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TOWARD A SURVEY INSTRUMENT FOR INVESTIGATING CUSTOMER KNOWLEDGE MANAGEMENT IN SOFTWARE COMPANIES

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ABSTRACT

This paper presents a method of developing an instrument for Customer Knowledge Management (CKM) in Enterprise Software (ES) development. Knowledge-Based View (KBV) and Theory of Technology in a Generic CKM framework were used to demonstrate the Organizational, Human, and Technological factors that enable the CKM process. Human, Organizational and Technological CKM enablers were identified from the literature. The weight and priority of these factors were determined by experts from the ES development companies. Based on the high priority factors, we hypothesized the constructs and develop measurement items to be validated. The measurement items are adopted from the previous validated sources. The instrument was evaluated using content validity and a pilot study. A Content Validity Index (CVI) approach was used to validate the instruments in term of relevancy and simplicity. During the content validity, the number of measurement items was reduced from 50 to 46. Moreover, the survey questionnaire of this study can be used as the foundation for the development of policy as well as strategy to enhance the probability of successful implementing the CKM.

Keywords: *Customer Knowledge Management (CKM), Customer Relationship Management, Knowledge Management, Software Quality, Content Validity Index, Pilot Study, Survey Questionnaire Development*

1. INTRODUCTION

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 (CK) is important to meet customer needs [2 ,1] . There is a risk of crucial CK not reaching the intended software engineers [3]. Most project managers in software development domain need to know the effect of Customer Knowledge Management (CKM) 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 [4]. Using customer knowledge to improve software in software project management is still in its infancy. It was reported that there have been only few comprehensive studies on the factors that impact software quality and that quantitative survey-based research is lacking on the subject [2]. Software quality research has focused on the technical and engineering aspects of quality control, while paying limited attention to its organizational dimensions.

Many studies in the field of Information Systems (IS) have investigated the significant factors that influence CKM. Research on the factors that enhance CKM in Enterprise Software (ES) development to improve software quality improvement is one of the less explored and examined topics [2]. 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 ES 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 [5] . 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 ES development, reflect a fundamental need to further explore [2, 3, 6].

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The aim of this paper is to developed valid and reliable measurement items using content validity and a pilot study. This paper is divided into the following sections. In Section 2, the theoretical foundation is reviewed. In Section 3, the instrument was developed . In section 4 the proposed instrument was validated. Section 5 presents the conclusion.

2. LITERATURE REVIEW

2.1 Customer Knowledge Management

According to Campbell [7], customer knowledge refers to the ordered and structured information pertaining to the customer driven by methodical processing. Gebert, et al. [8] offered a commonly acknowledged definition of customer knowledge: "the vigorous blend of value, experience, and perceptive information that is required, generated and imbibed during the process of transaction and interchange between the organization and customers". Gebert, et al. [9] classified customer knowledge into three main categories. The first type called "knowledge for customers" refers to knowledge about products, markets and suppliers applied to satisfy customers' knowledge needs. The second type is referred as "knowledge about customers," which is created based on the analysis of historical customers' data and information. The third type, which is known as "knowledge from customers", refers to the customers' feedbacks. Another type of customer knowledge stated by Smith and McKeen [10] is co-created knowledge. The CKM pertains to obtaining, sharing, and using the knowledge within customers for the benefit of those customers as well as the organization. It is termed as an on-going practice of creating, distributing and utilizing customer knowledge within a business entity and between a business entity and its customers.

2.2 The Generic CKM Framework

According to the Knowledge-Based View (KBV), knowledge is a distinctive resource and organizational performance relies on how well its members can improve the organization's knowledge base, assimilate various knowledge areas, and deploy the knowledge for the development of high quality and pioneering products [11, 12]. Lin [13] proposed a general framework of Knowledge Management (KM) processes which is supported by KBV. This framework involves three main aspects: Enablers, Processes and Outcomes. Lin [13] arranged Enablers into three categories which are: Human, Organizational and Technology. In this framework, Enablers are the mechanism for developing individual, organizational and technological capabilities to facilitate KM in the organization [13]. The Processes refers to the process of collecting, sharing and applying the experience, expertise, know-how, and contextual information in the organization. The Outcomes exposes the consequences of the degree of KM effectively achieved in a company's performance, innovation capability and product and service quality [13]. Salojärvi, et al. [14] follow this general framework for proposing the model for CKM. In this study based on the model developed by Lin [13], KBV and Theory of Technology proposed by Orlikowski [15], a Generic CKM Framework was proposed. This framework includes CKM enablers (Human, Organizational and Technological antecedent factors), the CKM processes (Acquisition, Storage, Sharing and Application) and the CKM outcomes. Recent studies have highlighted different outcomes for CKM such as business performance, operational performance, competitive advantages, innovation, service quality and product quality [16-20]. In the following sections, three important parts of the Generic CKM Framework (CKM enablers, CKM processes and CKM outcomes) are explained.

CKM Enablers. CKM enablers are mechanisms to activate CKM, break the obstacles of CKM, and provide Organizational, Human and Technological condition to facilitate CKM [8, 21, 22]. According to Gibbert, et al. [23], KM enablers are the crucial aspects which put the CKM ideas into practice for attaining CKM outcomes.

CKM Processes. There are four main processes involved in the CKM, with which the knowledge is employed in the organization [24]. The process begins with the phases of acquiring and storing the knowledge into the CKM system, and is followed by the phases of disseminating and using of the knowledge among the communities [24, 25]. Most of the researchers in the CKM area mentioned that CKM has four dimensions [23, 26-32]. In addition, Yang, et al. [32] measures CKM latent variable with four aspects (Acquisition, Storage, Dissemination and Utilization).

CKM Outcomes. Scholars have discussed different outcomes of CKM such as improving the efficiency of the firm's operation [33], enhancing the quality of products and service [34]. This pertains to enhancing the business entity's capability to identify customer requirements as well as the business and operational performance [3, 34].Al-Busaidi [25] found that the acquisition of customer knowledge is positively linked to the products' performance [25].

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Thus, product quality is one of the main CKM outcomes. However, the effect of CKM on product quality in the field of software development seems to be one of the less explored and examined topic.

