DEVELOPMENT OF INDICATORS FOR ASSESSING KM INPUT, KM PROCESS, KM EFFECTIVENESS, AND THEIR RELATIONSHIP

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Abstract: This research study aimed to propose the knowledge management (KM) indicators for assessing knowledge management success in higher education institutions in Thailand. The study also focused on developing and validating the knowledge management effectiveness model via 3 indicators: KM input, KM process, and KM effectiveness (explained by KM performance, performance effectiveness, and knowledge asset). This study was conducted through the employment of a survey method. The subjects for model testing were 442 KM practitioners from 40 universities in Thailand. The results of the research suggested that there are 26 indicators for assessing KM Effectiveness in higher education context, which can be divided as follows: 4 input indicators; 7 process indicators; 2 output indicators; and 13 outcome indicators. The proposed 2nd order confirmatory factor analysis model and causal model of KM effectiveness both fit with the empirical data set (χ^2 = 82.78, df = 68, χ^2/df = 1.217, p-value = 0.107, CFI = 0.999, NNFI = 0.999, AGF I= 0.957, RMSEA = 0.022 and χ^2 = 265.43, df = 230, χ^2/df = 1.154, p-value = 0.054, CFI = 0.999, NNFI = 0.999, AGFI = 0.932, RMSEA = 0.019). The coefficient of determination of the KM process and KM effectiveness were 0.78 and 0.99, respectively.

Keywords: Knowledge Management Indicators, Knowledge Management Assessment

Introduction

Knowledge Management (KM) and the idea of a learning society have become important concepts in the educational development of Thailand, especially at higher levels of education. In accordance with the educational reform trend which emphasizes the decentralization and transformation of universities from public to autonomous entities, universities are in the process of changing their administrative management systems for growth and survival by focusing more on human resources, both tacit and explicit knowledge, as they are the most valuable resources in this regard. This administrative management trend not only emphasizes human resources and human capital development but also intellectual capital management in order to increase intellectual properties that will lead to more successful competition with other universities, both domestic and abroad. The concept of knowledge management is one administrative tool for managing intellectual capital inside an organization and for upgrading the organization to be a learning organization.

Section 11 of the Royal Decree of good government standards and indicators B.E.2546, mentions that *"the government sectors functioned in knowledge development within the unit regularly as a learning organization"* thus all government sectors including higher education institutions provided policies and plans for knowledge management effectiveness. Since B.E. 2548, the Office of the Public Sector Development Commission (OPDC) has conducted the working assessment of government sectors using KM as an indicator of the development of an organization. Moreover, the Office of the Higher Education Commission (OHEC) has specified KM and learning organization indicators as important parts of annual internal and external evaluations.

Previous university KM evaluations consisted of both institution self-assessment and external assessment according to the OPDC and OHEC standards and indicators which aimed to check for KM strategy plans, KM procedure and the effectiveness and usefulness of KM. In addition, these evaluations checked the use of KM in routine university work and often improved KM plans (Office of the Public Sector Development Commission, 2010).

The evaluation of KM success according to Thailand OPDC and OHEC focuses on process components such as planning, gathering, transferring, setting up learning environment, and managing of information and organization knowledge. On the other hand, international countries evaluate KM success by using various indicators from many

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dimensions combined. These indicators of KM input factors consist of environmental and administrative management factors such as organization culture, organization goal, executive leadership, technologies support and organizational KM measurement; indicators of intellectual capital factors; indicators of investment reward or profit factor; indicators of KM procedure, and indicators of personnel performance and development (American Productivity and Quality Center (APQA), 1999; David Skyrme Associates, 1999; Grossman, 2006). Evaluating KM success in higher education institutions should be considered on the organizational characteristics which are unique and different from other organizations. Higher education institutions are classified as knowledge-based organizations to build, gather and promote knowledge; besides, they have high level of hierarchical administrations, complicated policy systems, and undertake various missions involving various groups of stake holders (Mintzberg, 1993 cited in Biloslavo & Trnavcevic, 2007). As a result, KM effectiveness and success should be considered on indicators of KM input, KM process, KM output and the outcome of missions undertaken by higher education institutions.

