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A Contingency Model of Knowledge Creation

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Abstract

Knowledge management (KM) has been recognized as one of the most important issues for sustaining competitive advantage. In order to achieve KM effectively, past research argued that it is important to facilitate and leverage knowledge assets. However, few studies examine knowledge processes and enablers that may influence the accumulation of knowledge assets. To fill this gap, drawing on dynamic capabilities perspective and absorptive capacity theory (ACAP), this paper develops a contingency model that interconnects the aforementioned KM factors. In order to test the feasibility of the research model, we conducted an empirical study. This study employed a survey instrument, which collected data from 1000 respondents from organizations in computer industry, finance, transportation and service, manufacturing, construction, electronics, trade, and academic institution. A total of 303 usable responses were analyzed. The major contributions of this research are: (1) develop a KM framework that identifies the impact of knowledge-creating processes on knowledge assets; (2) specify the moderating effect of task characteristics on the relationship mentioned in item (1). The implications of the study are provided, and further research directions are proposed.

Keywords: knowledge management, knowledge assets, knowledge-creating processes, task characteristics, absorptive capacity theory (ACAP)

1. Introduction

The primary motivation for knowledge creation is to share, create, accumulate, and leverage knowledge assets, which in turn improve business performance. Managing knowledge creation is required for sustaining the advantage of KM. However, managing knowledge creation processes effectively is not a trivial task. Few companies are capable of managing the KM process and maintaining and consuming the service/product produced by knowledge creation. Management focus is required for attaining the advantage of knowledge creation. Knowledge creation can be categorized according to two dimensions of management focus. The first one focuses on explicit knowledge that emphasizes the dynamic capability to facilitate the creation, store, share, and use of explicitly documented knowledge. The second one is tacit knowledge, which proposes that knowledge is created and shared by interpersonal interaction (Nonaka and Takeuchi 1995, Choi an Lee 2003).

Although the explicit and tacit perspectives of knowledge epistemology have been widely known by KM researchers, this lens of analysis fails to address the dynamic capabilities of knowledge creation that enable the firm to reconfigure its resource base— for example, knowledge assets-- and adapt to changing market conditions, from which another spiral of knowledge creation emerges (Chou and He 2004, Nonaka et al. 2000). More specifically, most of previous studies underline the KM enablers: social capital, culture, structure, people, and information technology (IT) (Wasko and Faraj 2005, Lee and Choi 2003, Sawhney and Prandelli 2000), whereas the outcomes of knowledge creation processes are usually overlooked. In order to fill this gap, this study employs the theory of absorptive capacity (Zahra and George 2002) besides the explicit-oriented and tacit-oriented perspectives as the theoretical lens to analyzing the role of knowledge creation processes that produces the dynamic capabilities of the firm—knowledge assets. These assets may initiate another cycle of knowledge creation.

Given that the relation between knowledge process and its product—knowledge assets—is not specified by previous study, the paper aims to explore the research question: "what role the knowledge creation processes play in facilitating the accumulating of knowledge assets which in turn may increase the absorptive capacity of the firm?" Our research objectives are: (1) identifying the links between knowledge creation processes—socialization, externalization, combination, and internalization (SECI)—and knowledge assets, which are the products/outcomes of SECI; (2) examining the above link under different circumstances—this study takes a contingency theoretic view, suggesting that the impact of SECI is moderated by the context in which the knowledge is being used. The focus is on one specific aspect of the context, namely the nature of the tasks performed by the individuals and groups using the outcomes resulting from SECI processes.

The layout of this paper is organized as follows. We first present a literature review on knowledge creation, knowledge assets, and task characteristics. Then we explain our conceptual framework and justify its hypotheses. Next, we describe the research methodology followed by a discussion of the empirical findings. Finally, we summarize our results and propose implications to research and practice.

