Exploring the Relationships among Individual Knowledge Management Outcomes

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Abstract

In knowledge work, it is the individual worker's innovations and performance that make organizations more productive. Previous HICSS discussions have focused on defining knowledge management success at the organizational or project level [20], but largely ignored the factors that define knowledge management success for the individual knowledge worker. This exploratory work proposes a model of the relationships among individual knowledge management outcomes such as conceptual knowledge, contextual knowledge, operational knowledge, innovation, and performance.

The model is tested using a sample of 252 knowledge workers. The results suggest that conceptual knowledge enhances operational and contextual knowledge. Contextual knowledge also improves operational knowledge. Contextual knowledge is the key predictor of innovations that, along with operational knowledge, enhance work performance. The results provide a model for defining and measuring knowledge management success (outcomes) at the individual level.

1. Introduction

Knowledge management (KM) has been interpreted and conceptualized at many levels of abstraction [8]. The most prominent treatment in the literature on knowledge management has viewed it as an organizational initiative or as an organizational system [2, 20]. This paradigm views knowledge as an organizational resource that has to be managed well in order to gain organizational competence. Specific processes and systems, especially, information systems (IS), are needed to manage this key resource. This view has been compared to the resource based view of the firm [13, 14].

Even while viewing knowledge management from such an organizational perspective, most researchers acknowledge the importance of individual knowledge in the success and implementation of these initiatives [13, 14]. At the individual level, a key resource in bringing about effective organizational action is individuals' task-related knowledge. This knowledge reflects the individuals' learning that takes place within the organizational context [22, 26], and can be enhanced by effectively managing the activities that contribute to it.

However, there is a lack of broader understanding of KM and its outcomes at the individual level that can potentially hamper the overall research efforts in the KM field [15]. Acknowledging that there are different types of task knowledge, this research contends that enhanced task knowledge is the primary outcome of individual knowledge management, and explores its relationship with other relevant individual outcomes such as their performance and innovation.

This research focuses on (1) developing measures of task knowledge, which includes conceptual knowledge, contextual knowledge, and operational knowledge, (2) exploring the relationships among the three types of knowledge, and (3) relating these types of knowledge to the innovation and performance of individual knowledge workers. The intent is to provide reliable and valid knowledge management outcome measures at the level of individual knowledge workers. These measures can help validate whether specific organizational factors or knowledge management practices improve knowledge management success. Understanding how conceptual, contextual, and operational knowledge relate to each other can also improve how researchers use these factors in designing future research studies.

2. KM outcomes for the individual

In this section, first we present a conceptual model (Figure 1) to clarify the research focus of this study, and to illustrate how this paper defines the knowledge management outcomes for an individual. This conceptual model is also used to illustrate how the organizational KM context factors are related to the

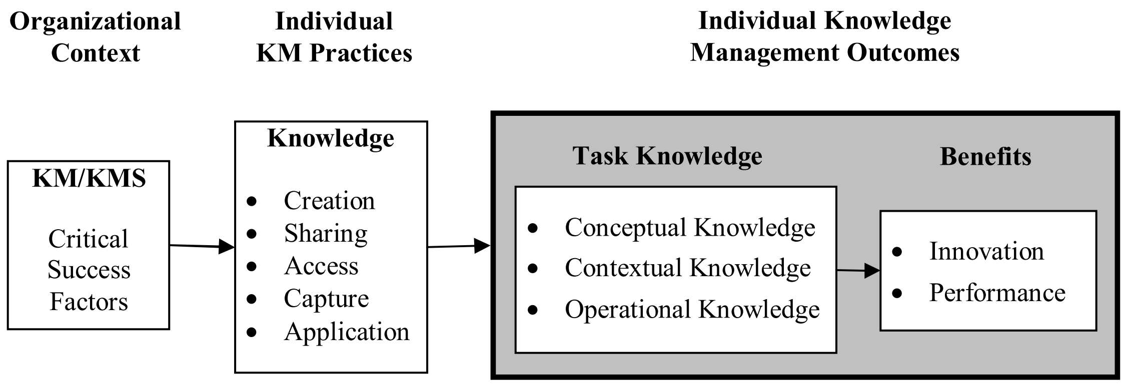

Figure 1. Research focus of this study (shaded area)

individual level factors. Next, we focus on the KM outcomes of the individual. Finally, a model of individual knowledge management outcomes is developed and empirically tested. This model focuses on the relationships among types of task knowledge, innovation, and the performance of individuals.

