CUSTOMER KNOWLEDGE MANAGEMENT ANTECEDENT FACTORS FOR ENTERPRISE SOFTWARE QUALITY

ARASH KHOSRAVI

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Dedicated to my beloved family

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ABSTRACT

Customer Knowledge Management (CKM) plays an important role in the production of high quality software products. Previous studies have only focused on the technical aspects of software quality. However, because of the nature of enterprise software, there is a greater dependence on CKM for customization, enhancement, maintenance, and training. As CKM in Enterprise Software (ES) development is still immature, this raises questions on how CKM can help ES development companies to improve their software quality. In this research, Knowledge-Based View (KBV) and Theory of Technology were used to demonstrate the Organizational, Human, and Technological antecedent factors that enable the CKM process and lead to ES quality. Human, Organizational and Technological CKM antecedent factors were identified from the literature. The importance degree of each factor was determined by experts from ES development companies using Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS). Moreover, based on high priority factors, a theoretical model was developed. The proposed model was evaluated by distributing a survey questionnaire to decision-makers in ES development companies. With 164 valid questionnaires received, the collected data was analyzed using the Partial Squares Structural Equation Modelling (PLS-SEM) technique. The results show that Customer Involvement together with Senior Management Support were the most influential factors. There was no impact from Organizational Training, Customer Knowledge Map, and CKM Strategy Development. The results revealed that the impact of CKM on software quality is significant. The model developed in this research can be used as a guideline for the successful application of CKM in enterprise software development companies to improve the software quality.

ABSTRAK

Pengurusan Pengetahuan Pelanggan (CKM) memainkan peranan yang penting dalam menghasilkan produk perisian yang berkualiti tinggi. Penyelidikan terdahulu yang telah dijalankan hanya memfokuskan aspek teknikal produk perisian. Namun begitu, disebabkan sifat semula jadi perisian perusahaan maka terdapat kebergantungan yang lebih tinggi terhadap CKM untuk penyesuaian, penambahbaikan, penyelenggaraan dan latihan. CKM adalah masih muda dalam pembangunan Perisian Perusahaan (ES) maka ini, menimbulkan persoalan tentang bagaimana CKM boleh digunakan untuk membantu syarikat-syarikat yang membangunkan perisian perusahaan bagi meningkatkan lagi kualiti perisian. Dalam kajian ini Pandangan Berasaskan Pengetahuan (KBV) dan Teori Teknologi digunakan untuk menunjukkan faktor yang efektif tentang Organisasi, Manusia dan Teknologi membolehkan proses CKM dan membawa kepada ES yang berkualiti. Faktor yang efektif tentang Manusia, Organisasi dan Teknologi CKM telah dikenal pasti melalui literatur. Tahap dan keutamaan setiap faktor telah ditentukan oleh pakar dalam syarikat-syarikat pembangunan ES menggunakan Teknik Tertib Keutamaan dengan Persamaan bagi Penyelesaian Unggul (TOPSIS). Selanjutnya, berdasarkan faktor yang mempunyai keutamaan tinggi, sebuah model teori telah dibangunkan. Model yang dicadangkan itu telah dinilai dengan mengedarkan kajian soal selidik kepada pembuat keputusan dalam syarikat pembangunan ES. Terdapat 164 buah soal selidik yang sah dan data yang dikumpul dianalisis menggunakan teknik Pemodelan Persamaan Separa Persegi Terkecil (PLS-SEM). Hasil analisis menunjukkan bahawa Penglibatan Pelanggan dengan Sokongan Pengurusan Kanan menjadi faktor yang paling berpengaruh. Tidak terdapat kesan daripada Latihan Organisasi, Peta Pengetahuan Pelanggan, dan Pembangunan Strategi CKM. Hasil kajian menunjukkan bahawa kesan CKM ke atas kualiti perisian adalah penting. Model yang dibangunkan dalam kajian ini boleh digunakan sebagai garis panduan bagi pelaksanaan CKM yang berjaya dalam syarikat-syarikat pembangunan perisian perusahaan bagi meningkatkan kualiti perisian.