To broaden knowledge of KM measurement and evaluation of higher education institution context, this research study aimed to propose, develop and validate KM indicators assessing KM success within higher education institutions via indicators of KM input, KM process, KM output and outcome factors; and also to study causal relationships of those KM factors. The benefits of this study were the development of a precise tool used for KM measurement and evaluation in the context of a higher education institution and to gather information on KM condition factors which will be useful in the effective and successful development of KM in higher education institutions.

Literature Review

Constructs of KM Success

KM Input refers to resources and organization basic structures supporting KM in higher education institution. Marquardt (1996) defined a learning organization as *"an organization which learns powerfully and collectively and is continually transforming itself to better collect, manage, and use knowledge for corporate success. It empowers people within and outside the company to learn as they work; in addition, technology is utilized to optimize both learning and productivity"*. From the definition of a learning organization, there is more consideration given to personnel and executives as KM workers whereas information technology resources support the KM process. A study conducted by Kulkarni et al. (2007) study presented a causal model of KM success affected by independent variables; organization context consisted of executive leadership, supervisor support, incentive of KM activities and coworker characteristics; goal and objective factors of knowledge sharing awareness; and KM system quality. In this study, four modes of KM input are identified: KM purpose, KM person, executive leadership and Information Technology. According to the related research, we designed the 11 items to measure this construct in the initial items pool.

KM process refers to KM process activities in which KM teams and personnel in higher education institutions participate to develop collaborative learning and to set up organization knowledge systems. KM processes involve explicit knowledge identified as academic and organization knowledge, and tacit knowledge. Thailand OPDC (2010) has specified the indicators of KM success with an emphasis on KM processes corresponding to strategy plans measured from knowledge identification, knowledge acquisition, knowledge creation, knowledge sharing, knowledge storage, knowledge utilization and knowledge dissemination. According to the work of many other researchers and the OPDC framework, we designed 23 items to measure the KM process construct.

KM Effectiveness refers to the results of KM process within the faculty/working unit of higher education institutions and is observed in the achievement of planned goals and objectives. As already mentioned, it was found that the effectiveness of KM and working performance/ achievement results of an organization cannot be distributive (Firestone & McElroy, 2005; Nonaka, 2006; Massey et al., 2002). Therefore, the effectiveness of KM in higher education institutions is evaluated from: (1) working performance from 7 KM processes; (2) working results from the important missions of curriculum development, teaching and learning activities, research production, academic services, quality insurance and university students' development; and (3) knowledge assets both quantitative and qualitative. In this study, three modes of KM effectiveness are identified: KM performance, performance effectiveness and knowledge assets. According to the KM policy and university missions, we designed 48 items to measure this construct in the initial items pool.

The constructs, dimensions to measure and some representative literatures are listed in Table 1 (see in last page).

Research Methodology

Sample

The sample group comprised KM practitioners (both instructors and personnel) from faculties and departments of public universities and autonomous universities in Thailand. The simple random sampling technique was used to select the sample group from the population. Forty out of eighty universities in Thailand were chosen. These included 12 public universities, 5 autonomous universities, 3 of King Mongkut's Universities of Technology, 3 Rajamangala Universities of Technology, 15 Rajabhat Universities, and 2 open universities. There were more than 5 personnel at each university enrolled in this study. The total number of KM practitioners who participated in the study was 442. This is congruent with the CFA and SEM models which require the estimated parameters to be tenfold larger than the sample size (Hair et al., 2006).

Data collection

This study was conducted using the survey method. A total of 600 survey questionnaires were sent to KM practitioners from 40 universities. There were 442 questionnaires returned. The response rate was 73.67%.