3. INSTRUMENT DEVELOPMENT

In order to extract the CKM antecedent factors as a basis for the instrument, seven databases (AISeL, Emerald Insight, IEEE Explore, Science Direct, Scopus, Springerlink, Taylor & Francis Online) were explored. Moreover, the articles were selected by filtering the results based on title, keywords and by reading the abstract and using inclusion and exclusion criteria. Thus, 72 articles from 2002 until 2016 were selected. After reviewing these articles, 22 CKM antecedent factors were extracted. Antecedent factors were categorized to Human, Organizational and Technological factors. Technique for order of Preference by Similarity to Ideal Solution (TOPSIS) as a Multi-Criteria Decision Making (MCDM) technique is applied to find the importance level of factors regarding CKM development in the software companies. 31 experts in the ES development companies determined the weight and priority of the factors. From the experts' viewpoint, the results showed that CKM antecedent factors can be categorized into high priority and low priority groups. 11 factors from the extracted antecedent factors were in the high importance group are shown in Table 1 with its definitions.

The relationship between constructs and their related indicators is stipulated by the measurement model [41]. In this study, to develop measurement model, the recommendations of Diamantopoulos, et al. [42] were followed. Single-item indicators were used to measure respondent demographic characteristics such as gender. For construct evaluation, multiple-items with at least three observable indicators were used [43]. Multiple-item measurements are reflective or formative. Reflective measurements signify a sample of all possible items that are present in the domain of a certain construct. This type of measurement reflects the construct' domain, therefore, if the domain is changed, all its measurement items are also changed. There is a great degree of interchangeability between the items of a reflective construct. On the other hand, the formative constructs are multi-dimensional and show measurements by reflective measurement items. This type of construct does not support interchangeability among its measurement items. Therefore, reflective and formative construct should be measured differently [41]. Hair, et al. [41] provided criteria to identify construct type (formative or reflective). This guideline is presented in Table 2.

Table 1: Definition Of Constructs

Construct	Definition	Source
Competencies and Skills	This refers to all competencies and skills of employees to acquire, share and use customer knowledge.	Zhongke and Lixin [36]
Trust	This refers to a reliable and trusting relationship in which both sides could feel secure and motivated in knowledge transfer.	Skotis, et al. [29]
Customer Involvement	This refers to the level of cooperation of the customer in the new product development or existing product enhancement.	Mukherji [28]
Organizational Culture	This refers to the atmosphere of the organization that facilitates the absorption, sharing, and application of customer knowledge.	Gibbert, et al. [23]
CKM Strategy Development	This pertains to the organisational approach that sees customer knowledge as a prized source of product and process enhancement, and simplifies the process of sharing, acquiring and implementing consumer knowledge.	Wu, et al. [37]
Cross-Functional Cooperation	This refers to the cooperation among different departments in a company.	Garrido-Moreno, et al. [38]
Senior Management Support	This pertains to the processes through which the top management indicates its backing for the generation and assimilation of customer knowledge within the organisation.	Campbell [7]
Organizational Training	This refers to the customer knowledge management training program for the employees.	Lyu, et al. [39]
CRM Technology Infrastructure	This refers to information technology infrastructure such as CRM and other software and hardware systems that facilitate management of customer data and information.	Buchnowska [26]
Collaboration System	This refers to the system that facilitates the collaboration among employees (horizontal and vertical collaboration in the organization) that all the employees can communicate with each other from all different departments and positions.	Bagheri, et al. [40]
Customer Knowledge Map	A customer knowledge map acts like a navigation utility for determining the sources of implicit and explicit customer knowledge by demonstrating how it flows through the organization.	Talet [30]

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Table 2: Guidelines For Choosing Measurement Model [41]

	Criteria	Decision
I	Causal priority between the indicator and the construct	(✓) From the construct to the reflective indicator: reflective (×) From the indicators to the construct: formative
II	Is the construct a trait explaining the indicators or rather a combination of the indicators?	(✓) If trait: reflective (×) If combination: formative
III	Do the indicators represent consequences or causes of the construct?	(✓) If consequences: reflective (×) If causes: formative
IV	Is it necessarily true that if the assessment of the trait changes, all items will change in a similar manner (assuming they are equally coded)?	(✓) If yes: reflective (×) If no: formative
V	Are the items mutually interchangeable?	(✓) If yes: reflective (×) If no: formative

In this study, this guideline is followed to develop the measurement instrument and select the appropriate items to assess the measurement model. Table A-1 in **Appendix A** illustrated that the construct is reflective or formative. For example, CKM is formative since the answer to the all the criteria is negative. Most of contemporary researchers used existing measurement items in the literature and revised them regarding to the purpose and the context of their research [44]. The same approach is followed. Therefore, the measurement items are adopted from the previous validated source. Table A-1 in **Appendix A** shows the refined measurement items which are adopted from the literature and the original source of them.

4. INSTRUMENT VALIDATION

The final step of developing the instrument is testing the reliability and validity of the measurement items. Thus, in the next section the validity of the content of measurement items are checked in term of relevancy and simplicity. Then in the pilot study section, the statistical reliability and validity are assessed.

4.1 Content Validity

The first step of the validity of any instrument is content validity. Content validity is the "degree to which an instrument has an appropriate sample of items for the construct being measured" [45]. Therefore, content validity identifies that to what degree, measurement items reflect the operational definition of constructs. In this research, Content Validity Index (CVI) approach is used to verify the content validity of the present measurement instrument [46]. Thus, the instrument is validated in term of relevancy and simplicity of measurement items. Waltz, et al. [47] used a 4-point ranking scale for each construct to measure relevancy and simplicity. In this research, the same approach is followed and the definition for each construct is provided and asked six experts in the field of information system who are familiar with CKM and software development to validate measurement items. Next step is to compute CVI. Researchers used two type of CVI computing. The first type is computed for individual items, and the second type calculate for entire scale. Polit and Beck [48] noted item-based CVI is calculated as "the number of experts giving a rating of 3 or 4, divided by the total number of experts". The criteria to accept items proposed by Lynn [46] based on the standard error of proportion. She suggested that with a panel of five or fewer experts, the item-based CVI must be 1.00. On the other words, all must agree in order to accept items. With the panel of six and more the I-CVI is not lower than 0.78.

Another type of CVI calculates entire scale which is divided into two types. The first type is scale-based CVI/universal-agreement, it can be clarified as "the portion of items on an instrument that achieved a rating of 3 or 4 by all the content experts" [48]. The second type is the average proportion of items rated as 3 or 4 by the panel of experts. This type of CVI is more popular that universal-agreement. According to Waltz, et al. [47], the threshold of acceptability of scale-based CVI for CVI/average and CVI/universal-agreement must be respectively 0.90 and 0.40.