2. Past studies and theoretical background

2.1 The hierarchy view of data, information, and knowledge, and alternative perspectives of knowledge

Prior research addresses the question of defining knowledge by distinguishing among knowledge, information, and data. There are two major types of views regarding this definition: hierarchy view of data-information-knowledge vs. inverse hierarchy view of data-information-knowledge. The former one suggests that data is raw numbers and facts, information is processed data, and knowledge is authenticated information (Alavi and Leidner 2001, Vance 1997). They also propose that the major aspect that may effectively distinguish between information and knowledge is not found in the content, structure, accuracy, or utility of the supposed information or knowledge. Rather, knowledge is information processed in the mind of individuals: it is personalized information (which

may or may not be new, unique, useful, or accurate) related to facts, procedures, concepts, interpretations, ideas, observations, and judgments.

The second view--inverse hierarchy view of data-information-knowledge--suggests that the often-assumed hierarchy form of data to knowledge is actually the inverse: knowledge must exist before information can be formulated and before data can be measured to form information (Tuomi 1999). Tuomi (1999) argues that knowledge exists which, when articulated, verbalized, and structured, becomes information which, when assigned a fixed representation, and standard interpretation, becomes data. The key concept of this argument is that knowledge is the result of cognitive processing triggered by the inflow of new stimuli—for individuals to arrive at the same understanding of data or information, they must share a certain understanding.

Previous studies examine the KM from other perspectives, besides the aforementioned views. The first view defines knowledge as an object, which can be stored and manipulated (McQueen 1998, Zack 1998). The second perspective confirms that knowledge can be viewed as a process of simultaneously knowing and acting (McQueen 1998, Zack 1998). This view focuses on the applying of expertise. Finally, knowledge can be viewed as a capability with the potential for influencing future actions (Alavi and Leidner 2001, Carlsson et al. 1996). This view suggests that knowledge is not so much a capability for specific action, but the ability to use information and existing knowledge resources; learning and experience result in an ability to interpret information and to ascertain what information is necessary in decision making. The major implication of the various conceptions of knowledge is that each perspective suggests a different strategy for managing knowledge.

2.2 Theoretical background

In the KM field, many researchers have identified the critical role that knowledge creation and knowledge assets may play (Lee and Choi 2003, Nonaka and Takeuchi 1995, Purvis et al. 2001, Smits and Moor 2004). Knowledge creation processes can be thought of as a structured coordination for effectively managing the activities such as creating, sharing, storage, and usage of knowledge. Whereas knowledge creating processes represent the basic operations of knowledge, knowledge assets are the possible outcomes of these operations (Nonaka et al. 2000). In addition, task characteristics represent the moderating effect between knowledge creation and knowledge assets, because the effectiveness of KM process depends on the circumstances under which it is used (Becerra-Fernandez and Sabherwal 2001).

Our primary research focus is on the relationships between knowledge creation processes and knowledge assets by elaborating on the contingent effect of task characteristics. The relationships among these components can be derived from the input-process-output model by Hackerman and Morris (1978). We modified this model by proposing that the input processes-- i.e. knowledge creation processes-- affect output—the accumulation of knowledge resource and assets through certain kinds of interaction variables—task characteristics.

We further explore the implications of the above relationships by referring to the definitions of knowledge from previous section. First, although most of the previous studies (Chou and He 2004, Lee and Choi 2003) identify that the importance of the enabling conditions for knowledge creation processes, we suggest that the output of such processes is also critical. In Nonaka et al's research (2000), they confirm that the output of knowledge creation may facilitate another sequence of knowledge creation, yet effective strategy and tool for evaluating and managing knowledge assets are absent. According to the inverse hierarchy view of data-information-knowledge (Tuomi 1999), existing knowledge has significant influence on the creating of new knowledge. Alavi and Leidner (2001) argues that in order to facilitate KM, individuals must share a certain understanding as well as triggered by the inflow of new stimuli—for example, information, knowledge resource and assets. In sum, measuring the output of SECI—knowledge assets--is also deserved recognition.