2.1. Research focus of this study

Outcomes of knowledge management and the factors that contribute to KM success are often confused or interchanged in the literature [20]. Jennex and Olfman [19] have shown a need to separate the critical success factors from the outcomes of KM/ knowledge management systems (KMS) success at an organizational level. From their perspective success factors are aspects of the organization or the environment that are needed for KM/KMS to succeed and should be viewed as distinct from the outcomes. They identify twelve such success factors which include knowledge strategy, technical infrastructure, and organizational culture and structure which may be crucial to the success of any KM implementation. Figure 1 indicates how the organizational critical success factors relate to individuals' knowledge management behaviors and how such sustained behaviors (practices) may contribute to the various individual knowledge management outcomes.

At an individual level, these organizational level factors affect individual behaviors by creating conducive or adverse work environments. From a KM perspective, these organizational factors enable or deter behaviors related to how individuals manage their knowledge. In a work setting, knowledge management behaviors of an individual can include processes involved in knowledge creation, knowledge sharing, knowledge access, knowledge capture, and knowledge application. By engaging in these sustained behaviors, which we call knowledge management practices, individuals should be able to realize improvements in their work related outcomes.

An obvious outcome of managing knowledge effectively at the individual level is to have the right knowledge at the right time, so that appropriate, value added, and creative actions can be enacted by those knowledge workers. To capture individuals' task-related knowledge in an organizational context, we conceptualized it as, conceptual, contextual and operational knowledge based on Yoshioka et al's [36] knowledge framework for communicative actions. Conceptual knowledge is the individual's understanding of why he/she needs to take specific actions to complete the task (know-why) [22, 31]. Contextual knowledge is an individual's understanding of the contextual factors surrounding the task at hand, such as the knowledge related to the people (know-who), locations (know-where), and timing (know-when) necessary to complete the task [8, 29]. Operational knowledge is the individual's understanding of task requirements (know-what) and the processes of how to accomplish the task (know-how) [7, 28].

Possessing knowledge is desirable. However, individuals should be able to use the knowledge to make their work more creative and productive, the outcome that organizations traditionally value. Thus, in addition to the task knowledge outcomes, we also focus on net benefits such as innovation and performance. Innovation is the extent to which individuals' work is novel and useful. Performance is how well individuals' work is done in terms of efficiency, effectiveness, and quality of their work.

2.2. Task knowledge and benefits

Traditionally, task knowledge is measured based on skill tests or tests that are specific to each kind of job. This approach might be appropriate in certain situations but is limited as a broad measure applicable across a wide range of tasks. This is similar to the tests that students take at the end of a particular course to assess their learning during a given period of time. Such assessment is limited in usefulness for researches that are designed to test substantive relationships among broad measures for building or testing theory. Further, the assessment itself is limited to the knowledge contained in such tests and the knowledge base largely needs to be defined a priori. Such a priori and narrow definition of one's knowledge base may not be realistically achieved in a constantly changing environment on an ongoing basis, and may also be context specific [6].

For this research an individual's task knowledge is defined as what an individual knows in relation to a particular task at a specific point in time; equating it to what one's mind hold as his/her mental models [22]. Based on the 5W1H paradigm of questioning a situation reflecting the communicative questions why, what, who, when, where, and how [36], and using a pragmatic approach, we conceptualize knowledge pertaining to a task to be traceable to these questions. These questions probe the conceptual, contextual, and operational knowledge involved in a task (see Table 1).