Instrument

The instrument used in this study was a 5-point Likert Scale questionnaire. It measured KM input, KM process, KM effectiveness in higher education context. KM input was measured from 4 observed variables and KM process was measured from 7 observed variables. KM effectiveness was measured from 15 observed and 3 latent variables; KM performance, performance effectiveness, and knowledge assets. Eighty-two evaluation items were created by researcher and some KM input and KM process items were modified based on the works of Biloslavo & Trnavcevic (2007), Wei-He & Qiu-Yan (2006), and American Productivity & Quality Center (2001). The reliability coefficient (Cronbach's α) for KM input, KM process, KM performance, performance effectiveness, and knowledge assets were 0.875, 0.951, 0.937, 0.927, and 0.800 respectively.

Statistical analyses

First and second order confirmatory factor analysis and SEM were analyzed with LISREL 8.7 using maximum likelihood estimation. To evaluate the fit of each model, five indices were used. These indices included chi-square (χ^2) index, comparative fit index (CFI), non-normed fit index (NNFI), adjusted goodness of fit index (AGFI) and root mean square error of approximation (RMSEA). The cutoff criteria of model fit indices claimed by researchers mentioned the model fits reasonably well with χ^2/df index is less than the value 5, and a ratio reaching 2 indicates a good fit (Marsh & Hau, 1996). Hu & Bentler (1999) suggested AGFI, CFI and NNFI greater than 0.95 indicates perfect model fit. However, Hair et al. (2006) presented guidelines for interpreting the RMSEA as follows: RMSEA <0.05 for good model fit; 0.05 <RMSEA <0.1 for reasonable model fit and RMSEA >0.1 for poor model fit.

Findings

Development of KM success indicators

In this study, three major constructs for assessing KM success in higher education context were considered: *KM input, KM process, and KM effectiveness*. In accordance with the four steps of educational indicator development, setting the method, selection overall variables, gathering the appropriate variable, and setting the variable loading (Johnstone, 1981), each construct was defined and a 26 indicators and 82-item questionnaire was designed for this study. Among these 26 indicators and 82 questionnaire items, 4 input indicators with 11 items were used to characterize KM input; 7 process indicators with 29 items were used to identify KM process; 13 outcome indicators with 32 items were used to analyze KM performance and Performance effectiveness; 2 output indicators with 10 items were used to consider KM assets. To verify the dimensionality and reliability of each construct, purification processes were conducted including expert construct validity verify, confirmatory factor analysis, item to total correlation analysis, and Cronbach's α analysis.

Factors used for KM success assessment were developed from the analysis specified the criteria of IOC greater than 75%, factor loadings greater than 0.6, item to total correlation coefficients greater than 0.5, and Cronbach's α coefficient greater than 0.6 (Ju et al., 2006). Firstly, the construct of KM input was explained by four dimensions; KM purpose, KM person, leadership, IT. Secondly, the construct of KM process was drawn from seven dimensions; knowledge identification, knowledge acquisition, knowledge creation, knowledge sharing, knowledge storage, knowledge utilization, and knowledge dissemination. Thirdly, the construct of KM effectiveness was explained by three factors; KM performance, performance effectiveness, and knowledge assets. Moreover, KM performance factor was explained by ability to perform 7 KM processes those were knowledge identification performance, knowledge acquisition performance, knowledge creation performance, knowledge sharing performance, knowledge storage performance, knowledge utilization

performance, and knowledge dissemination performance. Performance effectiveness was explained by curriculum development, instructional development, research production & development, academic services development, evaluation and quality insurance and student development. Finally, the knowledge assets factor was explained by quantity of knowledge (amount of knowledge gain from KM processes) and quality of knowledge (usefulness of knowledge).

Confirmatory factor analysis model testing

Three confirmatory factor analysis (CFA) models were tested by using the total sample matrix. Before we analyzed the CFA we had carried out the KMO and Bartlett's test of sphericity for each construct separately. The results showed that the KMO value was between 0.500 and 0.936, and there were significant correlations in those correlation matrices, therefore this sample satisfied the conditions of factor analysis.