Second, our model can be explained from the object, process, and capability perspectives. According to McQueen (1998) and Zack (1998), knowledge can be viewed as both an object and a process. In terms the latter, the knowledge creation processes contains four intertwined modes—Socialization, Externalization, Combination, and Internalization (SECI) (Nonaka and Takeuchi 1995), in which the KM activities focus on knowledge flows and the process of creation, sharing, and distributing knowledge. The outcomes of SECI—knowledge assets—can be treated as knowledge stocks that can be stored, used, built and managed by organizations. In addition, based on the capability view of knowledge (Alavi and Leidner 2001, Carlsson et al. 1996), the ability of creating knowledge and knowledge assets enhances the intellectual capital, which in turn builds core competence of a firm.

In order to further analyze the accumulated knowledge assets from the capability view, we borrow the theory of absorptive capacity (ACAP). Zahra and George (2002) conceptualize absorptive capacity as a dynamic capability pertaining to knowledge creation and utilization that enhances a firm's ability to gain and sustain competitive advantage. ACAP exists as two subsets of potential and realized absorptive capacity. While the potential ACAP makes the firm receptive to acquiring and assimilating external knowledge, realized ACAP denotes a firm's capability to leverage the knowledge that has been absorbed. In other words, from the capability view, ACAP refers to the set of organizational routines and processes, by which organizations acquire, assimilate, transform, and exploit knowledge to produce dynamic organizational capability. We use the absorptive capacity lens to build a conceptual framework that links the knowledge creation, knowledge assets, and task characteristics.

3. Hypothesis development

3.1 Effects of knowledge creation process on the accumulation of knowledge assets

Based on the analysis in previous sections, we derived our hypotheses which contain the following variables.

Knowledge creation processes

As discussed in above section, there is relatively little research pertaining knowledge creation, compared with other types of knowledge process such as knowledge transfer. On the other hand, previous studies also indicate that knowledge creation has impact on the accumulation of knowledge source—a dynamic capability that leads to a firm's competitive edge. Thus, the emphasis of this study is on knowledge creation.

In order to explore knowledge creation, this study employs Nanaka and Takeuchi's (1995) SECI model for the following two reasons. First, SECI model has become widely accepted (Scharmer 2000), and it has been used in a number of studies and research areas such as organizational learning (Scott 2000), IS (information systems) development and IT (information technology) assimilation (Purvis et al. 2001), user IT innovation (Nambisan et al. 1999), and organizational knowledge management (Becerra-Fernandez and Sabherwal 2001, Gold et al. 2001, Lee and Choi 2003). Second, SECI is a comprehensive knowledge management model; it contains diversified characteristics of knowledge management such as knowledge creation, knowledge transfer, and knowledge integration.

Socialization (S) is the process of converting existing tacit knowledge into new tacit knowledge. It is usually through shared experience and interacting with other people within or beyond organizational boundaries (Becerra-Fernandez and Sabherwal 2001). Externalization (E) is the process of articulating tacit knowledge into explicit knowledge. When tacit knowledge is made explicit, knowledge is crystallized, thus allowing it to be shared by others, and it becomes the basis of new knowledge (Nonaka and Konno 1998, Nonaka et al. 2000). Combination (C) is the process of converting explicit into more complex and systemic sets of explicit knowledge. Explicit knowledge is collected from inside or outside of the organization and then combined, edited or processed to form new knowledge (Alavi and Leidner 2001, Nonaka and Takeuchi 1995, Lee and Choi 2003). Internalization (I) is the process of embodying explicit knowledge into tacit knowledge. Through internalization, explicit knowledge is shared throughout an organization and converted into tacit knowledge by individuals (Becerra-Fernandez and Sabherwal 2001, Nonaka and Takeuchi 1995).

Science knowledge creation processes do not necessary produce the dynamic capability that influences a firm's competitive advantage, this study turns to the capability view and absorptive capacity theory to specify the relations between processes—SECI-- and products—knowledge assets, rather than only using the tacit and explicit perspectives to explain these relations.

