Knowledge Management Enablers, Processes, and Organizational Performance: An Integrative View and Empirical Examination

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ABSTRACT: Knowledge is recognized as an important weapon for sustaining competitive advantage and many companies are beginning to manage organizational knowledge. Researchers have investigated knowledge management factors such as enablers, processes, and performance. However, most current empirical research has explored the relationships between these factors in isolation. To fill this gap, this paper develops a research model that interconnects knowledge management factors. The model includes seven enablers: collaboration, trust, learning, centralization, formalization, T-shaped skills, and information technology support. The emphasis is on knowledge creation processes such as socialization, externalization, combination, and internalization. To establish credibility between knowledge creation and performance, organizational creativity is incorporated into the model. Surveys collected from 58 firms were analyzed to test the model. The results confirmed the impact of trust on knowledge creation. The information technology support had a positive impact on knowledge combination only. Organizational creativity was found to be critical for improving performance; neglecting ideas can undermine a business. The results may be used as a stepping stone for further empirical research and can help formulate robust strategies that involve trade-offs between knowledge management enablers.

KEY WORDS AND PHRASES: knowledge-creating processes, knowledge management, knowledge management enablers, organizational creativity, organizational performance.

Journal of Management Information Systems / Summer 2003, Vol. 20, No. 1, pp. 179–228.

0742–1222 / 2003 $9.50 + 0.00.

IN RECENT YEARS, IT SEEMS AS THOUGH businesses that could capture the knowledge embedded in their organization would own the future. Companies that isolate knowledge management risk losing its benefits. It is no surprise that knowledge is overturning the old rules about strategy and competition—the foundation of industrialized economics has shifted from natural resources to intellectual assets. In response, many managers and management thinkers have proclaimed an era of knowledge management. This has compelled researchers to investigate how knowledge is managed. Evidence is provided by a variety of studies on knowledge [19, 79, 82], knowledge process [38, 70, 76, 114], and knowledge management architecture [9, 21, 105].

Companies attempting to deploy knowledge management may be confused by a variety of efforts under way that go under the name of knowledge management [61]. Many companies have tried, with mixed success, to leverage knowledge assets by centralizing knowledge management functions or by investing heavily in information technology (IT) [44]. It is understandable, when confronted with a new business phenomenon, to look to new management practices for guidance. Caught up in the general fever, many managers may assume that knowledge management can improve their companies. However, despite their best efforts, most studies have not investigated how companies can leverage knowledge for the improved performance. It is important to distinguish themselves through strategies. The key question is not whether to manage knowledge, but how to manage it. These strategies should be validated by the use of further empirical tests.

To fill this gap, prior research has explored which factors are essential for managing knowledge effectively. One challenge is to decipher the relationships among these factors. Most studies have examined the relationships of knowledge management enablers, processes, or performance in isolation. For example, some research has focused on the relationship between enablers and processes [6, 43, 114, 124]; the emphasis of other studies is on the relationship between enablers and organizational performance [8, 11, 35, 104]. Researchers and practitioners have not tried an integrative model. An integrative perspective of the knowledge variables based on relevant theories is a necessity. It is also noted that very few empirical studies adopt a process-oriented perspective of organizational knowledge [90]. Knowledge creation or transfer would benefit companies more than knowledge itself because knowledge is not primarily about facts but more about context-specific characteristics [115]. For example, Xerox systemizes knowledge creation and transfer processes through strategic communities [109]. Consequently, another challenge is to leverage a process-oriented perspective.

The primary objective of this paper is to delineate an integrative view of knowledge management and provide strategic guidelines. For this purpose, this paper analyzes the previous empirical studies and attempts to find relationships among knowledge management factors such as enablers, processes, and organizational performance. An integrative research model is built from a process-oriented perspective and then tested empirically.