Firstly, the priori one-factor model with paths was tested with all four KM inputs; KM purpose, KM Person, Leadership, and IT. Model fit indices were χ^2/df=0.375, p-value>0.10, CFI=1.000, NNFI=1.003, AGFI=0.996, RMSEA=0.000 (see Table 2). The result showed that the confirmatory factor KM input model had structural validity, or well fit to the empirical data. The estimated parameters and observable standard error in Figure 1 showed factors loading for all variables were significant with the value between 0.597 and 0.739, and the completely standardized solution (SC) was between 0.667 and 0.843. It means all four variables to measure KM input are convergent. The maximum factor loading on KM purpose (SC=0.843) showed the most relevant of KM purpose in defining the KM input's dimensionality.

Secondly, similar to KM input model, the one-factor CFA model of KM process showed in Table 2 with the fitness indices, estimated parameters and standard error. Model fit indices were χ^2/df=0.728, p>0.10, CFI=1.000, NNFI=1.001, AGFI=0.987, and RMSEA=0.000. The result indicated that the KM process model was reasonable and got the good fitness. The factors loading on 7 observed variables were significant with the value between 0.649 and 0.749, and the SC was between 0.784 and 0.896 (see Figure 2). It means 7 processes to measure KM process are convergent. The maximum factor loading on KM acquisition (SC=0.896) showed the most relevant of KM acquisition in defining the KM process's dimensionality.

Thirdly, we used second order CFA to analyze KM effectiveness model. This model included 3 latent variables: KM performance, performance effectiveness, and knowledge assets, and 15 observed variables (see Figure 3). The fitness indices of KM Effectiveness model were χ^2/df=1.217, p>0.10, CFI=0.999, NNFI=0.999, AGFI=0.957, and RMSEA=0.022. The result showed that the KM effectiveness model showed the good fitness based on the covariance of the KM performance, performance effectiveness, and knowledge assets constructs. The factor loading of KM effectiveness on each construct were 0.939, 0.888, and 0.799. The high factor loading showed that all three constructs well explained KM effectiveness.

For the first construct, KM performance, factors loading of this latent variable on 7 observed variables were significant with the value between 0.671 and 0.821, and the SC between 0.781 and 0.835. The maximum factor loading on knowledge dissemination performance indicated that KM performance best explained by this dimension. For the second construct, performance effectiveness, factors loading of this latent on 6 observed variables were significant with the value between 0.665 and 0.751, and the SC between 0.758 and 0.849. The maximum factor loading on Evaluation & QA indicated that performance effectiveness best explained by this dimension. For the last construct, knowledge assets, factors loading from this latent on quantity and quality of knowledge were significant with the value between 0.238 and 0.777 and the SC between 0.238 and 0.926. This result indicated that knowledge assets best explained by quality of knowledge but not well by quantity of knowledge. Although, the quantity of knowledge had small loading (<0.3) because of more standard error, but it was significant (factor loading significantly different from zero), thus we desired to keep this items.

In addition, it was shown that based on the structure of KM effectiveness model, the coefficients of determination (R^2) of KM performance**,** performance effectiveness, and knowledge assets were 0.88, 0.79, and 0.64.