In this research, three type of CVI are calculate for relevancy and simplicity of measurement items and the proposed thresholds are followed to keep or remove the items from the measurement mode. Also the items are modified based on experts' comments. Table A-2 in **Appendix A** illustrate the experts' CVI evaluation scores for relevancy. It is clear from the results that the I-CVI value of CO4, OC3 and TN4 are less than 0.83, therefore, the researcher eliminated them from the instrument. It means that the degree of relevancy of these measurement items is low and from the experts' viewpoint, they cannot measure the relevance constructs. The value of rest is more than 0.83. Hence, the question would have remained as originally stated in the questionnaire. CVI/average and CVI/universal-agreement are respectively 0.94 and 0.76 which are acceptable. This result confirmed the content validity of the total instrument in term of relevancy.

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Table A-3 in **Appendix A** shows the experts' CVI evaluation scores for simplicity. I-CVI calculation of simplicity identified that from the experts' viewpoint, the I-CVI value of CO4 and SD2 are less than 0.83. Thus, the researcher eliminated them from the instrument. CVI/average and CVI/universal-agreement for simplicity are respectively 0.96 and 0.82, which are acceptable. This result confirmed the content validity of the total instrument in term of simplicity. Therefore, during the content validity, the number of measurement items reduced from 50 to 46, Also, some questions were refined regarding to their expression and wording.

4.2 Pilot Study

To ensure that the measurement items is understood and measured, a pilot was conducted in a small group. The pilot study assessed the reliability and validity of measurement items. The pilot testing has a role in ensuring that the designed instrument functions well [49]. In the pilot study which is called feasibility study by some scholars, small-scale study is done to find out whether it is possible to conduct the large-scale study [50]. The recommended size of pilot study is from 25 until 100 subjects, yet, it is not necessary to select respondents by statistical rolls [51]. In this research, the researcher called 80 software companies in Tehran. Only 61 of them accepted to cooperate with the researcher. Later, the survey questionnaires were distributed among 61 software companies. Out of 61, 48 completed questionnaires were collected. A five-point Likert-type survey is used to collect the data for pilot study. The aim of this process was to improve instrument reliability and find out how well the initial proposed model is.

4.2.1 Profile of respondents

The present study focuses on the software companies in Iran that produce ES such as CRM, Accounting Systems, and Enterprise Resource Planning (ERP). The respondents in this study are involved in the decision-making and handling customer inquiries 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 job function reported by the respondents was widely distributed between the Chief Commercial Officer (45%) to Chief Customer Officer (29%), and the majority of them (69%) had more than 10 years working experience in the field of software development. Most respondents reported (85%) 50-250 full-time employees in their organization. In this study, the definition of SMEs provided by the European Commission (2005) was adopted, which stipulates that micro enterprises have fewer than ten employees; small enterprises have 10-49 employees, medium-sized firms have 50-250 employees, and big organizations have more than 250 employees [52]. Therefore, in this study, 85% of the companies were medium-sized firms and 9% of them were small enterprises. Only 6 % of the respondents were from the big companies. The CRM experience variables represent how long a company has implemented CRM strategies [53]. In addition, the majority of the software companies (75%) used the CRM strategies for more than 5 years. The majority of the respondents were male (60%), hold Bachelor degrees (71 %), and were within the 36-54 age group (54 %). An overview of demographic characteristics expressed in percentage is given in Table 3.

Table 3: Profile of Survey Respondents

Gender	**%**	**Education**	**%**	**Age**	**%**
Respondents profile					
Male	60	Bachelor's	71	26-35	38
Female	40	Master's	19	36-45	54
		Higher	10	46-55	8
				>55	0
Job Title	**%**			**Working Experience**	**%**
Chief Executive Officer	13			<5	0
Chief Commercial Officer	45			5-10	31
Chief Customer Officer	29			10-15	42
Chief Product Officer	13			Over 15	27
Employees	**%**			**CRM Experience**	**%**
>250	6			<5	4
50-250	85			5-10	75
<50	9			>10	21

4.2.2 Assessment of Measurement Model

In this section, the measurement model is assessed to make sure that each construct is measured appropriately. The validity and reliability of both reflective and formative measurement models are assessed by different tests. Hair, et al. [41] noted that

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reflective measures need to be evaluated for the indicator reliability, internal consistency, discriminant validity and convergent validity. Internal consistency is estimated using Cronbach's alpha and composite reliability. Indicator reliability is estimated in term of item loading, while convergent validity is evaluated using the value of Average Variance Extracted (AVE). Fornell-Larker criterion together with evaluation of cross-factor loading were used to assess the discriminant validity. The formative constructs are evaluated for their collinearity issue using the tolerance and Variance Inflation Factor (VIF) together with checking the significance and relevance of their indicators' outer weights. The proposed model in this study consists of two endogenous latent variables (dependent) which are formative and 11 exogenous (independent) variables that are reflective. Tables 4 present the validity and reliability assessment of reflective constructs.

Table 4: Factor Loadings and Reliability of Reflective Constructs Using PLS-SEM

Construct	Item	Outer loading	Cronbach's α	CR[a]	AVE[a]
Trust	TR 01	0.26	0.63	0.78	0.50
	TR 02	0.80			
	TR 03	0.85			
	TR 04	0.75			
Competencies And Skills	CO 01	0.91	0.78	0.85	0.67
	CO 02	0.83			
	CO 03	0.69			
Customer Involvement	CI 01	0.89	0.75	0.83	0.57
	CI 02	0.81			
	CI 03	0.81			
	CI 04	0.39			
Organizational Culture	OC 01	0.86	0.86	0.90	0.71
	OC 02	0.88			
	OC 03	0.78			
	OC 04	0.84			
CKM Strategy Development	SD 01	0.85	0.84	0.90	0.75
	SD 02	0.84			
	SD 03	0.90			
Cross-Functional Cooperation	CF 01	0.76	0.81	0.87	0.64
	CF 02	0.86			
	CF 03	0.85			
	CF 04	0.73			
Senior Management Support	TS 01	0.75	0.74	0.85	0.65
	TS 02	0.83			
	TS 03	0.83			
Training	TN 01	0.85	0.77	0.86	0.68
	TN 02	0.85			
	TN 03	0.77			
CRM Technology Infrastructure	TI 01	0.81	0.84	0.89	0.74
	TI 02	0.86			
	TI 03	0.90			
Collaboration System	CS 01	0.86	0.78	0.87	0.69
	CS 02	0.79			
	CS 03	0.83			
Customer Knowledge Map	KM 01	0.77	0.81	0.88	0.72
	KM 02	0.89			
	KM 03	0.87			

Note: CR = Composite Reliability and AVE = Average Variance Extracted

As presented in Table 4, the alpha value and composite reliability of all constructs satisfied the required thresholds to support adequate internal consistency because they are greater than the recommended value (more than 0.7) except for the Trust in which its Cronbach's α was below 0.7. While the outer loadings of the most of the items were well above the standard threshold, some of the items failed to satisfy the acceptable level of 0.7 such as "TR 01" measuring the Trust and "CI 04" measuring Customer Involvement. Hair, et al. [41] suggested that indicators with outer loadings lower than 0.4 should be always eliminated from an instrument. In addition, indicators with outer loadings of 0.4 to 0.7 should be deleted only if its exclusion increases the composite reliability. Therefore, the researcher eliminated "TR 01" since the outer loading is below 0.4. The outer loading of "CI 04" is near 0.4, thus the researcher considers it as 0.4, and however, "CI 04" was deleted from the questionnaire because its exclusion increases the composite reliability. As a result, following the recommendation of Hair, et al. [41], the items with the outer loadings of less than 0.7 have been removed from the measurement model.