Conceptual knowledge pertaining to a task is the deeper understanding of why the person is engaged in a particular task and why it has to be done the way it is planned to be performed by that individual. This type of knowledge is often referred to as know-why [1, 11, 31]. Wiig and Jooste [35] point to the importance of such conceptual knowledge when they refer to the metaknowledge in their classification of task knowledge. According to Kim [22], know-why implies the ability to articulate a conceptual understanding of an experience. It is also sometimes referred to as the understanding of the principles and laws of nature, in human mind and in society [21].

Contextual knowledge in relation to a task is the knowledge that may not be central to the satisfactory execution of that task, but may be peripherally related to it. It may be considered as the backstage knowledge with respect to a particular task [29]. Often this knowledge is centered on the (1) knowledge regarding the people that may be involved or affected by that task (know-who: for example, knowledge regarding the customers and stakeholders) or such information as who knows what and who knows what to do [21, 30], (2) knowledge regarding the location of the task or the location of the information about the task (know-where: for example, where can I get appropriate resources to accomplish the task), and (3) the knowledge regarding the temporal aspects of the task (know-when: for example, when should each aspect of the job be done). Such knowledge helps embellish and enrich the operationalization of an act in addition to providing a broader knowledge base for innovative ideas [8].

Operational knowledge is the core knowledge that is needed to accomplish a task satisfactorily. This is also sometimes referred to as problem-solving knowledge or domain knowledge [7]. This core minimum knowledge regarding the task involves know-what and know-how, which is sometimes referred to as declarative and procedural knowledge [11, 31]. Know-what is the knowledge as to what is it that needs to be done in performing a task successfully [21]. And know-how is the knowledge regarding how that task needs to be performed [21]. Without at least a cursory idea of this operational knowledge of the task it is unlikely that the individual will be able to complete his/her tasks satisfactorily [23, 26, 28].

Often the value of knowledge gained is difficult to measure [6], and hence other more measurable indicators are used. For example, Janz and Prasarnphanich [18] use worker satisfaction, personal evaluation of performance, and stakeholder perception of team performance as the indicators of knowledge outcome. Having better knowledge of the task to be performed should be helpful in effectively and efficiently performing such tasks with high quality. Further, having a broader and disparate knowledge regarding a task should help embellish such task and provide a more innovative work outcome [35]. We focus on these two outcomes in this research.

Innovation is one of the important individual activities through which organizations create value [32, 34]. However, Scott and Bruce [32] find that creativity and innovation are often used interchangeable, but argue that innovation is not only the creation of new ideas but also the use of such ideas to create new work productions.

However, creativity is the central aspect of all innovation. Creativity is often defined as the production of ideas, products and procedures that are novel and useful to the organization [3, 24], as opposed to creative behavioral traits of the individual. Accordingly, the focus here is on the novelty of the external artifact rather than the internal behavioral trait. It may involve recombination of existing ideas, materials, and processes or introducing new ideas, materials, and processes [24].

Table 1. Knowledge management outcomes, definition and relevant literature		
Construct	**Definition**	**Literature Base**
Task Knowledge		
Conceptual Knowledge	Conceptual knowledge is an individual's understanding of why he/she needs to take specific actions to complete the task (know-why).	[1, 11, 21, 22, 31, 35, 36]
Contextual Knowledge	Contextual knowledge is an individual's understanding of the people (know-who), locations (know-where), and timing (know-when) aspects necessary to complete the task.	[8, 21, 29, 30, 36]
Operational Knowledge	Operational knowledge is the individual's understanding of task requirements (know-what) and the processes (know-how) to complete the task.	[7, 21, 23, 26, 28, 31, 36]
Benefits		
Innovation	Innovation is the extent to which individuals generate and apply new and useful ideas in their work.	[3, 24, 27, 32, 34]
Performance	Performance is how well the individual's work is done. This includes the efficiency, effectiveness, and quality of work.	[5, 9, 16, 18, 25]

In an organizational context, having the right knowledge is expected to enhance quality and reduce the variability of task performance [25]. For example, in a new product development context, existing knowledge of the firm, conceptualized as organizational memory, is found to affect information acquisition efficiency resulting in new product performance [5]. In a study of IS professionals in knowledge management context, Janz and Prasarnphanich [18] used team performance along three dimensions of efficiency, effectiveness and timeliness. This was based on the outcome measures primarily conducted in job characteristic studies and learning, and can be applicable to both individual and team levels [9, 16]. For this research we adapt their measure and operationalize the performance of individual knowledge worker as efficiency, effectiveness and quality of work (see Table 1).