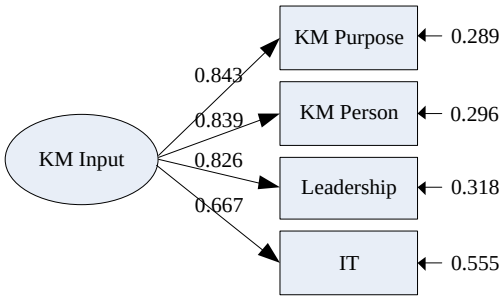

Figure 1: CFA Model of KM Input

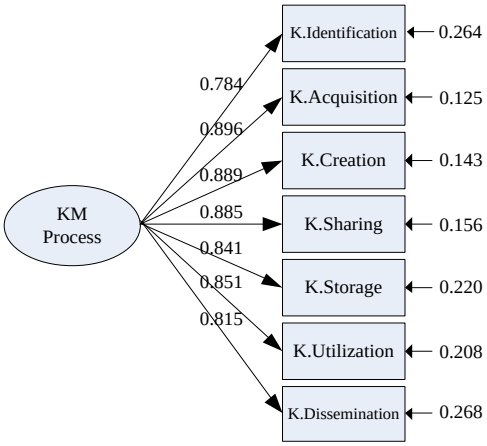

Figure 2: CFA Model of KM Process

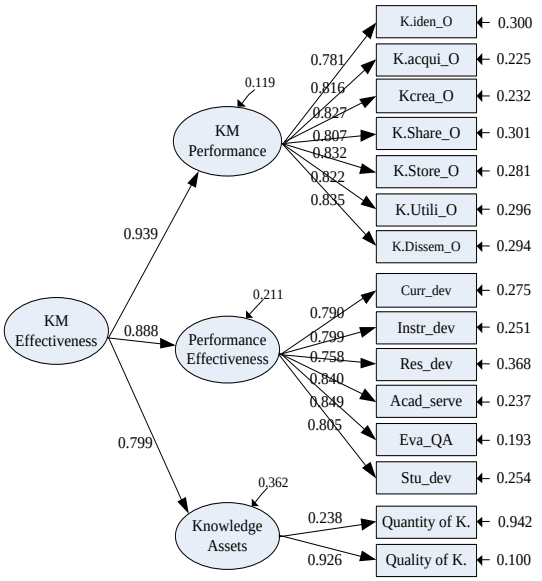

Figure 3: Second Order CFA Model of KM Effectiveness

Causal Model Testing

Based on the above literature review and relevant constructs in measurement model, this study developed a research model as shown in Figure 4. It was suggested that KM input, KM process, and KM effectiveness have been regarded as three important constructs for successful KM in higher education institution, and KM input was a critical factor that impact on KM process and KM effectiveness. In order to assess the hypothesized relationships, structural equation models (SEM) were employed using LISREL 8.7 to investigate the fitness of the research model. The model with paths from KM input to KM process, KM input to KM effectiveness, and KM effectiveness to their constructs in Figure 4 showed the χ^2=265.425, df=230, χ^2/df=1.154, p-value = 0.054, CFI = 0.999, NNFI = 0.999, AGFI = 0.932, RMSEA=0.019. The significant of the χ^2 value indicated that the hypothesized model mirrored the pattern of covariance contained within the empirical data. The paths from KM input to KM process and KM process to KM effectiveness showed high significantly regression weights on KM effectiveness (γ_1 = 0.881, β_1= 0.993). The significantly indirect effects of KM input on KM effectiveness, KM performance, performance effectiveness, and knowledge assets were 0.875, 0.874, 0.740, and 0.551 but the direct effect to KM effectiveness was not significant (γ_2 = 0.002). The coefficient of determination (R^2) of the KM process and KM effectiveness were 0.78 and 0.99. It means KM input achieved KM effectiveness with indirect effect through KM process.

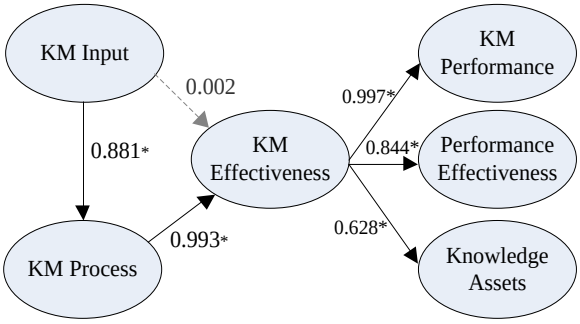

Figure 4: SEM Model of KM Effectiveness

Discussion

According to the aims of this research study, (1) KM indicators for assessing KM success were developed and validated, (2) those KM factors in higher education were examined for causal relationships. Based on the concept of system theory, the KM success constructs with its dimensions were created and tested. The results showed the three major constructs, KM input, KM process, and KM effectiveness.