To assess the discriminant validity, the measurement model is examined by the criteria of cross-loading values and the more conservative approach of Fornell-Larcker. Table A-4 in **Appendix A** demonstrated the Fornell-Larcker assessment, in which the square roots AVE of each construct should be greater than its correlation with the other constructs.

The formative constructs of the CKM and Software Quality were assessed regarding their collinearity issue and also the significance and relevance of their indicators' outer weights. The results of validity and reliability of these constructs are illustrated in Table 5.

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Table 5: Validity and Reliability Assessment for Formative Constructs

Construct	Measure	Collinearity assessment		Significance of outer weight [a] (> 1.96)
		Tolerance (> 0.2)	VIF (< 5)	
CKM	CK1	.906	1.103	2.7683
	CK2	.981	1.019	3.7945
	CK3	.943	1.061	2.4733
	CK4	.933	1.072	2.0797
Software Quality	SQ1	.833	1.201	2.7284
	SQ2	.765	1.307	2.9128
	SQ3	.864	1.158	2.4588
	SQ4	.942	1.061	3.7212
	SQ5	.847	1.181	2.8622

Notes: [a] Results based on the application of bootstrapping method.

5. CONCLUSION

This study developed valid and reliable measurement items for the hypothesized constructs and the relationships among constructs. The measurement items are adopted from previous literature and revised and evaluate them regarding to the context of this study. The questionnaire was evaluated using content validity and a pilot study. A Content Validity Index (CVI) approach was used to validate the instruments in term of relevancy and simplicity. During the content validity, the number of measurement items was reduced from 50 to 46. Some questions were refined in their expression and wording. The pilot study assessed the reliability and validity of the measurement items. In the pilot study, 48 completed questionnaires from the enterprise software development companies were collected. In this step, two instrument items were eliminated because of low outer loading. All other instruments were confirmed for the data collection. The results of this study can help CKM system providers to evaluate the interest of the organization for implementing the CKM. By using the developed instrument in this study, they can evaluate the organizations' weaknesses and readiness for implementing the CKM.

REFRENCES:

[1] M. Schaarschmidt, M. Bertram, G. Walsh, and H. F. von Kortzflieisch, "Customer Knowledge and Requirements Engineering in Customization Projects: A Multi-Method Case Study," *ICIS 2015 Proceedings*, vol. 12, pp. 111-126, 2015.

[2] G. Kannabiran and K. Sankaran, "Determinants of software quality in offshore development–An empirical study of an Indian vendor," *Information and Software Technology*, vol. 53, pp. 1199-1208, 2011.

[3] A.-M. Aho and L. Uden, "Customer knowledge in value creation for software engineering process," in *7th International Conference on Knowledge Management in Organizations: Service and Cloud Computing*, 2013, pp. 141-152.

[4] M. Dous, H. Salomann, L. Kolbe, and W. Brenner, "Knowledge Management Capabilities in CRM: Making Knowledge For, From, and About Customers Work," *AMCIS 2005 Proceedings*, p. 33, 2005.

[5] A. Khosravi, C. H. Ab Razak, and b. Minaei-Bidgoli, "Customer Knowledge Management in Software Development: A Descriptive Field Survey," *Journal of Theoretical and Applied Information Technology*, vol. 96, 2017.

[6] A. Khosravi and C. H. Ab Razak, "Customer Knowledge Management: Development Stages And Challenges," *Journal of Theoretical and Applied Information Technology*, vol. 91, 2016.

[7] A. J. Campbell, "Creating customer knowledge competence: managing customer relationship management programs strategically," *Industrial Marketing Management*, vol. 32, pp. 375-383, 2003.

[8] H. Gebert, M. Geib, L. Kolbe, and G. Riempp, "Towards customer knowledge management: Integrating customer relationship management and knowledge management concepts," in *The Second International Conference on Electronic Business (ICEB 2002)*, 2002, pp. 296-298.

[9] H. Gebert, M. Geib, L. Kolbe, and G. Riempp, "Towards Customer Knowledge Management–Integrating Customer Relationship Management and Knowledge Management concepts," in *The Second International Conference on Electronic Business (ICEB 2002)*, 2002, pp. 296-298.