3. Research model and hypotheses

Figure 2 shows the model that will be tested and the proposed relationship between conceptual, contextual, and operational knowledge and other individual-level work benefits: innovation and performance. Subsequent discussions explore these relationships and propose the associated hypotheses.

Conceptual knowledge, which is a deeper and broader understanding of the situation at hand, may not be always necessary to perform many aspects of a knowledge worker's job satisfactorily. However, having such knowledge provides a sense of purpose and motivation in performing the task in the best possible manner by enhancing know-what and know-how [1]. This broader understanding also helps the individual contextualize his or her actions in the larger scheme of things, and helps draw on appropriate and useful information in novel and useful ways. Conceptual knowledge helps the individual look at his/her actions from higher levels of abstraction. Being able to conceptualize the task from a higher level of abstraction means being able to make richer connections with other knowledge that may or may not be immediately necessary for the execution of the task at hand, and hence, enabling the creation of a richer context for the execution of that task [12, 21]. Thus we contend:

H1: The higher the conceptual knowledge of an individual, the higher the operational knowledge of the individual.

H2: The higher the conceptual knowledge of an individual, the higher the contextual knowledge of the individual.

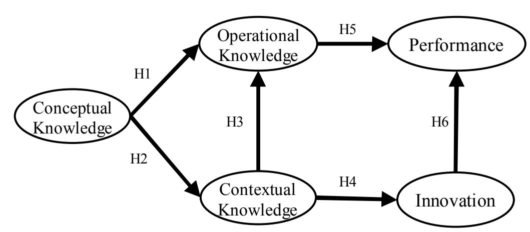

Figure 2. A model of the relationships among individual knowledge management outcomes

Know-who, know-where, and know-when knowledge, though may not be essential to a greater extent to accomplish the tasks satisfactorily (unless the primary purpose of the task itself is based on such knowledge), it creates a rich background for individual actions to take place. Even in situations where the task is primarily centered on this type of knowledge, there still exists a potential to draw upon more of such background information. Such knowledge helps in contextualizing and enriching the primary information that individuals need to use in any of their organizational actions [21]. The greater contextual knowledge individuals can consider, relate to, and base upon their actions in performing various tasks, the better the individuals can embellish their direct task-related knowledge to carry out such actions. Especially in today's knowledge intensive environment there is an increasing need to combine and negotiate such knowledge from multiple domains [12]. Thus, we hypothesize:

H3: The higher the contextual knowledge of an individual, the higher the operational knowledge of the individual.

A key aspect of being innovative in the work place is the ability to generate and apply creative and useful ideas in one's work. Creative artifacts in material originate as the creative ideas in the mind. Novelty is the hallmark of a creative production and requires that individuals connect disparate knowledge in novel ways in their minds. In such situations, rich contextual knowledge provides the potential for the individuals to draw upon seemingly unimportant data to connect them in novel ways to the task at hand. Knowing who the stake holders are and understanding their needs and expectations can positively contribute to not only making the outcomes of one's actions useful to them but also making the outcomes novel and interesting for them. Being able to easily access knowledge about where to get appropriate resources and information regarding a particular task, and knowing when to use such information and take appropriate actions can help the individuals ease the task of performing those actions. This frees their mental prowess for more creative work. Further, it is often essential to make use of disparate, multi-domain contextual information to produce hybrid and novel solutions [10]. Thus, we contend:

H4: The higher the contextual knowledge of an individual, the higher the innovativeness of the individual's work.