The KM input and KM process indicators that were found had resource-based correspondent dimensions similar to those suggested by most previous studies (Ju et al., 2006; Wei-he & Qiu-yan, 2006; Aujirapongpan et al., 2010). The KM input construct with high factors loading on KM purpose, KM person, and leadership identified that human resources are the main factors to support KM practices and effective implementation of KM in higher education institutions. KM practices are concerned with human knowledge as intellectual capital that increases in value when shared by university members and if a university can provide a clear KM policy and purpose, and then a clear and effective process will be followed. For the IT

dimension, although it had a smaller factor loading than the other three dimensions, it can explain KM input as one of the supporting factors that can drive KM processes to progress more rapidly, especially KM sharing, KM storage, and KM dissemination.

In order to validate the KM process construct, seven process indicators were built into the model. The fitted model with equally factor loading identified that KM process was sufficiently measured by knowledge identification, knowledge acquisition, knowledge creation, knowledge sharing, knowledge storage, knowledge utilization, and knowledge dissemination. The fitted model and the high reliability of the instrument used to measure KM process in higher education institutions implied that most of the universities have a good understanding of KM process and try to adopt it for enhancing their organizational performance.

Based on the important missions of higher education institutions and scholars' suggestions (OHEC, 2011; Biloslavo & Trnavcevic, 2007), three constructs and fifteen indicators of KM effectiveness were created. The fitted model with effect on KM performance, performance effectiveness, and knowledge assets showed that all three constructs and KM effectiveness are relevant. KM performance was a construct that best explained KM effectiveness because of the direct outcome of KM processes. Unfortunately, for the validation of the knowledge assets construct, there was found to be a low factor loading of knowledge assets on quantity of knowledge, even though the estimated parameter was significant. Because of the various terms and definitions of types and characteristics of knowledge at each institution, the number of types of knowledge in this data set had more variation than anticipated. Therefore, for further KM research, a researcher should clearly define the types and characteristics of knowledge and period of observation before data collection.

Conclusion

Given the importance of KM to higher education institutions, ways for measuring and assessing KM success were created. The indicators developed in this study enable to assess the KM inputs, KM practices via seven KM processes, and KM effectiveness in higher education institutions. There were 26 indicators and 82 evaluation items developed. All three measurement models of KM input, KM process, and KM effectiveness had good fitness with the empirical data with fit indices in range of suggestion. It was shown that the constructs had structural validity. For the study of causal relationships of those KM factors, KM input had significant impact on both KM process and KM effectiveness with a high magnitude of direct and indirect effect size.

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Table 1: Constructs, Dimensions, and Main Literatures

Constructs	Dimensions	Main Literature
KM Input	• KM Purpose • KM Person • Leadership • IT	Kulkarni et al. (2007), Marquardt (1996)
KM Process	• K. Identification • K. Acquisition • K. Creation • K. Sharing • K. Storage • K. Utilization • K. Dissemination	OPDC (2006), Marquardt (1996), Schwartz (2006), William R. et al. (2008), Igel & Numpra- sertchai (2004)
KM Effectiveness		
KM Performance	• K.Identification Per. • K. Acquisition Per. • K. Creation Per. • K. Sharing Per. • K. Storage Per. • K. Utilization Per. • K. Dissemination Per.	Ju et al. (2006), Kulkarni et al. (2007), Biloslavo & Trnavcevic (2007)
Performance Effectiveness	• Curriculum Development • Instructional Development • Research Development • Academic Services Development • Evaluation & QA Development • Student Development	OHEC (2011), Biloslavo & Trnavcevic (2007), Igel & Numpra- sertchai (2004)
Knowledge Asset	• Quantity of Knowledge Asset • Quality of Knowledge Asset	Muhammed et al., (2008), Kulkarni et al. (2007) Shannak (2009)

Table 2: Fitness Indices, Estimated Parameters, & Standard Error of Confirmatory Factor Analysis Model

