. 18, no. 1, pp. 39-50, 1981.

[55] J. Stevens, *Applied Multivariate Statistics for the Social Sciences*, 4th Ed. Mahwah, NJ, USA: Lawrence Erlbaum Associates, 2002.

[56] R. Goffee, and G. Jones, *"What holds the modern company together?,"* Harvard Business Review, vol. 74, no. 6, pp. 133-48, 1996.

[57] J. C. Nunnally, and I. H. Bernstein, *Psychometric theory*, 3rd Ed., New York, USA: McGraw-Hill, 1994.

[58] W. W. Chin, B. L. Marcolin, and P. R. Newsted, "A Partial Least Squares Latent Variable Modeling Approach for Measuring Interaction Effects: Results from a Monte Carlo Simulation Study and an Electronic-Mail Emotion/Adoption Study," *Information Systems Research,* vol.4, no. 2, pp. 189-217, 2003.

[59] N. Kock, WarpPLS 5.0. *User Manual*. Laredo, Texas: Script Warp Systems, 2015.

[60] P. M. Bentler, and D.G. Bonett, "Significance tests and goodness of fit in the analysis of covariance structures," *Psychological Bulletin*, vol. 88, no. 3, pp. 588-606, 1980.

[61] L. Hu and P. M. Bentler, "Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives," *Structural Equation Modeling*, vol. 6, no. 1, pp. 1-55, 1999.

[62] D. X. Peng, and F. Lai, "Using partial least squares in operations management research: A practical guideline and summary of past research," *Journal of Operations Management*, vol. 30, no. 6, pp. 467-480, 2012.

[63] P. Duarte, and M, Raposo, "A PLS model to study brand preference: An application to the mobile phone market," in *Handbook of Partial Least Squares*, V. E. Vinzi, W. W. Chin, J. Henseler, and H. Wang, Eds., Berlin, Germany: Springer Berlin Heidelberg, 2010, pp. 449-485.

[64] R. V. McCarthy and G. F. Claffey, "Task-Technology Fit in Data Warehousing Environments: Analyzing the Factors that Affect Utilization," *Journal of International Technology and Information Management*, vol. 14, no. 4, article 4, pp. 45-60, 2005.

[65] E. K. Chang, R. P. Victor, D. R. Sherry, and A. W. Yu, "A Model for Mandatory Use of Software Technologies: An Integrative Approach by Applying Multiple Levels of Abstraction of Informing Science", *Informing Science: The International Journal of an Emerging Transdiscipline,* vol. 13, pp.1-27, 2010.

[66] P. M. Wright, K. M. Kacmar, G. C. McMahan, and K. Jansen, "Impact of information technology on employee attitudes: A longitudinal field study," *(CAHRS Working Paper #97-11)*. Ithaca, NY: Cornell University, School of Industrial and Labor Relations, Center for Advanced Human Resource Studies, 1997.

[67] K.W. Ward, S. A. Brown, and A. P. Massey, "Organisational influences on attitudes in mandatory system use environments: a longitudinal study," *International Journal of Business Information Systems*, vol. 1, nos. 1/2, pp. 9-30, 2005.

[68] A. Dasa, and R. Narasimhan, "Process-technology fit and its implications for manufacturing performance," *Journal of Operations Management,* vol. 19 pp. 521-540, 2001.

[69] F. F. Nah, X. Tan, and S. H. Teh, "An Empirical Investigation on End-Users' Acceptance of Enterprise Systems," *Information Resource Management Journal*, vol. 17, no. 3, pp. 32-53, 2004.

[70] A. Aljabre, "Cloud computing for increased business value," *International Journal of Business and Social Science*, vol. 3, no.1, pp. 234-239, 2012.

[71] P. K. Wamuyu "The Impact of Information and Communication Technology Adoption and Diffusion on Technology Entrepreneurship in Developing Countries: The Case of Kenya," *Information Technology for Development,* vol. 21, issue 2, pp. 253-280, 2015.

[72] P. Geczy, N. Izumi, and K. Hasida, "Cloud Sourcing: managing cloud adoption," *Global Journal of Business Research,* vol. 6, no. 2, pp. 57-70, 2012.

[73] S. Marston, Z. Li, S. Bandyopadhyay, J. Zhang, and A. Ghalsasi, "Cloud computing-the business perspective," *Decision Support Systems*, vol. 51, no. 1, pp. 176-189, 2011.

Appendix 1: The Survey questionnaire

Section A

Firm size

- Business Sector (Manufacturing, Trade, Service, Construction)
- The number of employees
- Annual business volume

Cloud Computing Adoption

- Which organizational cloud computing services have you adopted (Specify the particular services in each of the following categories)
    - Infrastructure (IaaS)
    - Platforms (PaaS)
    - Software (SaaS
    - Others (XaaS)

Section B (All items are based on 5-point scale)

Task-Technology Fit (Direct Measures)

- TTF1: Cloud computing services are well suited for our MSE's daily routine tasks.
- TTF2: Cloud computing services fit well our MSE's business tasks.
- TTF3: Using cloud computing allows the employees to perform their specific tasks more quickly
- TTF4: Cloud computing services are well suited for the MSEs' ICT needs.

Work Compatibility (Direct Measures)

- WC1: The use of cloud computing is compatible with the way I worked before.
- WC2: The use of cloud computing is compatible with my style of work.
- WC3: Using cloud computing is compatible with the MSEs' job culture and value system.

Business Process Fit (Direct Measures)

- BPF1: Within the MSE there are the necessary skills to implement cloud computing services.
- BPF2: The use of cloud computing is fully compatible with current MSE's business operations.
- BPF3: Cloud computing technology has improved the efficiency between the MSE's business processes.
- BPF4: Cloud computing technology has improved the MSE's business processes.

- BPF5: The use of cloud computing services has improved the quality of the MSE's business operations.
- BPF6: The use of cloud computing is compatible with existing hardware and software in the MSE.

Inter-organization Fit (Direct Measures)

- IOF1: The cloud computing service providers have considerate user support models and pricing, providing an end-to-end continuity plan.
- IOF2: The cloud computing service providers have frequent interactions with the MSEs for the management of the services and its operations.
- IOF3: The cloud service provider is flexible in providing service levels in line with the MSE's requirements.

Cost Fit (Direct Measures)

- CF1: The benefits of cloud computing are greater than the costs of adoption.
- CF2: Cloud computing costs Fits the enterprise's annual ICT budget costs.
- CF3: Cloud computing technology has reduced the annual ICT Maintenance costs.

Biographical notes

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Patrick Kanyi Wamuyu is an Assistant Professor of Information Technology at United States International University-Africa, Nairobi, Kenya. He has a Ph.D. in Information Systems and Technology from the University of KwaZulu-Natal, Durban, South Africa and a Postdoc from Indian Institute of Information Technology, Allahabad. His current research interests include: Information and Communication Technologies for Development (ICT4D), E-business Infrastructures, ICT Innovations and Entrepreneurship, E-Participation, Text and Social Analytics and Databases.

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