Operational knowledge is the primary knowledge that an individual needs to have in performing the task. This knowledge includes knowing what is it that needs to be done to accomplish a task and the knowledge regarding how to do it. When an individual has such information readily accessible to his or her mind, performing the task becomes substantially effortless. Wiig and Jooste [35] contend that having such personal knowledge and understanding provides workers at all levels with the basic ability to be efficient in the provision of their contributions. When more such information is available, the implementation of such actions becomes more effective and efficient. In this case, the individual can focus on performing the task rather than making sense of the situation and performing the task at the same time.

H5: The higher the operational knowledge of an individual, the higher the performance of the individual's work.

Organizational productivity gains are achieved by making people work more efficiently through many work improvements including better innovations [35]. Especially, in non routine work such as in knowledge work, individual innovations help them create procedures and artifacts that help them accomplish the task faster and more effectively [32, 34]. Even small constant innovations in work can produce significant performance improvement for the individual and the firm. Thus, we hypothesize:

H6: The higher the innovativeness of an individual's work, the better the performance of the individual.

4. Research methods

Following a pretest of the items, measures were further refined by conducting a pilot test. The pilot test involved a small scale data collection and assessment of validity, dimensionality and reliability of the scales. Subsequently, a large scale data collection targeting managerial and professional knowledge workers was implemented using a web-based questionnaire. The following sections briefly describe the pilot, the large scale sample, and the measurement development. Structural equation modeling software package LISREL is employed for measurement assessment and for testing the structural model and hypotheses.

4.1. Pilot testing

A pilot test was performed based on 53 responses obtained out of the 68 survey requests from knowledge workers. Twenty four responses were received from the individuals working in the various functions within a few mid-west organizations involved in design, manufacturing or consulting and the rest of 29 responses were received primarily from MBA students working for manufacturing firms. The respondents were identified by their managers or themselves as knowledge workers who used information technology heavily for their daily work. The pilot stage data analysis involved item purification using corrected item-total correlation (CITC) scores, evaluation of unidimensionality using principal component factor analysis, evaluation of convergent and discriminant validity using structural equation modeling and reliability assessment using Chronbach's alpha. Items pertaining to each construct were modified or eliminated based on the feedback from the pilot results.

4.2. Large scale sample

To implement the large scale data collection, a web based survey was implemented. An email list from Manufacturer's News Inc targeting managerial knowledge workers were used to reach the target respondents. The website implemented tracking of click-throughs based on the email invitations requesting the individual to complete the survey online. After administering two waves of emailing, 252 usable and complete responses were obtained yielding a 31.6% response rate based on click-throughs. Thus, the response rate is based on those who read the email and clicked on the link. Respondents include individuals from a wide range and size of industries. The majority of the respondents are professionals or in middle management or above positions. Non-response bias is evaluated using a Chi-square test of goodness-of-fit of various demographic variables between the first and second wave of data collection [33]. Results indicated no significant difference (p-value > 0.10) between the various demographic variables. Measures were then evaluated in steps similar to the pilot stage involving item purification, evaluation of factor structure, unidimensionality, and convergent and discriminant validity.

4.3. Measures

Respondents were asked to answer the survey items based on a particular project or an assignment, or based on the last six months of their work if they did not typically work on projects. Providing a more specific framework as mentioned above was expected to help respondents recall the work situation and answer the question with a consistent frame of reference. It is important to provide such a consistent framework to elicit the level of respondents' knowledge within the specified duration because, conceptual and contextual knowledge at any given time may be the result of knowledge that may have been accumulated over a long period of time, whereas the operational knowledge could have been often acquired closer to when the task needs to be performed. The specific measures for the three dimensions of task knowledge is newly developed in this research and uses a five point Likert type scale where 1= None or to a very little extent and 5= To a very great extent.

Innovation is measured using three items as indicated in Table 2 based on Oldham and Cummings' [27] creative performance and Scott and Bruce's [32] innovative behavior with the focus on the work outcome. Performance is measured based on Janz and Prasarnphanich's [18] measure used in a team performance context.