[10] H. A. Smith and J. D. McKeen, "Developments in practice XVIII-customer knowledge management: adding value for our customers," *Communications of the Association for Information Systems,* vol. 16, p. 36, 2005.
[11] K. M. Eisenhardt and F. M. Santos, "Knowledge-based view: A new theory of strategy," *Handbook of strategy and management,* vol. 1, pp. 139-164, 2002.
[12] R. M. Grant, "Toward a knowledge-based theory of the firm," *Strategic management journal,* vol. 17, pp. 109-122, 1996.
[13] H.-F. Lin, "Knowledge sharing and firm innovation capability: an empirical study," *International Journal of manpower,* vol. 28, pp. 315-332, 2007.
[14] H. Salojärvi, S. Saarenketo, and K. Puumalainen, "How customer knowledge dissemination links to KAM," *Journal of Business & Industrial Marketing,* vol. 28, pp. 383-395, 2013.
[15] W. J. Orlikowski, "The duality of technology: Rethinking the concept of technology in organizations," *Organization science,* vol. 3, pp. 398-427, 1992.
[16] S. Tseng, "The effect of knowledge management capability and customer knowledge gaps on corporate performance," *Journal of Enterprise Information Management,* vol. 29, pp. 34-71, 2016.
[17] H. Salojärvi and L.-M. Sainio, "CRM Technology and KAM Performance : The Mediating Effect of Key Account-Related Knowledge," *Journal of Business Marketing Management,* vol. 8, pp. 435-454, 2015.
[18] P. Fidel, W. Schlesinger, and A. Cervera, "Collaborating to innovate: Effects on customer knowledge management and performance," *Journal of Business Research,* vol. 68, pp. 1426-1428, 2015.
[19] P. Fidel, A. Cervera, and W. Schlesinger, "Customer's role in knowledge management and in the innovation process: effects on innovation capacity and marketing results," *Knowledge Management Research & Practice,* vol. 9, pp. 132-146, 2015.
[20] S. Choi and I. Ryu, "Leveraging Customer Knowledge in Electronic Knowledge Repositories for Service Expertise," *PACIS 2013 Proceedings,* vol. 31, pp. 132-145, 2013.
[21] A. Khosravi, M. A. B. Ismail, and M. Najaftorkaman, "A Taxonomy Of Knowledge Management Outcomes For Smes," 2014.
[22] S.-H. Liao and C.-c. Wu, "System perspective of knowledge management, organizational learning, and organizational innovation," *Expert Systems with Applications,* vol. 37, pp. 1096-1103, 2010.
[23] M. Gibbert, M. Leibold, and G. Probst, "Five styles of customer knowledge management, and how smart companies use them to create value," *European Management Journal,* vol. 20, pp. 459-469, 2002.
[24] H. Salojärvi, L.-M. Sainio, and A. Tarkiainen, "Organizational factors enhancing customer knowledge utilization in the management of key account relationships," *Industrial Marketing Management,* vol. 39, pp. 1395-1402, 2010.
[25] K. A. Al-Busaidi, "Empowering Organizations through Customer Knowledge Acquisition: A pilot investigation," *Proceedings of the Nineteenth Americas Conference on Information Systems, Chicago, Illinois,* vol. 9, p. 121, 2013.
[26] D. Buchnowska, "Customer Knowledge Management Models: Assessment and Proposal," in *Research in Systems Analysis and Design: Models and Methods*, ed: Springer, 2011, pp. 25-38.
[27] F. Khodakarami and Y. E. Chan, "Exploring the role of customer relationship management (CRM) systems in customer knowledge creation," *Information & Management,* vol. 51, pp. 27-42, 2014.
[28] S. Mukherji, "A framework for managing customer knowledge in retail industry," *IIMB Management Review,* vol. 24, pp. 95-103, 2012.
[29] A. Skotis, I. Katsanakis, A. Macris, and M. Sfakianakis, "Creating Knowledge within a C-Business Context: A Customer Knowledge Management View," in *Collaborative, Trusted and Privacy-Aware e/m-Services*, ed: Springer, 2013, pp. 264-277.
[30] A. N. Talet, "KM Process and CRM to manage Customer Knowledge Relationship Management," *International Proceedings of Economics Development & Research IPEDR,* vol. 29, pp. 60-67, 2012.
[31] J. Ranjan and V. Bhatnagar, "Role of knowledge management and analytical CRM in business: data mining based framework," *Learning Organization, The,* vol. 18, pp. 131-148, 2011.
[32] L.-R. Yang, C.-F. Huang, and T.-J. Hsu, "Knowledge leadership to improve project and organizational performance,"

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

International Journal of Project Management, vol. 32, pp. 40-53, 2014.

[33] S. M. Hammami and A. Triki, "Exploring the information technology contribution to service recovery performance through knowledge based resources," *Vine,* vol. 41, pp. 296-314, 2011.

[34] M. Alamgir and M. Quaddus, "Customer Relationship Management Success Model : A Conceptual Framework," *The 26th Australian and New Zealand Academy of Management Conference (ANZAM), Dec 5-7 2012.,* pp. 1-39, 2012.

[35] S. B. MacKenzie, P. M. Podsakoff, and N. P. Podsakoff, "Construct measurement and validation procedures in MIS and behavioral research: Integrating new and existing techniques," *MIS quarterly,* vol. 35, pp. 293-334, 2011.

[36] Z. Zhongke and L. Lixin, "The Application Tactics of Customer Knowledge Management," in *Management and Service Science (MASS), 2010 International Conference on*, 2010, pp. 1-4.

[37] J. Wu, B. Guo, and Y. Shi, "Customer knowledge management and IT-enabled business model innovation: A conceptual framework and a case study from China," *European Management Journal,* vol. 31, pp. 359-372, 2013.

[38] A. Garrido-Moreno, N. Lockett, and V. García-Morales, "Paving the way for CRM success: The mediating role of knowledge management and organizational commitment," *Information & Management,* 2014.

[39] J.-J. Lyu, S.-C. Yang, and C. Chen, "Transform customer knowledge into company value—case of a global retailer," in *Service Systems and Service Management, 2009. ICSSSM'09. 6th International Conference on*, 2009, pp. 959-964.

[40] S. Bagheri, R. J. Kusters, and J. J. M. Trienekens, "Business-IT Alignment in PSS Value Networks - Linking Customer Knowledge Management to Social Customer Relationship Management," *Proceedings of the 17th International Conference on Enterprise Information Systems,* pp. 249-257, 2015.

[41] J. F. Hair, G. T. M. Hult, C. Ringle, and M. Sarstedt, *A primer on partial least squares structural equation modeling (PLS-SEM)*: Sage Publications, 2013.

[42] A. Diamantopoulos, M. Sarstedt, C. Fuchs, P. Wilczynski, and S. Kaiser, "Guidelines for choosing between multi-item and single-item scales for construct measurement: a predictive validity perspective," *Journal of the Academy of Marketing Science,* vol. 40, pp. 434-449, 2012.

[43] D. Gefen, D. W. Straub, and E. E. Rigdon, "An update and extension to SEM guidelines for admnistrative and social science research," *Management Information Systems Quarterly,* vol. 35, pp. 34-41, 2011.

[44] E. Ramirez, M. E. David, and M. J. Brusco, "Marketing's SEM based nomological network: Constructs and research streams in 1987–1997 and in 1998–2008," *Journal of Business Research,* vol. 66, pp. 1255-1260, 2013.

[45] D. F. Polit and C. T. Beck, *Nursing research: Principles and methods*: Lippincott Williams & Wilkins, 2004.

[46] M. R. Lynn, "Determination and quantification of content validity," *Nursing research,* vol. 35, pp. 382-386, 1986.

[47] C. Waltz, O. Strickland, and E. Lenz, "Measurement in nursing and health research," ed: New York, NY: Springer, 2005.

[48] D. F. Polit and C. T. Beck, "The content validity index: are you sure you know what's being reported? Critique and recommendations," *Research in nursing & health,* vol. 29, pp. 489-497, 2006.