Based on Nonaka et al's (2000) definition and Smits and Moor's (2004) empirical investigation, knowledge assets are the firm-specific resources that are indispensable to create values for the firm. They identify four different knowledge assets (KA). First, experiential knowledge assets contain the skills and know-how that are acquired and retained by individuals from their working experiences. There are four other types of experiential knowledge assets. The first one is emotional knowledge such as care, love, and trust. The second one is physical knowledge such as facial expressions and gestures. Energetic knowledge is the third type of experiential knowledge assets such as senses of

existence, enthusiasm, and tension. The last type is rhythmic knowledge such as improvisation and entrainment. The second type of knowledge assets is conceptual knowledge assets, which are the assets based on the perceptions held by customers and employees of the organization. These assets are easily articulated through images, symbols, and language such as what products need to be developed and the specific design features that need to be designed in the products. For example, brand equity represents the perceptions of customers. Another example includes concepts or designs, which are perceived by the members of the organization. Third, systemic knowledge assets consist of the systematic and organized knowledge, such as clearly stated technologies, product specifications, manuals, and documented and packaged information about customers and suppliers. Legally protected intellectual properties such as patents and licenses also fall into this category. Finally, routine knowledge assets consist of the activities that are embedded and regulated in the actions and practices of a firm. Know-how, working practices, organizational culture, and organizational routines for carrying out day-to-day business are examples of routine knowledge assets.

In order to analyze the relationship between SECI and knowledge assets, we use ACAP. ACAP allows one to estimate a firm's dynamic capability through four dimensions: acquisition, assimilation, transformation, and exploitation (Malhotra et al. 2005, Zahra and George 2002). First, the accumulated knowledge assets such as documents, manuals, and database may in turn facilitate the individuals to identify and acquire the internally and externally generated knowledge that is critical to its operation-- acquisition. Second, the accumulated routine and systemic knowledge assets allow individuals to analyze, process, interpret, and understand the information that is obtained from external resources—assimilation. Third, in terms of transformation, from the inverse hierarchy view of data-information-knowledge, the accumulated knowledge assets play an important role in facilitating the acquiring of new knowledge, the combining of existing and the newly acquired and assimilated knowledge, because existing knowledge help individuals and organizations formulate and measure new knowledge that is useful (Tuomi 1999). Finally, with the help of skills, know-how, and others type of experiential and routine knowledge assets, organizations create the capability that allow them to refine, extend, and leverage existing competence or to create new ones by incorporating acquired and transformed knowledge into a firm's operations—exploitation.

H1: Socialization process is positively associated with the creating of knowledge assets.
H2: Externalization process is positively associated with the creating of knowledge assets.
H3: Combination process is positively associated with the creating of knowledge assets.
H4: Internalization process is positively associated with the creating of knowledge assets.

3.2 The moderating effects of task characteristics

This study departs from prior research on KM by arguing that the creating of knowledge assets depends on the conditions under which the knowledge-creating processes are used (Gelderman 2002). As shown in Figure 1, the basic argument of our model is that the SECI process that individuals and groups should use depends on the nature of tasks they

achieve (Becerra-Fernandez and Sabherwal 2001). This argument has been supported by previous research. For example, Van de Ven and Delbecq's (1974) study proposed a contingency relationship between subunit tasks and organization structure. Two task characteristics—task orientation and task domain-- that may affect the suitability of knowledge-creating processes are examined in this study. In order to achieve knowledge management in an effective way—to facilitate the creating of knowledge assets effectively, task dimensions require different types of organizational knowledge, which in turn suggests that individuals may adopt the most appropriate knowledge-creating process to creating knowledge assets based on the task characteristics.

Task orientation

Recent studies regarding strategic management and organization theory emphasize the importance of task orientation that may differentiate firms (Pisano 1994). Based on task orientation, organization subunits have been classified into two basic categories: process-oriented and content-oriented. Content-oriented tasks focus on the specific goals to be fulfilled. For example, the specific features or functions of products that an organization may produce. Thus, the main concern of content-oriented tasks is the know-what or declarative knowledge (Kusonaki et al. 1998).