For innovation, a seven point Likert type scale ranging from 1= Not at all to 7= To an exceptionally high degree, is used, and a scale ranging from 1= Strongly disagree to 7= Strongly agree is used for performance. The final items for each construct after purification and measurement analysis are listed in Table 2.

5. Results

Data analysis is performed in a two step process where first the measurement model is evaluated followed by the analysis of the structural model to evaluate the hypotheses [4]. In the first step, descriptive statistics are presented along with the analysis of reliability, convergent validity and discriminant validity of the measures. Next, the structural model is evaluated using LISREL to test the substantive hypotheses H1 through H6.

5.1. Measurement model results

The descriptive statistics, Cronbach's alpha, average variance extracted (AVE) and correlations between the variables are reported in Table 3. The means range from 3.99 for contextual knowledge (on a 5 point scale) to 5.85 for performance (on a 7 point scale). The standard deviations range from 0.66 for contextual knowledge to 1.24 for Innovation. The skewness values are between -2 and +2 and the kurtosis values are all lower than 5.0, providing evidence that the scales are normally distributed.

The Cronbach's alpha indicates adequate reliability and ranges from 0.81, for operational knowledge, to 0.94 for conceptual knowledge. Correlations range from 0.14 to 0.59, and are all

Table 2. Measurement items for task knowledge and performance outcomes

Construct	Label	Items
	Towards the end of the assignment/project/work to what extent did you have FULL knowledge of…	
Conceptual Knowledge	CONC1	the reasons behind your actions
	CONC2	the philosophy behind your actions
	CONC3	the purpose of your actions
	CONC4	the rationale behind your actions
Contextual Knowledge	CONT1	whom to go to for the necessary resources
	CONT2	who were the most knowledgeable people at work
	CONT3	where you could get the required resources
	CONT4	when different things had to be done
	CONT5	when to share information
Operational Knowledge	OPER1	how to implement your work routines
	OPER2	the relevant know-how
	OPER3	your job requirements
Innovation	During the assignment/project/work compared to other people in similar position…	
	INNV1	I was the first to use certain ideas in my kind of work
	INNV2	my work was original and practical
	INNV3	my work was creative
Performance	Towards the end of the assignment/project/work compared to other people in similar position…	
	PERF1	I was very efficient at my work
	PERF2	I was very effective in my work
	PERF3	my work was of very high quality

significant at p-value < 0.01 except for correlation between operational knowledge and innovation (0.14) which is significant at p-value < 0.05.

AVE scores range from 0.53 for contextual knowledge to 0.80 for conceptual knowledge. Scores above 0.50 are an indication of convergent validity. Convergent validity is also assessed by how well the items load on their respective latent variable. Figure 3 shows standardized item-factor loadings for all the five constructs. All standardized item-factor loadings are 0.70 or higher, except for one item for contextual knowledge (which has a loading of 0.69), indicating good convergent validity for the items measuring each of these constructs. Further, all loadings are significant at p-value < 0.01.

An analysis of AVE scores and the squared correlations in Table 3 indicates that the AVE scores are greater than the square of the correlation between the focal factor and other factors, suggesting adequate discriminant validity. A more rigorous chi-square (χ^2) test of discriminant validity indicates whether a unidimensional rather than a two-dimensional model can account for the inter-correlations among the observed items in each pair. For ten comparisons, the chi-square value for the test of discriminant validity between pairs of latent factors must be equal to or greater than 10.83 for significance at p-value 0.01. Chi-square difference between the correlated model and the measurement model with correlations fixed to 1 indicate that all values are significant at $p < 0.01$ (Table 3), suggesting discriminant validity between all pairs.