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LIST OF SYMBOLS AND ABBREVIATIONS

AISeL	-	Association for Information System
CVI	-	Content Validity Index
CK	-	Customer Knowledge
CKM	-	Customer Knowledge Management
CRM	-	Customer Relationship Management
ERP	-	Enterprise Resource Planning
ES	-	Enterprise Software
ELECOMP	-	Exhibition of Electronic, Computer & E-Commerce
IS	-	Information System
IT	-	Information Technology
IEC	-	International Electro Technical Commission
ISO	-	International Organization for Standardization
ISNA	-	Iranian Students' News Agency
KM	-	Knowledge Management
KBV	-	Knowledge-Based View
MCDM	-	Multi Criteria Decision Making
PLS	-	Partial Least Squares
β	-	Path Coefficients
RBV	-	Resource-Based View
SQ	-	Software/ System quality
SEM	-	Structural Equation Modeling
SCI	-	Supreme Council of Informatics
SLR	-	Systematic Literature Review
TOPSIS	-	Technique for order of Preference by Similarity to Ideal Solution
CTO	-	The Computer Trade Organization
VIF	-	Variance Inflation Factor

CHAPTER 1

INTRODUCTION

1.1 Overview

Customer Knowledge (CK) is increasingly important for company competitiveness. Consequently, research on Customer Knowledge Management (CKM) is rapidly increasing. (Korhonen-Sande and Sande, 2016; Wang, 2015; Rollins et al., 2012). Customer Knowledge Management (CKM) helps companies leverage their unique Customer Knowledge (CK) to improve new product performance, enhance product\service quality, and cut costs (Korhonen-Sande and Sande, 2016; Salojärvi et al., 2013; Rollins et al., 2012). However, companies desiring to develop a well-functioning CKM face challenges (Korhonen-Sande and Sande, 2016; Wang, 2015; Rollins et al., 2012). In particular, there is a lack of research on how company should deploy Human, Organizational and Technological conditions to manage CK and become more responsive to customer needs (Korhonen-Sande and Sande, 2016; Salojärvi et al., 2013; Garrido-Moreno and Padilla-Meléndez, 2011).

Given an unpleasant past of substandard solutions and technology fiascos, several companies have a tough time defending CKM initiatives in the current business environment. Several researchers have addressed the dearth of an assimilated and all-inclusive framework from a CKM perspective. Attafar et al. (2013) stated that, in Iran, less than 50 percent of the manufacturing companies always or often utilize instruments to assess the external environment, as well as to evaluate and acquire knowledge from consumers. Only 25 percent of Iranian companies methodically

conducted a customer knowledge absorbing process. Around 50 percent of the business entities do not typically engage in any CKM. (Attafar et al., 2013). A survey pointed out that customer knowledge was mentioned as the most significant kind of knowledge (97 percent) that aids business entities to effectively act. (Aghamirian et al., 2015). As software development is a very knowledge intensive task (Patil and Bamnote, 2015), the design and development of innovative, high quality Enterprise Software (ES) such as Microsoft Dynamics CRM requires sufficient CK (Schaarschmidt et al., 2015; Vaezitehrani, 2013). Therefore, companies should thoroughly analyze underlying customer characteristics to deepen their knowledge regarding how to satisfy customer needs and desires, as well as to enhance customer satisfaction and corporate performance (Tseng, 2016).