Observed Variables	Coefficient (b)	Standard Error (SE)	t	Factor Score Regression (FS)	Completely Standardized Solution (SC)	R^2
KM input						
KM Purpose	0.701	0.033	21.469*	0.419	0.843	0.711
KM Person	0.664	0.032	20.611*	0.427	0.839	0.704
Leadership	0.739	0.037	20.061*	0.318	0.826	0.682
IT	0.597	0.041	14.713*	0.114	0.667	0.445
χ^2=0.749, df=2, p-value=0.688, CFI=1.000, NNFI=1.003, AGFI=0.996, RMSEA=0.000						
KM processe						
K.identification	0.649	0.034	18.922*	-0.045	0.784	0.615
K.acquisition	0.713	0.030	23.681*	0.407	0.896	0.803
K.creation	0.736	0.031	23.671*	0.241	0.889	0.791
K.sharing	0.749	0.032	23.239*	0.309	0.885	0.783
K.storage	0.728	0.034	21.594*	0.119	0.841	0.707
K.utilization	0.740	0.034	21.686*	0.176	0.851	0.724
K.dissemination	0.729	0.035	20.579*	0.093	0.815	0.664
χ^2=4.371, df=6, p-value=0.627, CFI=1.000, NNFI=1.001, AGFI=0.987, RMSEA=0.000						
KM Effectiveness						
KM performance						
K.iden_O	0.685	-	-	0.116	0.781	0.610
K.acqui_O	0.671	0.035	19.373**	0.204	0.816	0.666
K.crea_O	0.709	0.036	19.471**	0.122	0.827	0.684
K.share_O	0.750	0.042	17.908**	0.144	0.807	0.652
K.store_O	0.793	0.039	20.093**	0.156	0.832	0.692
K.utili_O	0.784	0.044	17.811**	0.124	0.822	0.675
K.dissem_O	0.821	0.044	18.641**	0.174	0.835	0.697
Performance effectiveness						
Curr_dev	0.674	-	-	0.173	0.790	0.624
Instr_dev	0.665	0.029	23.120**	0.101	0.799	0.638
Res_dev	0.705	0.043	16.423**	0.113	0.758	0.575
Acad_serve	0.751	0.042	17.960**	0.277	0.840	0.705
Eva_QA	0.707	0.037	19.052**	0.289	0.849	0.721
Stu_dev	0.685	0.035	19.800**	0.106	0.805	0.648
Knowledge assets						
Quantity of K.	0.238	-	-	0.067	0.238	0.057
Quality of K.	0.777	0.206	3.766**	0.930	0.926	0.858
χ^2=82.78, df=68, p-value=0.107, CFI=0.999, NNFI=0.999, AGFI=0.957, RMSEA=0.022						