The five factor correlated measurement model is judged to have good model-data fit with $\chi^2 = 186.47$ for 125 degrees of freedom (chi-square per degree of freedom = 1.49), Root Mean Square Error of Approximation (RMSEA) = 0.044, Bentler-Bonett Non-Normed Fit Index (NNFI) = 0.97, and Bentler Comparative Fit Index (CFI) = 0.98. Values of RMSEA less than 0.05, and NNFI and CFI closer to one is recommended for a model to be considered to have good fit [17]. All items have an item-factor loadings greater than 0.69 (p-value < 0.01). The major modification index (12.05) is an error correlation between two items in conceptual knowledge. The expected value of the change for this modification is only 0.05. There are also two cross-loadings to conceptual knowledge, the expected value of change for the larger one of the two is 0.19, indicating a relatively weak cross loading as compared to a much stronger standardized loading on the respective constructs.

5.2. Structural model results

In order to test the substantive hypotheses a combined measurement and structural LISREL model is developed (Figure 3). The result of this analysis is used to accept or reject the hypotheses based on the significance of the standardized structural coefficients of the relationships. In order to evaluate the significance of the structural coefficients, a reasonable model-data fit is necessary and is evidenced based on

Table 3. Reliability, convergent validity and discriminant validity of task knowledge and performance outcomes

	Conceptual Knowledge	Contextual Knowledge	Operational Knowledge	Innovation[!]	Performance[!]
Conceptual Knowledge	AVE=0.80				
	α=0.94				
Contextual Knowledge	*r=0.56***	AVE=0.53			
	χ^2= 387.52	α=0.85			
Operational Knowledge	*r=0.53***	*r=0.59***	AVE=0.59		
	χ^2= 155.60	χ^2= 106.90	α=0.81		
Innovation	*r=0.25***	*r=0.22***	*r=0.14**	AVE=0.73	
	χ^2= 977.91	χ^2= 650.38	χ^2= 248.77	α=0.89	
Performance	*r=0.25***	*r=0.29***	*r=0.45***	*r=0.39***	AVE=0.71
	χ^2= 366.02	χ^2= 364.07	χ^2= 202.62	χ^2= 345.70	α=0.88
Mean=	*4.19*	*3.99*	*4.08*	*5.12*	*5.85*
SD=	*0.81*	*0.66*	*0.68*	*1.24*	*0.88*
Skewness=	*-1.14*	*-0.81*	*-0.69*	*-0.60*	*-1.14*
Kurtosis=	*1.28*	*1.04*	*0.17*	*0.24*	*1.64*

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).
! a seven point Likert scale is used for this variable.
$\chi^2 \geq 10.83$ for 1 d.f. is significant at p-value corrected for number of comparisons (0.01/10).