Today, consumers seek thorough and complete solutions (Schaarschmidt et al., 2015). The manufacturing of custom-made products entails precise knowledge regarding (and from) the customer. This is particularly vital in terms of value creation for software engineering (Aho and Uden, 2013). Lingering issues in software development include unfulfilled user needs, disparities in user requirements, and systems unsuccessful in meeting the expectations of consumers.(Schaarschmidt et al., 2015). CK integration enhances software development effectiveness (Tiwana, 2004). In addition, users prefer and expect to pay premiums for high quality products. Hence, the priority factors that determine competitive advantage has also changed from cost to quality (Aho and Uden, 2013). To achieve high quality products, software developers must acquire and use knowledge regarding customer needs or otherwise risk software failures because they do not satisfy end users (Kannabiran and Sankaran, 2011). Furthermore, it is simply not enough to identify customers in terms of interests, future needs or behavior analysis regarding software use are also required (Aho and Uden, 2013). This is because, over the course of time, the software industry has acknowledged that successful innovation requires a synthesis of knowledge from various perspectives. Hence, CK has become an indispensable component for encouraging product innovation and enhancing product quality (Zogaj and Bretschneider, 2012). However, there is a risk that the produced software will not satisfy end user needs (Korhonen-Sande and Sande, 2016; Aho and Uden, 2013).

1.2 Background of Study

Although a few studies have been conducted regarding the effect of organizational factors on software quality, there is still a fundamental need for researchers to focus more on investigating Customer Knowledge Management (CKM) success factors to improve software quality in enterprise software development for reasons that will be elaborated in the following section.

First, compared to the other types of software, the quality of Enterprise Software (ES) is vital and the sales of ES include products and services which are associated with it (Cho et al., 2013). ES requires related services such as installation, customization, maintenance (repair and updates), training, and routinization (Sarrab and Rehman, 2014; Cho et al., 2013). These related services need customer and end user comments, feedback, suggestions, complaints, and experiences regarding software utilization (Knowledge from customers). Customization needs knowledge about customers to suggest the best solution. The final goal of CKM is to have a steady and long-term relationship with customers in order to turn them into trade partners. Therefore, customers expect from software companies a continuous relationship that informs them of software updates, bugs, and new versions. They also expect continuous training (Knowledge for customers). The process of ES adoption requires long-term organizational and financial commitments (Cho et al., 2013). Compared to other types of software products, the support services of ES are unique. If ES development companies invest more in software development, then the quality of the ES will improve, which can reduce the cost of service delivery. For example, as the capability, scalability and flexibility of the ES increases, it will cost less to customize enterprise systems to meet customer's needs. Thus, investigation on enhancing software quality is much demanded in the enterprise software development industry.

Second, many previous studies in software quality enhancement have focused only on the technical aspects of software quality such as reliability, maintainability, and functionality. However, because of the nature of enterprise software, the transfer and integration of customer knowledge for customization, enhancements, maintenance and training is required (Schaarschmidt et al., 2015; Cho et al., 2013). Customers are

one of the most important stakeholders in any project (Association for Project Management, 2006). There is no doubt that appropriate communication and collaboration with customers in different phases of the ES development project can help in increasing the overall satisfaction of customers and the overall success of an entire project (Schaarschmidt et al., 2015). For software development projects in particular, there are four key aspects for CKM, which are: improvement of customer relationships, receiving customer feedback, collecting and utilization of customer information and more importantly, gathering and understanding of customers' requirements (Lohan, et al., 2011). CKM could be used to facilitate the reception of customer feedback, the collection and utilization of customer information as well as gathering and understanding of customers' requirements (Zhang, 2011). As the integration of CK in enterprise software development is still immature, there is a lack of theoretical frameworks to fully capture the use of CKM to improve software quality in ES. There is a fundamental need to further explore how organizational factors such as CKM can enhance ES quality.