In contrast, process-oriented tasks focus on the processes or methods that are adopted by individuals or groups to develop the products. They concern issues such as how to perform the processes that are necessary in achieving the specific product design. According to Nonaka and Takeuchi's (1995) definition, "know-what" and "know-how" have been associated with explicit and tacit types of knowledge respectively. Thus, based on the definitions of SECI, it seems that externalization and combination will benefit content-oriented tasks. In contrast, process-oriented tasks are more likely to benefit by socialization and internalization.

Task domain

According to Kusonaki et al's (1998) definition, task domains can be divided into two categories: focused and broad tasks. Subunits performing focused tasks have low task variability but greater specialization, while subunits performing broad tasks have greater task variability and greater need for collaborating and exchanging knowledge with other subunits within the organization (Ven de Ven and Delbecq 1974). In order to perform tasks that are focused in domain, individuals need distinctive units of knowledge such as "functional knowledge embodied in a specific group of engineers, elemental technologies, information processing devices, databases and patents (Kusonaki et al 1998)." They often require deep knowledge or knowledge that is highly specific in a particular area.

According to the definitions of internalization and externalization (Nonaka and Takeuchi 1995), the former process emphasizes the acquisition of knowledge by observing or doing (i.e. learning by doing). Regarding externalization, individuals use metaphors, analogies, or narratives to model their knowledge. The purpose of externalization is to make individual's knowledge more agreeable and understandable to others in the group, while through internalization individual absorbs knowledge held by others in the group.

Both of internalization and externalization contain the knowledge-creating processes, which are personal and individualized (Magalhães 1998). Therefore, internalization and externalization belong to the focused task domain category (Becerra-Fernandez and Sabherwal 2001).

Performing tasks that are broad in domain relies primarily on dynamic interactions among people from different functional groups. In order to achieve the tasks with a broad domain, individuals combine and transform their knowledge through communicating and exchanging across different expertise. As Nahapiet and Ghoshal (1998) suggest, "significant progress in the creation of intellectual capital often occurs by bringing together knowledge from disparate sources and disciplines." Both of socialization and combination processes help integrate and synthesize existing knowledge to create new knowledge. When the types of knowledge being integrated are explicit, combination can help to generate new explicit knowledge. On the other hand, socialization is more appropriate to produce the types of knowledge that being synthesized are tacit.

In summary, it seems appropriate to adopt combination and socialization processes to handle task with broad domain, whereas externalization and internalization processes seem more suitable for focused task domain. In addition, externalization and combination processes are likely a relevant choice for content-oriented tasks, while internalization and socialization processes seem correct for process-oriented tasks. As shown in Figure 1, this paper proposes a contingent model that delineates the relationship among knowledge creation, knowledge assets, and task characteristics.

--Insert Figure 1 about here--

H5: Compared to other organizational subunits, socialization process has a greater impact on the creation of knowledge assets in organizational subunits that fulfill broad and process-oriented tasks.

H6: Compared to other organizational subunits, externalization process has a greater impact on the creation of knowledge assets in organizational subunits that fulfill focused and content-oriented tasks.

H7: Compared to other organizational subunits, combination process has a greater impact on the creation of knowledge assets in organizational subunits that fulfill broad and content-oriented tasks.

H8: Compared to other organizational subunits, internalization process has a greater impact on the creation of knowledge assets in organizational subunits that fulfill focused and process-oriented tasks.

4. Research methodology, data analysis, and results

Data

Data were collected from firms of Taiwan through a survey instrument. An initial version of the survey instrument was developed based on the theory-grounded operationalization of the various constructs. The instrument used to measure the knowledge assets has been adapted from previous research concerning knowledge management and knowledge

assets (Becerra-Fernandez and Sabherwal 2001, Chou and He 2004, Lee and Choi 2003, Nonaka et al. 2000).

Validity and reliability

The results of factor analysis relating to unidimensionality/convergent validity are shown in Table 1. A joint domain factor analysis was performed, including all of the items used to develop the research constructs (Hair et al. 1998). Reliability was evaluated by assessing the internal consistency of the indicator items of each construct by using Cronbach's α(0.7364~0.9292). All alphas are greater than the recommended 0.70 level, therefore suggesting an adequate level of internal consistency and reliability.