Research Background and Literature Review

Theoretical Background

MANY RESEARCHERS HAVE EMPHASIZED three major factors for managing knowledge: enablers, processes, and organizational performance [9, 21, 85]. Knowledge management enablers (or influencing factors) are organizational mechanisms for fostering knowledge consistently [57]; they can stimulate knowledge creation, protect knowledge, and facilitate the sharing of knowledge in an organization [108]. Knowledge processes (knowledge management activities) can be thought of as a structured coordination for managing knowledge effectively [35]. Typically, knowledge processes include activities such as creation, sharing, storage, and usage [2, 9]. Whereas knowledge processes represent the basic operations of knowledge [105], enablers provide the infrastructure necessary for the organization to increase the efficiency of knowledge processes [96]. Organizational performance may be defined as the degree to which companies achieved its business objectives [28]. It may be measured in terms of organizational learning, profitability, or other financial benefits in knowledge management [18, 104]. Without measurable success, passion from employees and managers will vanish [85].

There is a general recognition among academics that knowledge management is a cross-functional and multifaceted discipline. A variety of components make up knowledge management and the understanding of their interaction is important; a holistic view is very useful [80]. To this end, an integrative research model is necessary; that is, the relationships among knowledge enablers, processes, and organizational performance can be identified within the framework of systems thinking. Systems thinking theory considers problems in their entirety [95]. This theory is better able to describe complex and dynamic characteristics of knowledge management in a systematic fashion. Therefore, our integrative framework will be based on this systems thinking theory.

Our primary research focus is on the relationships between knowledge enablers and organizational performance by elaborating on the significance of knowledge processes as the foundation of organizational advantage [79]. The relationship among these three components is nothing new; it can be found in the input-process-output model by Hackerman and Morris [41]. The model assumes that the input factors affect output performances through certain kinds of interaction processes; knowledge management enablers affect organizational performance through knowledge processes. This relationship is also explained by the use of the knowledge-chain model proposed by Holsapple and Singh [51]. This model suggests that leadership establish enabling conditions for achieving organizational outcome through the knowledge management activities such as acquisition, generation, internalization, and externalization. It means that knowledge enablers (e.g., leadership) affect organizational outcome through knowledge processes.

A direct relationship between knowledge processes and organizational performance is not explored yet. Because many factors influence the determination of the organizational performance, attempts to trace causality to any single factor such as knowledge

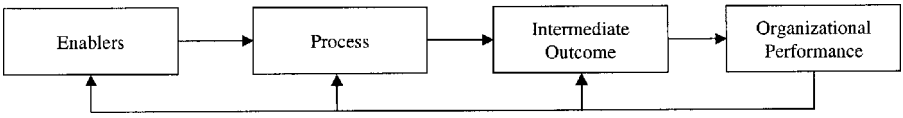


Figure 1. An Integrative Research Framework for Studying Knowledge Management

process may be risky. In order to understand the effect of the knowledge processes on organizational performance, intermediate outcomes (for example, knowledge satisfaction or organizational creativity) may be introduced [18]. Intermediate outcomes reflect different aspects of an organization's performance, both financial and nonfinancial. This incorporation may help confirm that enablers ultimately create business value.

In sum, this paper proposes a research framework as shown in Figure 1.

Previous Empirical Studies

Previous empirical studies have investigated the relationships among knowledge management factors. They can be classified into four categories depending on how they identify the relationships: (1) relationships between knowledge enablers; (2) relationships between knowledge enablers and process; (3) relationships between knowledge process and organizational performance; and (4) relationships among knowledge enablers, processes, and organizational performance. This comparison may be highlighted as shown in Figure 2.

The studies under the first category focus on the relationships among knowledge enablers. The emphasis is on the examination of the effect of knowledge enablers. To identify this effect, they have investigated various knowledge enablers such as knowledge management methods, structure, and culture. For example, Bennett and Gabriel [10] analyzed a number of knowledge management methods in view of organizational structure, culture, size, and environment.