[49] A. Bryman, "Social Reasearch Mehtods," ed: NewYork: Oxford University Press, 2012.

[50] R. Kumar, *Research Methodology: A Step-By-Step Guide For Beginners*, 2012.

[51] D. R. Cooper and P. S. Schindler, *Business research methods*: NewYork:McGraw-Hill, 2003.

[52] S. Durst and I. Runar Edvardsson, "Knowledge management in SMEs: a literature review," *Journal of Knowledge Management,* vol. 16, pp. 879-903, 2012.

[53] A. Garrido-Moreno and A. Padilla-Meléndez, "Analyzing the impact of knowledge management on CRM success: The mediating effects of organizational factors," *International Journal of Information Management,* vol. 31, pp. 437-444, 2011.

[54] W. Belkahla and A. Triki, "Customer knowledge enabled innovation capability: proposing a measurement scale," *Journal of Knowledge Management,* vol. 15, pp. 648-674, 2011.

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

[55] B. Menguc, S. Auh, and A. Uslu, "Customer knowledge creation capability and performance in sales teams," *Journal of the Academy of Marketing Science,* vol. 41, pp. 19-39, 2013.

[56] R.-J. Lin, R.-H. Chen, and K. Kuan-Shun Chiu, "Customer relationship management and innovation capability: an empirical study," *Industrial Management & Data Systems,* vol. 110, pp. 111-133, 2010.

[57] C. J. Stefanou, C. Sarmaniotis, and A. Stafyla, "CRM and customer-centric knowledge management: an empirical research," *Business Process Management Journal,* vol. 9, pp. 617-634, 2003.

[58] P. Carbonell, A. I. Rodríguez-Escudero, and D. Pujari, "Customer Involvement in New Service Development: An Examination of Antecedents and Outcomes," *Journal of Product Innovation Management,* vol. 26, pp. 536-550, 2009.

[59] Z. Li, B. Wu, and Y. Li, "Relational Model of and its Appraisal on Environment Supporting Factors and Customer Knowledge Management Performance," in *Business Intelligence and Financial Engineering (BIFE), 2012 Fifth International Conference on*, 2012, pp. 536-539.

[60] J. W. Peltier, D. Zahay, and D. R. Lehmann, "Organizational Learning and CRM Success: A Model for Linking Organizational Practices, Customer Data Quality, and Performance," *Journal of Interactive Marketing,* vol. 27, pp. 1-13, 2013.

[61] Y. C. Lin, Y. C. Wang, and L. A. Kung, "Influences of cross-functional collaboration and knowledge creation on technology commercialization: Evidence from high-tech industries," *Industrial Marketing Management,* vol. 49, pp. 128-138, Aug 2015.

[62] I.-C. Hsu, "Knowledge sharing practices as a facilitating factor for improving organizational performance through human capital: A preliminary test," *Expert Systems with applications,* vol. 35, pp. 1316-1326, 2008.

[63] B. N. Unger, A. Kock, H. G. Gemünden, and D. Jonas, "Enforcing strategic fit of project portfolios by project termination: An empirical study on senior management involvement," *International Journal of Project Management,* vol. 30, pp. 675-685, 2012.

[64] Y. Yu and Y. Choi, "Stakeholder pressure and CSR adoption: The mediating role of organizational culture for Chinese companies," *The Social Science Journal,* vol. 53, pp. 226-235, 2014.

[65] A. N. Hidayanto and S. T. Setyady, "Impact of Collaborative Tools Utilization on Group Performance in University Students," *TOJET,* vol. 13, 2014.

[66] J.-B. Sim and Y.-J. Kim, "Influencing Factors For The Adoption Of Mobile Office Services: Empirical Investigation Among Sales Workers," *International Journal of Arts & Sciences,* vol. 6, p. 797, 2013.

[67] W. Mei-Hsiang, H. Chen-Fen, and T.-Y. Yang, "Acceptance of Knowledge Map Systems: An Empirical Examination of System Characteristics and Knowledge Map Systems Self-efficacy," *Asia Pacific Management Review,* vol. 17, 2012.

[68] J.-Y. Shih, "A Comparison of Knowledge Map and Keyword Search in Knowledge Retrieval," *Asian Social Science,* vol. 10, pp. 118-132, 2012.

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Appendix A:

Table A-1: Measurement Items of Each Construct

Construct	Type	Code	Refined Item	Source
Competencies and Skills	Reflective	CO1	In our company, employees are empowered to share and apply what they have learnt from customer experiences.	Belkahla and Triki [54]
		CO2	Our company has employees that are qualified to acquire and manage customer knowledge.	Garrido-Moreno and Padilla-Meléndez [53]
		CO3	In our company, employees have sufficient skills and competencies to manage customer feedback.	Menguc, et al. [55]
		CO4	This company has the right technical staff to provide technical support using CRM technology in building customer knowledge.	Garrido-Moreno and Padilla-Meléndez [53]
Trust between customer and company	Reflective	TR1	This company is committed to improving the management of customer feedback.	Lin, et al. [56]
		TR2	Our company has shaped trustworthy relationships with most customers.	Stefanou, et al. [57]
		TR3	Most of our customers trust the company to provide suggestions for our products and services.	Lin, et al. [56]
		TR4	This company has built an environment of trust for its customers, in order to effectively manage customer knowledge.	Yang, et al. [32]
Customer Involvement	Reflective	CI1	We often meet customers to discuss their requirements and needs during the software development process.	Belkahla and Triki [54], Carbonell, et al. [58]
		CI2	We involve some of our customers during software development activities.	Lin, et al. [56]
		CI3	Our customers help the company by sharing their knowledge with us to overcome software bugs.	Lin, et al. [56]
		CI4	We adapt and modify our products and services on the basis of customer feedback	Belkahla and Triki [54],Lin, et al. [56]
Organizational Culture	Reflective	OC1	Our company's organizational culture stimulates customer knowledge sharing between employees.	Garrido-Moreno and Padilla-Meléndez [53]
		OC2	The atmosphere of our company encourages employees to absorb and manage customer knowledge.	Li, et al. [59]
		OC3	Most of our employees believe that acquisition of customer knowledge can enhance their experience and knowledge.	Menguc, et al. [55]
		OC4	In our company, employees frequently interact with each other to discuss customer-related needs, suggestions and ideas.	Menguc, et al. [55]
		OC5	We share a vision across the organization of how we manage customer knowledge.	Peltier, et al. [60]
CKM Strategy Development	Reflective	SD1	Our company has established clear business objectives, with respect to customer knowledge management.	Garrido-Moreno and Padilla-Meléndez [53]
		SD2	Our company's business strategies are oriented towards effective customer knowledge utilization.	Garrido-Moreno and Padilla-Meléndez [53]
		SD3	The company cares about long-term strategies to manage customer knowledge effectively.	Lin, et al. [56]
		SD4	The firm's business strategies are driven by the objective of perceiving customer knowledge as a valuable source of product innovation and quality improvement.	Garrido-Moreno and Padilla-Meléndez [53]
Cross-Functional Cooperation	Reflective	CF1	In our company, open and two-way communication exists between different departments to manage customer knowledge.	Garrido-Moreno and Padilla-Meléndez [53]
		CF2	Different departments within the company cooperate and share customer knowledge with each other.	Belkahla and Triki [54]
		CF3	In our company, employees spend time discussing customers' future needs with employees from other departments.	Belkahla and Triki [54]
		CF4	Our company has established an integrated mechanism for the cooperation of different departments to apply customer knowledge.	Lin, et al. [61]
Senior Management Support	Reflective	TS1	The company's senior management considers CKM to be a top priority.	Garrido-Moreno, et al. [38]
		TS2	Senior management regards CKM as a helpful strategy to increase company profits.	Hsu [62]
		TS3	In our company, the senior management has provided the necessary resources for CKM.	Yang, et al. [32],Unger, et al. [63]
Training	Reflective	TN1	In our company, training programs are designed to help employees develop the skills needed to effectively manage customer knowledge.	Garrido-Moreno, et al. [38]