Third, due to rapid changes in user requirement and expectation of users to develop and deliver greater volumes of high-quality products and services, customer knowledge is important to meet customer needs (Schaarschmidt et al., 2015; Kannabiran and Sankaran, 2011). There is a risk of crucial customer knowledge not reaching the intended software engineers (Aho and Uden, 2013). Furthermore, customer data, such as customer suggestions are not appropriately documented. It would seem that currently the use of customer knowledge in software development is insufficient (Aho and Uden, 2013). Most project managers in software development domain need to know the effect of customer knowledge management on software quality, and strategies and mechanisms for acquiring customer knowledge. Most project managers are not familiar with the use of customer knowledge in software project management. Using customer knowledge to improve software in software project management is still in its infancy (Yang et al., 2014). It was reported that there have been only few comprehensive studies on the factors that influence software quality and that quantitative survey-based research is lacking on the subject (Tseng, 2016; Kannabiran and Sankaran, 2011). Software quality research has focused on the technical and engineering aspects of quality control, while paying limited attention to its organizational dimensions. So are insufficient empirical studies on the management

of quality software development (Kannabiran and Sankaran, 2011). Studies related to the effect of customer knowledge on software quality are few in number.

Fourth, there are significant challenges regarded the transfer and integration of customer knowledge inside software companies. Attafar et al. (2013) reported that a lack of senior management commitment to CKM, poor communication, a lack of cultural readiness, and a lack of customer management skills are barriers to CKM (Attafar et al., 2013). The major problems facing the effective application of CKM in any company are organizational, not technical (Smith and McKeen, 2005). According to Al-Shammari and Global (2009), successful CKM requires the transformation of organizations from product–centric operations to customer centric operations. Attafar et al. (2013) noted that an important barrier to CKM is interdepartmental conflict. When internal departments operate autonomously, cooperation between such departments is limited. Thus, several likely benefits of CKM are not exploited (Garrido-Moreno *et al.*, 2014b; Khodakarami and Chan, 2014). "Some organizations shy away from customer-centricity because of corporate narcissism, i.e., a sense that we know better than our customers. Furthermore, not all companies want to hear what their customers really think of their products, services, image, and credibility. In addition, companies must be willing to actually change their behavior towards customers based on what they are told" (Gibbert et al., 2002). Moreover, Skotis et al. (2013) reported that one of the most important challenges of CKM is a lack of CK absorptive capacity in organizations.

Aho and Uden (2013) found that in software development, creating possibilities to participate and express personal opinions are key to successful development processes. Thus, systems should motivate consumers to complain, with an aim to supply better feedback to an organization. In employing a CKM system within an organization, customer information profiles should be expanded to involve non-transactional data, including general enquiries, recommendations and grievances.(Stefanou et al., 2003). Salojärvi et al. (2010) found that most companies have a tendency to absorb CK rather than use it. Salojärvi et al. (2010) noted that most companies lacked systematic processes for CKM. According to Davenport et al. (2001), the utilization of CK is a 'stumbling block' for several firms. However, the rate

of absorption and application of CKM in ES is low, for example only 27% of ES development companies that proposed products in ELECOMP 2014 (Big annual ICT exhibition in Tehran) had a CKM strategy to increase production efficiency and provide better service to customers.

Fifth, many studies in the field of Information Systems (IS) have investigated the significant factors that influence customer knowledge management. Research on the factors that enhance CKM in ES development to improve software quality improvement is one of the less explored and examined topics in IS (Kannabiran and Sankaran, 2011) . Particularly for developing countries, according to an investigation of 22 software development companies that proposed products in ELECOMP 2014 (Big annual ICT exhibition in Tehran), 63% of enterprise software development companies used CRM systems, 69% of them have no solution or guidelines for gathering customer knowledge, and only 36% of them had a solution or guidelines for the use of customer knowledge to increase the quality of products and services. 61% of them mentioned that the software production process in their companies is product-centric rather than customer centric. An inadequate theoretical framework for antecedents factors of CKM in general, and a lack of comprehensive theoretical framework for the effect of CKM on software quality in enterprise software development, reflect a fundamental need to further explore (Aho and Uden, 2013; Kannabiran and Sankaran, 2011).