The second category explores the relationships between knowledge enablers and knowledge processes. A central proposition is that knowledge enablers (e.g., industry characteristics or knowledge characteristics) should influence knowledge processes (e.g., transfer). Zander and Kogut [124] proposed that the transfer of organizational capabilities be related to the characteristics of social knowledge; they analyzed the effects of the ease of codifying manufacturing capabilities on its transfer time. Appleyard [6] explored knowledge transfer patterns among various nations and industries. Szulanski [114] investigated the relationship between four origins of stickiness (characteristics of the knowledge transferred, the source, the recipient, and the context in which the transfer takes place) and knowledge transfer. Hansen [43] employed the notion of complex knowledge to explain the role of weak ties in transferring knowledge in a multiunit organization.

The third category examines the relationships between knowledge enablers and organizational performance. The purpose of these studies is to sharpen the understanding of the effects of knowledge enablers (e.g., knowledge management strategy)

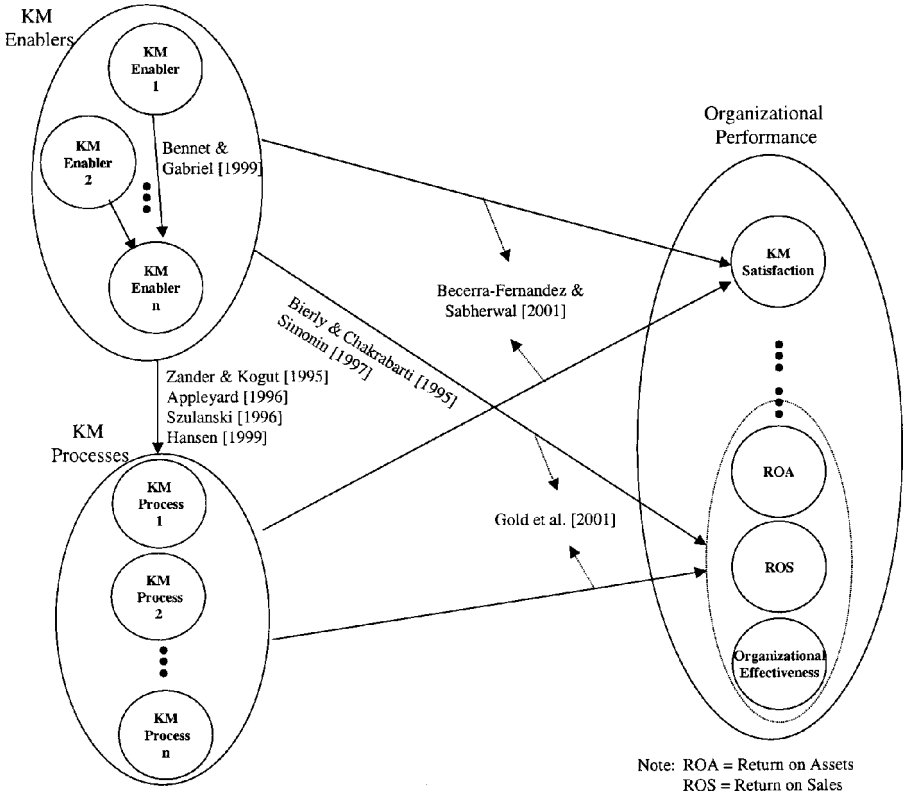


Figure 2. Research Models for Studying Knowledge Management

on organizational performance (e.g., return on assets [ROA] or return on sales [ROS]). Bierly and Chakrabarti [11] tried to identify how knowledge management strategies affect organizational performance. They analyzed knowledge strategies of 21 U.S. pharmaceutical companies that had been categorized into explorers, exploiters, loners, and innovators. Simonin [104] tested the relationships among collaborative experience, know-how, and achievement of organizational performance. He proposed that the experience of a firm has to be transformed into know-how before it could improve organizational performance.