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Construct	Type	Code	Refined Item	Source
		TN2	Our company provides a customer knowledge management training program for the employees.	Yu and Choi [64]
		TN3	In this company, staff training is undertaken that focuses specifically on better customer communication to absorb and store more customer knowledge.	Kannabiran and Sankaran [2]
		TN4	Our employees are well trained in the use of CRM technologies.	Garrido-Moreno, et al. [38]
CRM Technology Infrastructure	Reflective	TI1	This company has an appropriate portfolio of CRM technologies to manage customer knowledge.	Garrido-Moreno, et al. [38]
		TI2	In this company, CRM technology infrastructure is used to effectively acquire and store customer knowledge.	Belkahla and Triki [54]
		TI3	This company uses CRM technology infrastructure to manage customer demands, complaints and suggestions.	Lin, et al. [56]
Collaboration System	Reflective	CS1	In our company, a collaboration system is used for the better management of customer knowledge.	Hidayanto and Setyady [65]
		CS2	In our company, a collaboration system assists in the interaction between co-workers to communicate customer complaints and suggestions.	Sim and Kim [66]
		CS3	The company's collaboration system maintains collaborative communication between software developers to apply customer knowledge.	Lin, et al. [61]
Customer Knowledge Map	Reflective	KM1	In our company, employees often use the customer knowledge map to identify customer needs and suggestions.	Mei-Hsiang, et al. [67]
		KM2	Using the company's customer knowledge map simplifies determining what customer knowledge is available and where.	Mei-Hsiang, et al. [67], Shih [68]
		KM3	In our company, the customer knowledge map has become the media to organize customer knowledge well.	Mei-Hsiang, et al. [67]
Customer knowledge management (CKM)	Formative	CK1	This company has established processes to acquire customer knowledge.	Garrido-Moreno, et al. [38]
		CK2	Customer knowledge is shared across units for software development projects.	Yang, et al. [32]
		CK3	Customer knowledge is stored and updated periodically for software development projects.	Yang, et al. [32]
		CK4	This company utilizes customer knowledge practically to improve product quality.	Yang, et al. [32]
Software quality	Formative	SQ1	According to customer feedback, most of our customers assert that the company's software products have fulfilled their stated specifications.	Kannabiran and Sankaran [2]
		SQ2	Customer feedback shows that the response time of our company's software products is rated as good, and meets user's expectations.	Kannabiran and Sankaran [2]
		SQ3	Customer feedback shows that our company's software products are stable and unlikely to fail.	Kannabiran and Sankaran [2]
		SQ4	The majority of our customers state that the company's software products are easily understood by the users and convenient to use.	Kannabiran and Sankaran [2]
		SQ5	Our company's software can be easily customized to suit new specifications or operating environments.	Kannabiran and Sankaran [2]

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Table A-2 (a): Experts' CVI Evaluation Scores For Relevancy of Measurement Items

Item	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Number in Agreement	Item CVI
1	✓	✓	✓	✓	✓	✓	6	1.00
2	✓	✓	×	✓	✓	✓	5	0.83
3	✓	✓	✓	✓	✓	✓	6	1.00
4	×	✓	✓	×	✓	×	3	0.50
5	✓	✓	✓	×	✓	✓	5	0.83
6	✓	✓	✓	✓	✓	✓	6	1.00
7	✓	✓	✓	✓	✓	✓	6	1.00
8	✓	✓	✓	✓	✓	✓	6	1.00
9	✓	✓	✓	✓	✓	✓	6	1.00
10	✓	✓	✓	✓	✓	✓	6	1.00
11	✓	✓	✓	✓	✓	✓	6	1.00
12	✓	✓	✓	✓	✓	✓	6	1.00
13	✓	✓	✓	✓	✓	✓	6	1.00
14	×	✓	✓	✓	✓	✓	5	0.83
15	✓	✓	✓	✓	×	×	4	0.67
16	✓	×	✓	✓	✓	✓	5	0.83
17	✓	✓	✓	✓	✓	✓	6	1.00
18	✓	✓	✓	✓	✓	✓	6	1.00
19	✓	✓	✓	×	✓	✓	5	0.83
20	✓	✓	✓	✓	✓	✓	6	1.00
21	✓	✓	✓	✓	✓	✓	6	1.00
22	✓	✓	✓	✓	✓	✓	6	1.00
23	✓	✓	✓	✓	✓	✓	6	1.00
24	✓	✓	✓	✓	✓	✓	6	1.00
25	✓	✓	✓	✓	✓	✓	6	1.00
26	✓	✓	✓	✓	✓	✓	6	1.00
27	✓	✓	✓	✓	✓	✓	6	1.00
28	✓	✓	✓	✓	✓	✓	6	1.00
29	✓	✓	✓	✓	✓	✓	6	1.00
30	✓	✓	✓	✓	✓	✓	6	1.00
31	✓	✓	✓	✓	✓	✓	6	1.00
32	✓	✓	✓	×	×	✓	4	0.67

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Table A-2(b): Experts' CVI Evaluation Scores for Relevancy of Measurement Items (Continue)