We adopted stepwise regression analyses to investigate the relationship between SECI and knowledge assets. The regression model is not meaningful if the correlation between a DM's biases and system success measure is not significant. We used Pearson correlation analyses and ANOVA to examine the correlations among the constructs of SECI and knowledge assets. The results indicate that the aforementioned correlations among SECI and knowledge assets are in a significant level (i.e. for Pearson $p< 0.01$; for ANOVA $p< 0.05$). We then tested the effect of each knowledge creation process on knowledge assets measure.

--Insert Table 1 about here—

The results of the stepwise regression analyses show that all of the knowledge creation processes have significant impact on the accumulating of knowledge assets. As shown in Table 2, combination (β= 0.358) has the highest effect on knowledge assets whereas externalization (β= 0.129) exerts the lowest influence. In addition, the impact of internalization (β= 0.301) on knowledge assets is higher than that of socialization (β= 0.154). The results of the collinearity test (CI = 13.171~24.862) suggest no multicollinearity problem. Thus, these findings support hypothesis 1 through 4.

In order to test the effect of SECI on knowledge assets for different task characteristics, we divided respondents into four cells based on the task that they usually perform—cell 1 (process-oriented and broad), cell 2 (process-oriented and focused), cell 3(content-oriented and focused), and cell 4(content-oriented and broad). We employed multiple regression analyses to examine the aforementioned relationships. As Table 3 illustrated, in cell 1, both combination (β= 0.613) and internalization (β= 0.225) have significant positive effect, whereas externalization and socialization do not have significant impact. In terms of cell 2, only combination (β= 0.450) and socialization (β= 0.343) have significant positive influence on knowledge assets, while neither externalization nor internalization exerts impact on knowledge assets significantly. Regarding cell3, all of the four aspects of SECI have significant positive effect. Internalization (β= 0.337) has the highest impact on knowledge assets, yet externalization (β= 0.155) has the lowest effect on knowledge assets. Finally, in cell 4, only internalization (β= 0.480) and combination (β= 0.332) have positive effect significantly, whereas socialization and externalization do not have significant influence. From above analysis, although H5, H6, H7, and H8 are not supported by our findings, task characteristics do exert interaction effect on the relationship between SECI and the creating of knowledge assets.

--Insert Table 2 about here—
--Insert Table 3 about here—

5. Discussions and implications

This study has implications for both research and practice. From the theoretical perspective, this study provides a contingent model that examines the interrelationship among knowledge process, knowledge enablers, and performance based on absorptive capacity lens. Our model differentiates the implications of knowledge assets from previous research by assessing the KM from a more comprehensive perspective—dynamic capability by employing ACAP (Zahra and George 2002) as an analysis lens. This is important, because in order to leverage the knowledge assets it is important to realize the potential value of knowledge resources and assets itself first. In addition, this study analyzes the knowledge capability and KM relationships in a more integrate way. In other words, while task characteristics, SECI, and knowledge resources all play a critical role for fostering KM individually, they are complementary and unseparated. It is difficult to achieve KM effectively without having a comprehensive understanding of the above factors. Combining Chou and He's (2004) empirical research and our study, the dual role of knowledge assets— the product of knowledge processes that influence the "the potential and realized ACAP" of a firm and "the potential to initiate another knowledge creation processes"--is identified. Future research may examine our model in a more specific context, for example in a supply chain management environment.

In terms of practical implications, this study provides guidance for accumulating knowledge resources that are recognized as the ACAP, from which a firm may achieve competitive advantage. This effect is examined from two perspectives. First, what types of knowledge processes are critical for creating knowledge resources, and do task characteristics influence the above relation? Second, the contents of these knowledge resources and assets are analyzed according to ACAP theory, from which managers gain important implications. Future research could elaborate on the impact of other knowledge enablers such as intrinsic and extrinsic motivation.