The emphasis of the fourth category is on relationships among knowledge enablers, knowledge processes, and organizational performance. The primary objective of these studies is to identify and assess knowledge enablers (e.g., task or infrastructure capabilities) and processes (e.g., creation or their capabilities) for improving organizational performance (e.g., knowledge satisfaction or organizational effectiveness). Becerra-Fernandez and Sabherwal [8] proposed a contingency framework including two attributes of the organizational subunit's tasks—process or content orientation, and focused or broad domain—and linked them to Nonaka's knowledge creation process [82]. The relationship between knowledge creation process and knowledge satisfaction was also investigated. Gold et al. [35] analyzed two relationships: one

between infrastructure capabilities and organizational effectiveness, and the other between process capabilities and organizational effectiveness. Table 1 compares these previous studies.

Synthesis of Previous Studies

Synthesis of previous studies yields some observations. First, an integrative model is still missing. Although some studies investigate the relationships among knowledge enablers, processes, or organizational performance [8, 35], they fail to explore the relationships between enablers and processes simultaneously. If managers understand these relationships in an integrative fashion, they can stand a better chance of improving their firm's performance.

Second, the role of knowledge management processes is not consistent. Some studies recognized both knowledge enablers and processes as antecedents of organizational performance [8, 35]. Other studies recognized knowledge enablers as preconditions of knowledge processes [6, 43, 114, 124]. Therefore, the challenge is to clarify the role of knowledge management processes [108].

Third, measuring knowledge management performance is still difficult. Some studies captured the contribution by the use of knowledge management outcome measures such as knowledge satisfaction [8], whereas others adopted conventional performance measures such as ROA [11, 104] or organizational effectiveness [35]. It would appear that the former studies take the relationship between knowledge management outcome and organizational performance for granted although the relationship has not been validated. The results of the latter studies should be examined carefully because the direct relationship between knowledge management processes and organizational performance has not been validated yet [18].

Fourth, the knowledge transfer process has been studied extensively [6, 43, 114, 124] whereas the other processes such as creation or utilization have received relatively little attention. In particular, some studies have suggested that knowledge creation is most critical for an organization's long-term success [30]. Moreover, knowledge transfer has been assessed by the use of object-perspective measures such as time to transfer [124], number of times of knowledge transfer [6], or percentage of transferred knowledge [43]. Recently, some researchers have tried to measure knowledge processes themselves [8, 35]. For example, Becerra-Fernandez and Sabherwal [8] measured the capacity for knowledge creation by Nonaka's knowledge creation model, not by the use of creation output such as the number of created ideas or patents.

A Research Model

OUR OBJECTIVE IS NEITHER TO PROPOSE a model that delineates all of the relationships underlying knowledge management nor to generate a longer list of possible knowledge enablers or processes that affect organizational performance. Therefore,

Table 1. A Comparison of Previous Studies

Study	KM enablers	KM processes	Organizational performance	Findings
Relationship among enablers				
Bennet and Gabriel [10]	Structure Culture Size Environment **KM method**	N/A	N/A	Effect of change-friendly culture on the number of KM methods employed.
Relationship between enablers and processes				
Zander and Kogut [124]	Characteristics of societal knowledge	**Transfer (time to transfer)**	N/A	Codifiability, teachability, and parallel development have significant effects on the time to transfer.
Appleyard [6]	Industry and national characteristics	**Transfer (number of times the respondents provide and receive knowledge in a given period)**	N/A	public sources of knowledge are much more prevalent in knowledge transfer in semiconductors than in the steel industry; Public sources of technical knowledge play a larger role in knowledge transfer in Japan than in the United States.

(continues)

Table 1. (Continued)

Study	KM enablers	KM processes	Organizational performance	Findings
Relationship between enablers and processes (continued)				
Szulanski [114]	Characteristics of the knowledge transferred source recipient context.	**Transfer (four-stage transfer processes).**	N/A	Recipient's lack of absorptive capacity, causal ambiguity, and an arduousness of the relationship are the major impediments to knowledge transfer.
Hansen [43]	Weak ties (distant and infrequent relationships); Knowledge characteristics.	**Transfer (percentage of a project's total knowledge that come from other divisions).**	N/A	Weak ties impede the transfer of complex knowledge.
Relationship between enablers and performance				
Bierly and Chakrabarti [11]	KM strategy	N/A	**ROS** **ROA**	Innovators and explorers are more profitable than exploiters and loners.
Simonin [104]	Collaborative experience Collaborative know-how	N/A	**Tangible benefits (ROI, ROA);** **Intangible benefits.**	Collaborative know-how allows firms to achieve greater organizational benefits; collaborative experience alone does not ensure that a firm will benefit from a collaboration.