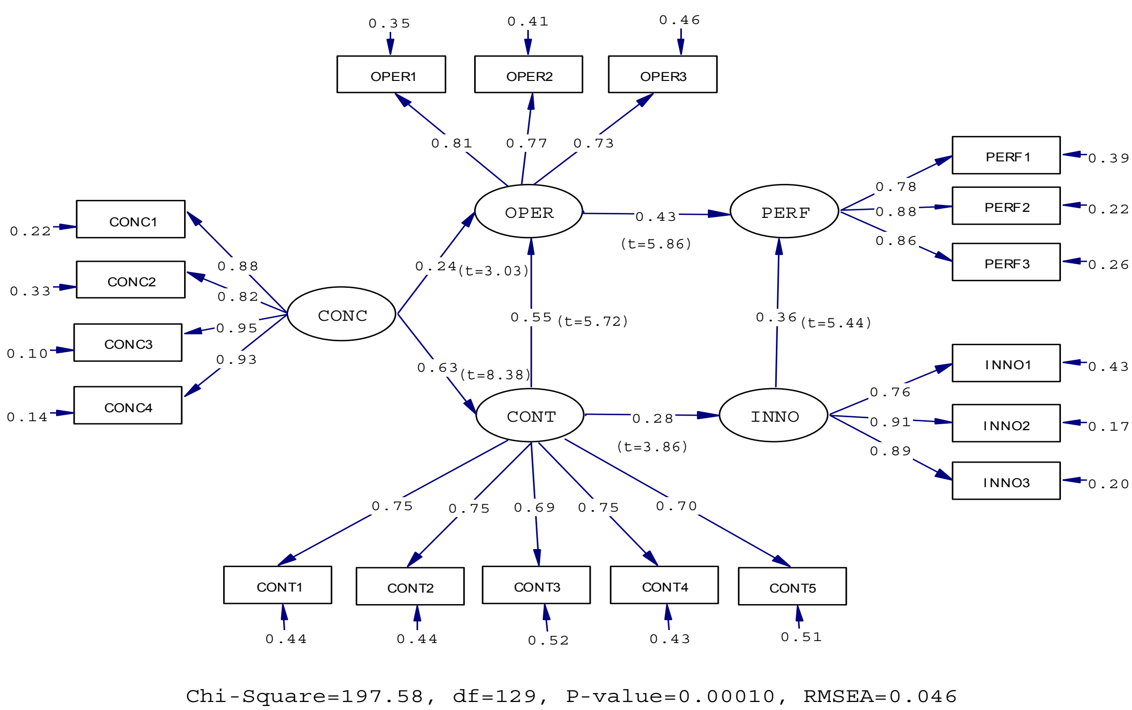

Figure 3. Combined LISREL measurement and structural model: Standardized solution

the various fit statistics. All item loadings and structural relationships are significant at p-value<0.01.

Modification indices indicate three correlations among error terms. These correlated error terms are relatively weak with the largest modification index being 11.43 between CONC3 and CONC4. The model indicates good model-data fit upon examination of the various absolute and incremental fit indices (RMSEA=0.046, NNFI=0.97, CFI=0.98). The structural coefficient from conceptual knowledge to contextual knowledge has the strongest relationship with a standardized coefficient of 0.63. Weakest direct link is from conceptual knowledge to operational knowledge (0.24). However, all structural coeficents are significant (p-values < 0.01) and support all six proposed hypotheses.

6. Discussion and conclusions

Critical success factors (CSFs) represent an organizational context that is necessary for the success of knowledge management initiatives at the organizational level. They are factors that contribute to an organization's success at building knowledge-based competencies or taking advantage of the knowledge created by individuals. Knowledge is primarily created by individuals and then shared among a community of knowing in an organization.

The success of knowledge management depends upon: the knowledge management practices used by individuals; the extent that these knowledge management practices enhance the conceptual, operational, or contextual knowledge of individuals; and whether this enhanced task knowledge improves individual innovation and performance. Increased task knowledge is the enhancement of an individual's mental model of frameworks and routines (declarative and procedural knowledge) related to the work.

The results indicate that conceptual knowledge has an indirect rather than a direct effect on innovation and performance. Conceptual knowledge works through contextual and operational knowledge to impact innovation and performance, respectively. Thus, it is a necessary, but not a sufficient condition for achieving these benefits such as innovation and performance.

Contextual knowledge helps enhance operational knowledge. Know-what and know-how can be enhanced by having greater knowledge of know-who, know-where, and know-when. This suggests that operational knowledge may not be fully usable for improving performance without a specified context for action. Contextual knowledge has not been conceptualized and researched explicitly as a separate variable. The relationship between process and context has not been adequately studied. For example, you may know the product development process but your success in this process will be enhanced if you have identified a specific target market, have better knowledge of your customers' needs, and know when the product needs to be introduced to provide a first-to-market advantage.

The results indicate that contextual knowledge also plays an important role in predicting innovation. For example, the knowledge of customer requirements will help knowledge workers identify innovations that meet or exceed customer expectations. Enhanced contextual knowledge provides richer background to generate novel ideas.

This paper also contributes to the KM literature by developing measurement instruments for evaluating KM outcomes at an individual level. The measurement instruments can be used to understand antecedent factors such as KM practices or KMS CSFs. These instruments have good reliability, convergent validity, and discriminant validity. They are short and easy to incorporate into other studies of knowledge management success. In addition to validating these measures in other contexts, future research should also focus on determining which KMS CSFs or KM practices are most instrumental in enhancing the task knowledge, innovation, and performance of individuals.

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