6. Conclusions

This study examines the antecedents of knowledge management—knowledge creation processes, task characteristics, and knowledge assets—from the perspective of dynamic capabilities of knowledge management. According to the synthesis of previous studies and the theory of absorptive capacity, we develop a contingency model and test it empirically. Our results extend, augment, and apply to the important issues in KM—SECI and knowledge resource, and the relationship between them. Since these are the important KM issues with which individuals and organizations deal, there is a real need for an integrated theory and model for these critical factors. Given that the merit of knowledge creation and knowledge resources may have in a firm's competitive advantage, our model has far-reaching application in KM. In sum, this study contributes to theory and practice in the KM domain that focus on conceptualizing the relation between knowledge creation and knowledge resources as the dynamic capabilities.

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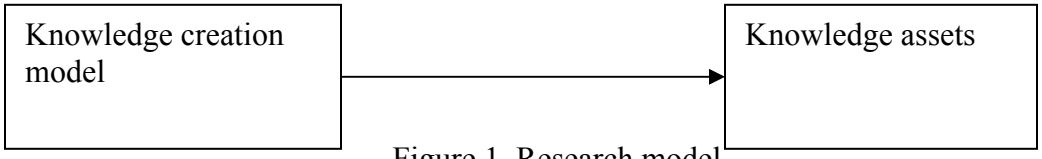

Figure 1. Research model

Table 1. Factor analysis for knowledge creation (KC)

Factor	Eigen Value	Variance (%)	Cum Variance (%)	Mean (S.D.)	Factor Loading
KC1:Internalisation	3.158	21.054	21.054	3.760(0.889)	
1. Learning by doing					0.854
2. Learning by observation					0.840
3. On-the-job training					0.480
4. Face-to-face meetings to sharing knowledge and experiences					0.568
KC2:Externalisation	2.471	16.474	37.528	3.486(0.968)	
1. Capture and transfer of experts' knowledge					0.489
2. Groupware and other team collaboration tools					0.675
3. Chat groups/Web-based discussion groups					0.747
4. Express and model tacit knowledge by metaphors and analogies					0.616
KC3: Socialisation	2.386	15.909	53.437	3.339(0.987)	
1. Collect best practice by joining brainstorming retreats and camps					0.605
2. The use of apprentices and mentors to transfer knowledge					0.541
3. Employees rotation across areas					0.728
4. Cooperative projects across directorates					0.753
KC4: Combination	2.127	14.180	67.617	3.554(0.985)	
1. Web pages (Intranet and Internet)					0.859
2. Repositories of information, best practices, and lessons learned					0.802
3. Databases and Knowledge base					0.636

Table 2. Results of stepwise regression analysis (KA and SECI)

Dependent Variable	β	t	P	Condition index (CI)	Variance proportions
Combination	0.358	7.339	0.000**	13.171	0.05
Internalization	0.301	5.602	0.000**	14.671	0.00
Socialization	0.154	3.095	0.002**	19.109	0.28
Externalization	0.129	2.192	0.029**	21.990	0.66

Dependent variable is knowledge assets (KA)

Significance levels are indicated as follows: **p< 0.01, *p< 0.05

Table 3. Results of multiple regression (KA and SECI) for different task characteristics

	Cell 1		Cell 2		Cell 3		Cell 4	
Independent Variable	*β*	P	*β*	P	*β*	P	*β*	P
Socialization	-	0.158	0.343	0.001**	0.172	0.017**	0.192	0.198
Externalization	0.201	0.196	0.221	0.102	0.155	0.064*	-	0.921
Internalization	0.225	0.066*	0.051	0.664	0.337	0.000**	0.480	0.003**
Combination	0.613	0.000**	0.450	0.001**	0.259	0.000**	0.332	0.010**

Note: Dependent variable is knowledge assets (KA)
Cell 1: task domain is broad and task orientation is process-oriented; N=55
Cell 2: task domain is focused and task orientation is process-oriented; N= 44
Cell 3: task domain is focused and task orientation is content-oriented; N= 164
Cell 4: task domain is focused and task orientation is content-oriented; N= 40
Significance levels are indicated as follows: **p< 0.01, *p< 0.05