Relationship among knowledge enablers, processes, and performance

Becerra-Fernandez and Sabherwal [8]	Task (process or content orientation; focused or broad domain).	Creation (socialization, externalization, combination, internalization).	**KM satisfaction**	Socialization is suitable for broad and process-oriented tasks, externalization for focused and content-oriented tasks, combination for broad and content-oriented tasks, and internalization for focuses and process-oriented tasks; combination and externalization affect knowledge satisfaction.
Gold et al. [35]	Infrastructure capability (technology, structure, culture).	Process capability (acquisition, conversion, application, protection).	**Organizational effectiveness**	Infrastructure and process capabilities contribute to the achievement of organizational effectiveness.

Note: Boldface type indicates dependent variables.

our model highlights a few major factors that can explain a large proportion of the variance in knowledge management.

Variables

Enablers

A variety of knowledge management enablers have been addressed in the literature [57, 70, 97]. Among these enablers, organizational culture, structure, people, and IT are incorporated into our research model. Organizational culture is the most important factor for successful knowledge management [15, 20, 21, 35]. Culture defines not only what knowledge is valued, but also what knowledge must be kept inside the organization for sustained innovative advantage [71]. Organizations should establish an appropriate culture that encourages people to create and share knowledge within an organization [49, 70]. This study focuses on collaboration, trust, and learning on the basis of the concept of care [29]. Care is a key enabler for organizational relationships [68]. When organizational relationships are fostered through care, knowledge can be created and shared.

The organizational structure within an organization may encourage or inhibit knowledge management [35, 47, 82]. For example, Ichijo et al. [57] insisted that firms should maintain consistency between their structures to put their knowledge to use. Our study includes two key structural factors such as centralization and formalization [77]. They are recognized as key variables underlying the structural construct. Moreover, their effects on knowledge management within organizations are widely recognized to be potent [29, 59, 72, 91].

People are at the heart of creating organizational knowledge [15, 49, 80]. It is people who create and share knowledge. Therefore, managing people who are willing to create and share knowledge is important [85]. Knowledge and competence can be acquired by admitting new people with desirable skills [108]. In particular, T-shaped skills embodied in employees are most often associated with core capability [56, 60, 70]. T-shaped skills may enable individual specialists to have synergistic conversations with one another [74].

Technology contributes to knowledge management [35]. This technology infrastructure includes IT and its capabilities [90, 99]. IT is widely employed to connect people with reusable codified knowledge, and it facilitates conversations to create new knowledge. Among technology-related variables, this study focuses on IT support [108]. ITs allow an organization to create, share, store, and use knowledge [70]. Therefore, the support of IT is essential for initiating and carrying out knowledge management.

Enablers may be structured based upon a socio-technical theory [86]. This theory describes an organization from the social and technical perspectives. The two perspectives are not unique to management information systems (MIS) research [12]; they are made up of two jointly independent but correlative interacting components. Organizational culture, organizational structure, and people are social enablers; IT is

a technical enabler. For the sake of clarity, we consider the impact of each knowledge enabler independently.

Processes

A number of studies have addressed knowledge management processes; they divide knowledge management into several processes. For example, Alavi and Leidner [2] considered four processes such as creation, storage, transfer, and application. These processes are often concurrent and not always in a linear sequence [9].

Among these processes, creation-related activities (for example, creation [2] or construction [21]) become important because knowledge creation is a strategic weapon in today's global marketplace; without the constant creation of knowledge, a business is condemned to obsolescence [83, 87]. Knowledge creation is a continuous process whereby individuals and groups within a firm and between firms share tacit and explicit knowledge [82]. Although a great deal has been discussed about the importance of knowledge creation, there is relatively little empirical evidence [90]. Therefore, the emphasis of this study is on knowledge creation.