** $p < 0.01$

Table 3: Correlation Matrix of Measured Dimensions

Var.	KM input				KM process							KM performance							Performance effectiveness						K. assets	
	purpose	person	leader	IT	Kiden	Kacq	Kcre	Kshar	Kstore	Kutili	Kdiss	Kiden_0	Kacq_0	Kcre_0	Kshar0	Kstore0	Kutili0	Kdiss_0	curr	instr	res	acad	eva_qa	stu	K.quan	K.qual
purpose	1.000																									
person	0.704**	1.000																								
leader	0.690**	0.698**	1.000																							
IT	0.569**	0.552**	0.632**	1.000																						
Kiden	0.700**	0.688**	0.654**	0.582**	1.000																					
K.acq	0.637**	0.644**	0.628**	0.630**	0.783**	1.000																				
K.cre	0.618**	0.636**	0.644**	0.541**	0.743**	0.805**	1.000																			
K.shar	0.603**	0.692**	0.614**	0.528**	0.701**	0.741**	0.782**	1.000																		
K.store	0.605**	0.657**	0.594**	0.576**	0.734**	0.739**	0.746**	0.755**	1.000																	
K.utili	0.601**	0.637**	0.588**	0.590**	0.709**	0.715**	0.753**	0.754**	0.790**	1.000																
K.diss	0.590**	0.600**	0.597**	0.542**	0.638**	0.732**	0.719**	0.715**	0.700**	0.752**	1.000															
Kiden_0	0.634**	0.682**	0.607**	0.523**	0.824**	0.751**	0.708**	0.659**	0.704**	0.648**	0.596**	1.000														
K.acq_0	0.600**	0.616**	0.592**	0.593**	0.664**	0.824**	0.740**	0.687**	0.673**	0.669**	0.670**	0.677**	1.000													
K.cre_0	0.596**	0.669**	0.602**	0.516**	0.710**	0.780**	0.844**	0.780**	0.728**	0.728**	0.694**	0.694**	0.730**	1.000												
K.shar 0	0.582**	0.660**	0.588**	0.504**	0.684**	0.721**	0.755**	0.833**	0.714**	0.718**	0.686**	0.661**	0.676**	0.760**	1.000											
K.store 0	0.560**	0.615**	0.535**	0.604**	0.704**	0.704**	0.695**	0.667**	0.844**	0.772**	0.660**	0.694**	0.644**	0.696**	0.669**	1.000										
K.utili_0	0.561**	0.590**	0.531**	0.624**	0.681**	0.697**	0.671**	0.648**	0.753**	0.838**	0.722**	0.618**	0.639**	0.662**	0.635**	0.797**	1.000									
K.diss_0	0.567**	0.601**	0.572**	0.530**	0.664**	0.710**	0.708**	0.707**	0.704**	0.751**	0.869**	0.644**	0.669**	0.696**	0.679**	0.692**	0.734**	1.000								
curr	0.452**	0.480**	0.504**	0.430**	0.557**	0.641**	0.638**	0.571**	0.579**	0.623**	0.597**	0.541**	0.587**	0.597**	0.544**	0.569**	0.581**	0.600**	1.000							
instr	0.467**	0.460**	0.475**	0.420**	0.568**	0.627**	0.651**	0.580**	0.584**	0.634**	0.588**	0.537**	0.570**	0.585**	0.558**	0.593**	0.624**	0.584**	0.809**	1.000						
res	0.416**	0.423**	0.412**	0.382**	0.517**	0.593**	0.659**	0.553**	0.584**	0.579**	0.578**	0.464**	0.537**	0.541**	0.508**	0.574**	0.626**	0.579**	0.631**	0.726**	1.000					
acad	0.499**	0.491**	0.482**	0.512**	0.567**	0.631**	0.605**	0.613**	0.577**	0.612**	0.641**	0.495**	0.568**	0.564**	0.592**	0.600**	0.630**	0.621**	0.642**	0.686**	0.684**	1.000				
eva_qa	0.535**	0.526**	0.517**	0.488**	0.640**	0.642**	0.644**	0.646**	0.629**	0.630**	0.618**	0.578**	0.611**	0.588**	0.587**	0.613**	0.620**	0.609**	0.702**	0.686**	0.663**	0.726**	1.000			
stu	0.475**	0.458**	0.422**	0.442**	0.549**	0.618**	0.614**	0.569**	0.592**	0.602**	0.563**	0.528**	0.565**	0.569**	0.555**	0.640**	0.615**	0.571**	0.726**	0.720**	0.656**	0.705**	0.773**	1.000		
K.quan	0.103*	0.086	0.073**	0.106*	0.100*	0.140**	0.110*	0.097*	0.060	0.108*	0.129**	0.072	0.126**	0.088**	0.106*	0.072**	0.099*	0.141**	0.161**	0.101*	0.114*	0.160**	0.100*	0.103*	1.000	
K.qual	0.431**	0.472**	0.444**	0.388**	0.466**	0.504**	0.512**	0.471**	0.522**	0.559**	0.528**	0.456**	0.515**	0.503**	0.447**	0.500**	0.537**	0.505**	0.508**	0.511**	0.493**	0.467**	0.485**	0.481**	0.154**	1.000
MEAN	3.692	3.577	3.753	3.687	3.525	3.578	3.440	3.544	3.310	3.433	3.579	3.490	3.676	3.425	3.511	3.249	3.378	3.405	3.512	3.558	3.447	3.562	3.710	3.473	2.876	3.659
SD	0.833	0.792	0.895	0.894	0.827	0.798	0.829	0.847	0.867	0.871	0.895	0.878	0.822	0.860	0.930	0.955	0.955	0.985	0.909	0.888	0.982	0.914	0.848	0.900	1.203	0.754

* $p < 0.05$, ** $p < 0.01$