Item	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Number in Agreement	Item CVI
33	✓	✓	✓	✓	✓	✓	6	1.00
34	✓	✓	✓	✓	✓	✓	5	0.83
35	✓	✓	✓	✓	✓	✓	6	1.00
36	✓	✓	✓	✓	✓	✓	6	1.00
37	✓	✓	✓	✓	✓	✓	6	1.00
38	✓	✓	✓	✓	✓	✓	6	1.00
39	✓	✓	✓	✓	✓	✓	6	1.00
40	✓	✓	✓	✓	✓	✓	6	1.00
41	✓	✓	✓	×	✓	✓	5	0.83
42	✓	✓	✓	✓	✓	×	5	0.83
43	✓	✓	✓	✓	✓	✓	6	1.00
44	✓	✓	✓	✓	✓	✓	6	1.00
45	✓	✓	✓	✓	✓	✓	6	1.00
46	✓	✓	✓	✓	✓	✓	6	1.00
47	✓	✓	✓	✓	✓	×	5	0.83
48	✓	✓	✓	✓	✓	✓	6	1.00
49	✓	✓	✓	✓	✓	✓	6	1.00
50	✓	✓	✓	✓	✓	✓	6	1.00
Proportion Relevant:	**.96**	**.98**	**.98**	**.88**	**.96**	**.92**	**CVI/Universal= .76 S-CVI/Ave = .94**	

Note: CVI = content validity index; I-CVI = Item content validity index; S-CVI/Ave = average scale content validity index
Shaded items received the scores less than the acceptable threshold.

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Table A-3 (a): Experts' CVI evaluation scores for Simplicity of measurement items

Item	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Number in Agreement	Item CVI
1	✓	×	✓	✓	✓	✓	5	0.83
2	✓	✓	×	✓	✓	✓	5	0.83
3	✓	✓	✓	✓	✓	✓	6	1.00
4	×	✓	✓	×	✓	×	3	0.50
5	✓	✓	✓	✓	✓	✓	6	1.00
6	✓	✓	✓	✓	✓	✓	6	1.00
7	✓	✓	✓	✓	✓	✓	6	1.00
8	✓	✓	✓	✓	✓	✓	6	1.00
9	✓	✓	✓	✓	✓	✓	6	1.00
10	✓	✓	✓	✓	✓	✓	6	1.00
11	✓	✓	✓	✓	✓	✓	6	1.00
12	✓	✓	✓	✓	✓	✓	6	1.00
13	✓	✓	✓	✓	✓	✓	6	1.00
14	✓	✓	✓	✓	✓	✓	6	1.00
15	✓	✓	✓	✓	✓	×	5	0.83
16	✓	✓	✓	✓	✓	✓	6	1.00
17	✓	✓	✓	×	✓	✓	5	0.83
18	✓	✓	✓	✓	✓	✓	6	1.00
19	×	✓	✓	×	×	✓	3	0.50
20	✓	✓	✓	✓	✓	✓	6	1.00
21	✓	✓	✓	✓	✓	✓	6	1.00
22	✓	✓	✓	✓	✓	✓	6	1.00
23	✓	✓	✓	✓	✓	✓	6	1.00
24	✓	✓	✓	✓	✓	✓	6	1.00
25	✓	✓	✓	✓	✓	✓	6	1.00
26	✓	✓	✓	✓	✓	✓	6	1.00
27	✓	✓	✓	✓	✓	✓	6	1.00
28	✓	✓	✓	✓	✓	✓	6	1.00
29	✓	✓	✓	✓	✓	✓	6	1.00
30	✓	✓	✓	✓	✓	✓	6	1.00
31	✓	✓	✓	✓	✓	✓	6	1.00
32	✓	✓	✓	×	✓	✓	5	0.83

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Table A-3 (b): Experts' CVI evaluation scores for Simplicity of measurement items (Continue)

Item	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Number in Agreement	Item CVI
33	✓	✓	✓	✓	✓	✓	6	1.00
34	✓	✓	✓	✓	✓	✓	6	1.00
35	✓	✓	✓	✓	✓	✓	6	1.00
36	✓	✓	✓	✓	✓	✓	6	1.00
37	✓	✓	✓	✓	✓	✓	6	1.00
38	✓	✓	✓	✓	✓	✓	6	1.00
39	✓	✓	✓	✓	✓	✓	6	1.00
40	✓	✓	✓	✓	✓	✓	6	1.00
41	✓	✓	✓	×	✓	✓	5	0.83
42	✓	✓	✓	✓	✓	✓	6	1.00
43	✓	✓	✓	✓	✓	✓	6	1.00
44	✓	✓	✓	✓	✓	✓	6	1.00
45	✓	✓	✓	✓	✓	✓	6	1.00
46	✓	✓	✓	✓	✓	×	5	0.83
47	✓	✓	✓	✓	✓	✓	6	1.00
48	✓	✓	✓	✓	✓	✓	6	1.00
49	✓	✓	✓	✓	✓	✓	6	1.00
50	✓	✓	✓	✓	✓	✓	6	1.00
Proportion Relevant:	**.96**	**.98**	**.98**	**.90**	**.98**	**.94**	**CVI/Universal= .82 S-CVI/Ave = .95**	

Note: CVI = content validity index; I-CVI = Item content validity index; S-CVI/Ave = average scale content validity index
Shaded items received the scores less than the acceptable threshold.

Table A-4. Fornell-Larcker Criterion Results

	CF	CI	CK	CO	CS	KM	OC	SD	SQ	TI	TN	TR	TS
CF	**0.804**												
CI	0.675	**0.843**											
CK	0.382	0.385	1.000										
CO	0.527	0.283	0.147	**0.820**									
CS	0.448	0.449	0.531	0.243	**0.833**								
KM	0.418	0.323	0.175	0.485	0.072	**0.850**							
OC	0.763	0.514	0.473	0.535	0.558	0.422	**0.846**						
SD	0.643	0.433	0.324	0.440	0.474	0.128	0.695	**0.868**					
SQ	0.239	0.241	0.760	0.080	0.310	-0.024	0.335	0.318	1.000				
TI	0.091	0.036	0.313	0.137	0.106	-0.097	0.094	0.178	0.267	**0.862**			
TN	0.505	0.415	0.512	0.373	0.460	0.385	0.562	0.431	0.317	0.143	**0.831**		
TR	0.561	0.456	0.259	0.351	0.385	0.191	0.493	0.266	0.008	0.039	0.193	**0.814**	
TS	0.160	0.174	0.279	0.154	0.341	0.047	0.156	0.429	0.173	0.412	0.071	0.136	**0.810**

Note: **F** indicates formative construct.