To explore knowledge creation, our study adopts the SECI (socialization, externalization, combination, internalization) model by Nonaka and Takeuchi [82] for the following reasons. First, their work has become widely accepted [98]; it has been used in many research areas such as organizational learning, new product development, and IT [98, 99]. Second, their model includes not only knowledge creation but also knowledge transfer. The transfer of existing knowledge and the creation of new knowledge are important, and both of them should be considered in knowledge management [69]. Their SECI model is made up of four intertwined activity modes; socialization (S), externalization (E), combination (C), and internalization (I). Socialization converts tacit knowledge into new tacit knowledge through social interactions among members. Externalization codifies tacit knowledge into explicit concepts. Combination converts explicit knowledge into more systematic sets by combining key pieces. Internalization embodies explicit knowledge into tacit knowledge.

Intermediate Outcome

In order to achieve a better understanding of knowledge management performance, companies should attempt to link knowledge processes with intermediate outcomes [18]. An important intermediate outcome is organizational creativity, which provides a key to the understanding of organizational effectiveness and survival [122]. Our model incorporates organizational creativity because it is the seed of all innovation [5] and at the very heart of knowledge management [40]. Organizational creativity transforms knowledge into business value. Neglecting organizational creativity can quickly undermine a business. The relationship between knowledge creation and organizational creativity has received relatively little attention despite its high potential [119].

Organizational Performance

Measuring organizational performance is not a trivial task because it strongly affects the behavior of managers and employees. The ultimate test of any business is whether it leads to measurable improvements in organizational performance.

Methods for measuring organizational performance in knowledge management can be categorized into four groups: financial measures [11], intellectual capital [110], tangible and intangible benefits [104], and balanced scorecard [63]. This study adopts a specific measure, which is developed and validated by Deshpande et al. [22] and Drew [25]. This measure can be thought of as a variation of the balanced scorecard method. The balanced scorecard retains financial performance and supplements it with measures on the drivers of future potential. In addition, it is more useful than intellectual capital or a tangible and intangible approach because it shows cause and effect links between knowledge components and organization strategies [63].

In summary, our empirical research model illustrates the relationship among variables as shown in Figure 3. In total, the model consists of 13 variables.

Hypotheses

Our hypotheses are largely derived from theoretical statements made in the literature on knowledge management. We present our hypotheses through the following variables.

Collaboration

Collaboration may be defined as the degree to which people in a group actively help one another in their work [55]. Collaborative culture affects knowledge creation through increasing knowledge exchange [68, 79]. Exchanging knowledge among different members is a prerequisite for knowledge creation. Collaborative culture fosters this type of exchange by reducing fear and increasing openness to other members. For example, Zucker et al. [126] confirmed the significance of collaborative culture in knowledge creation by examining the biotechnology industry. Collaboration between organizational members also tightens individual differences [70]. It can help people develop a shared understanding about an organization's external and internal environments through supportive and reflective communication. Without shared understanding among organizational members, little knowledge is ever created [30, 47]. We do not have a priori reason to expect a different relationship.

> *H1: There is a positive relationship between collaboration and knowledge creation process.*

Trust

Trust can be defined as maintaining reciprocal faith in each other in terms of intention and behaviors [67]. Trust may facilitate open, substantive, and influential knowledge