1.3 Statement of the Problems

Due to the significant challenges of CKM in ES context, investigation of the Human, Organizational, and Technological factors for implementing CKM in the software development companies is lacking in the literature. There is a need to proposing a theoretical model that considers critical success factors of CKM for enhancing software quality in ES context. Therefore, the main question of this study is “How CKM can help the enterprise software development companies to improve software quality?”

In order to address the above question on this topic, the following research questions that can address the problem are identified as follows:

i. What are the antecedent factors that influence CKM in an organization?

ii. What are the high priority factors that influence CKM for ES quality improvement in enterprise software development companies?

iii. What is the research model that aims at fostering ES quality by using high priority CKM factors within the enterprise software development companies?

1.4 Objectives of the Study

The objectives of the study are:

i. To identify the antecedent factors that influence CKM in an organization.

ii. To rank the potential factors that influence CKM for ES quality improvement in the context of enterprise software development companies.

iii. To develop and validate a research model that aims at fostering ES quality by using successful CKM factors within the enterprise software development.

1.5 Scope of the Study

This study will concentrate on investigating the effects of Human, Organizational, and Technological factors on CKM to enhance ES quality in enterprise software development companies. The scope of this study is enterprise software development companies registered with the Supreme Council of Informatics (SCI) in Iran. The SCI is a high-level government body that monitors and ranks all companies active in the Iranian informatics sector.

This study concentrated on software companies that develop enterprise software such as Customer Relationship Management (CRM), Accounting Systems, and Enterprise Resource Planning (ERP). The respondents in this study are involved in decision-making and handling customer inquiries in Iranian software companies such as the Chief Customer Officer, Chief Commercial Officer, Chief Product Officer, and Chief Executive Officer who are highly knowledgeable about the management of customer knowledge and product quality. The data is collected by the questionnaire. The collected is analyzed by using Smart PLS (Partial Least Squares).

1.6 Significance of the Study

A. For practitioners:

I. This study proposes a model that can be used as a guideline for successful CKM application in ES development companies.
II. This study provides suggestions which are useful to specify various activities that are necessary for the successful implementing CKM system in enterprise software development companies. It can be considered the first step in the development of various CKM system modules.
III. It can help managers implement CKM successfully to improve product quality in software companies.

B. For researchers:

I. The Human, Organizational, and Technological factors that were extracted from the literature are theoretical contribution of this study that assists the researchers for further research on the significant effect of them in other industries and contexts.
II. This study proposes the model that can be useful as a foundation for research to improve CKM systems in enterprise software development companies in developing countries.

This study represents one of the first studies focusing on the influence of Human, Organizational, and Technological enablers on CKM and illustrates the most important CKM outputs (software quality) in enterprise software development.

1.7 Structure of the Thesis

This research is structured to provide a critical review of information related to the topic of the study. This study consists of seven chapters structured as follows:

Chapter 1 introduces the research field, research questions, research objectives, problem background, study scope, and study significance.

Chapter 2 describes the relationship between CKM and ES. CKM challenges are highlighted. The theoretical foundation of CKM is discussed. Software quality as an important outcome of CKM is highlighted.

Chapter 3 focuses on the methodology used in this study and justifies the choice and use of particular methodological approaches. The research design framework is proposed and described in detail.

Chapter 4 focuses on conducting a systematic literature review to discover CKM antecedent factors. Survey questionnaires based on TOPSIS method are distributed among ES experts to select adaptable CKM factors for ES. This chapter is finished by proposing a research model and research hypotheses.

Chapter 5 focuses on developing instruments. Measurement items were extracted from the literature for instrument development. The questionnaire was evaluated using content validity and a pilot study.

Chapter 6 is related to the main data collection of this study and the analysis approach used to test the model. It includes the assessment of the measurement model and structural model using PLS-SEM. The final model and the main outcomes of this study are presented at the end of the chapter.

Chapter 7 highlights the key findings of the study for each research objective. It also presents the implications of the research's outcomes for both academics and practitioners. The limitations of this study and opportunities for future research are provided at the end of the chapter.

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