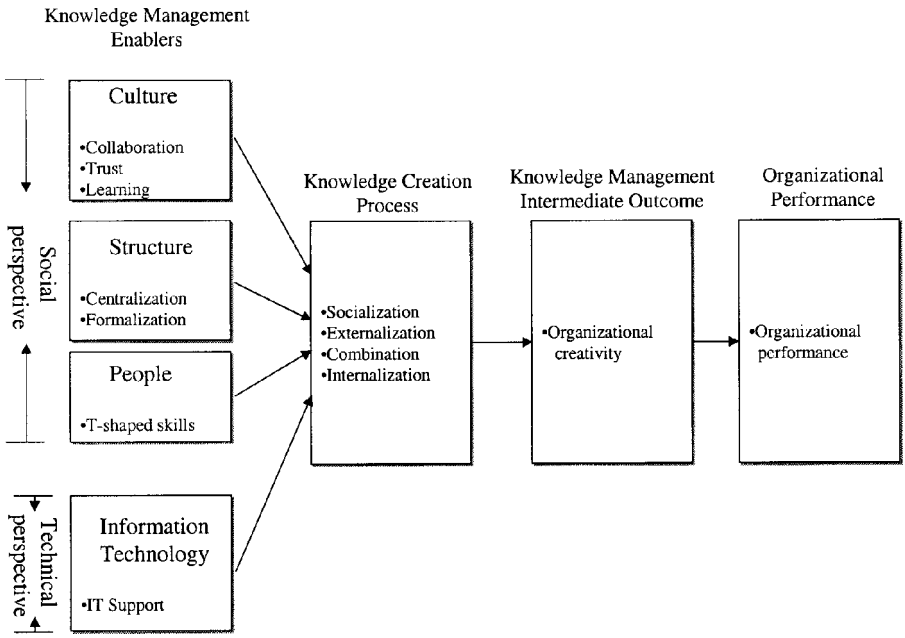


Figure 3. A Research Model

exchange [81, 85]. When their relationships are high in trust, people are more willing to participate in knowledge exchange [79]. Szulanski [114] empirically found that the lack of trust among employees is one of the key barriers against knowledge exchange. The increase in knowledge exchange brought on by mutual trust results in knowledge creation. Trust also encourages a climate conducive to better knowledge creation by alleviating the fear of risk. The presence of a high level of trust can reduce this risk [81, 92, 100]. Trust is also critical in a cross-functional or interorganizational team because withholding information because of a lack of trust can be especially harmful to knowledge creation [47, 59]. Therefore, we would expect the following relationship to hold true:

H2: There is a positive relationship between trust and knowledge creation process.

Learning

Learning can be defined as the degree to which it is encouraged in organizations [55]. The emphasis on learning infuses an organization with new knowledge [17]. Learning is the acquisition of new knowledge by people who are able and willing to apply that knowledge in making decisions or influencing others [78]. Through the emphasis on learning and development, organizations can help individuals play more active roles in knowledge creation. Kanevsky and Housel [62] insisted that the amount of time spent on learning is positively related with the amount of knowledge. For successful knowledge creation, organizations should develop a deeply ingrained learning culture

[88] and provide various learning means such as education, training, and mentoring [112, 113]. For example, Nucor [39], which has been the most innovative steel company in the United States, built a knowledge creation foundation by investing in continuous and multifunctional training programs. Hence, we hypothesize:

H3: There is a positive relationship between learning and knowledge creation process.

Centralization

Centralization refers to the locus of decision authority and control within an organizational entity [14, 27]. The concentration of decision-making authority inevitably reduces creative solutions, whereas the dispersion of power facilitates spontaneity, experimentation, and the freedom of expression, which are the lifeblood of knowledge creation [37]. Moreover, centralized structure hinders interdepartmental communication and frequent sharing of ideas [122] due to time-consuming communication channels [10]; it also causes distortion and discontinuousness of ideas [108]. Without a constant flow of communication and ideas, knowledge creation does not occur. A decentralized organizational structure has been found to facilitate an environment where employees participate in knowledge building process more spontaneously [52]. Participatory work environments foster knowledge creation by motivating organizational members' involvements. Therefore, decreased centralization in the form of locus of authority can lead to increased creation of knowledge [106, 108, 115]. We advance the fourth hypothesis:

H4: There is a negative relationship between centralization and knowledge creation process.

Formalization

Formalization refers to the degree to which decisions and working relationships are governed by formal rules, standard policies, and procedures [49, 89]. Knowledge creation requires flexibility and less emphasis on work rules [57, 73]. The range of new ideas seems to be restricted when strict formal rules dominate an organization. Flexibility can accommodate better ways of doing things [37]. Therefore, the increased flexibility in an organizational structure can result in increased creation of knowledge. Knowledge creation also requires variation [121]. In order to be more adaptable when unforeseen problems arise, an organization may accommodate variation in process and structure. Low formalization permits openness and variation, which encourage new ideas and behaviors [17]. Knowledge creation is also likely to be encouraged through unhindered communications and interactions [10]. Formality stifles the communication and interaction necessary to create knowledge. Lack of formal structure tends to enable organizational members to communicate and interact with one another to create knowledge [59]. Hence, we hypothesize:

H5: There is a negative relationship between formalization and knowledge creation process.

T-Shaped Skills

T-shaped skills are both deep (the vertical part of the "T") and broad (the horizontal part of the "T"); that is, their possessors can explore particular knowledge domains and their various applications in particular products [70]. For example, persons with T-shaped skills not only have a deep knowledge of a discipline (like ceramic materials engineering), but also know how their discipline interacts with other disciplines (such as polymer processing) [56]. People with T-shaped skills are extremely valuable for creating knowledge because they can integrate diverse knowledge assets [70]. They have the ability both to combine theoretical and practical knowledge and to see how their branch of knowledge interacts with other branches. Therefore, they can expand their competence across several functional branch areas, and thus create new knowledge [60, 74].

H6: There is a positive relationship between the presence of the organizational members with T-shaped skills and knowledge creation process.

IT Support

IT support means the degree to which knowledge management is supported by the use of ITs [35]. Many researchers have found that IT is a crucial element for knowledge creation [19, 36, 39]. IT affects knowledge in a variety of ways. First, IT facilitates rapid collection, storage, and exchange of knowledge on a scale not practicable in the past, thereby assisting the knowledge creation process [92]. Second, a well-developed technology integrates fragmented flows of knowledge [35]. This integration can eliminate barriers to communication among departments in organization. Third, IT fosters all modes of knowledge creation and is not limited to the transfer of explicit knowledge [90, 91, 99]. For instance, InfoTEST's enhanced product realization (EPR) project employs electronic whiteboarding and videoconferencing to enhance exchanges of tacit knowledge [91]. Thus, we hypothesize:

H7: There is a positive relationship between IT support and knowledge creation process.

Organizational Creativity

Organizational creativity is the capability of creating valuable and useful products, services, ideas, or procedures by individuals working together in a complex social system [5, 122]. Knowledge plays an important role in the ability of the organization to be creative [119]. Thus, organizations with better knowledge diffusion and creating mechanisms are more intelligent [34]. Organizational creativity also connects and rearranges knowledge to create new, often surprising ideas that others judge to be

useful [65]. Creativity is not necessarily related to the amount of knowledge that an employee possesses, but rather the way in which knowledge is created and shared [4]. The processes of knowledge creation unleash organizational creativity. Naturally, organizational creativity has a strong link with knowledge creation [119].

H8: There is a positive relationship between the knowledge creation process and organizational creativity.

Organizational Performance

In our study, organizational performance is assessed by the use of global output measures such as market share, profitability, growth rate, innovativeness, successfulness, and the size of business in comparison with key competitors [22, 25]. In a knowledge-based economy, organizational creativity represents a dramatic organizational change. Robinson and Stern [93] insisted that the tangible results of corporate creativity are the organizational change such as improvements (changes to what is already done) and innovations (entirely new activities for the company). Without creativity, organizations may fail to adapt to changing internal and external conditions [88], and thus lose their knowledge advantage. Typically, the goals of organizational change include the various aspects of organizational performance such as organizational effectiveness, survival, improvement, or innovation. Organizational performance can be thought of as the output of a process that encourages creativity [97]. Thus, improvements of creativity might lead to better organizational performance [18, 88, 102]. We hypothesize that:

H9: There is a positive relationship between organizational creativity and organizational performance.

Sample and Measures

SAMPLES WERE RESTRICTED TO THE LISTED COMPANIES in order to include major companies in Korea. *Annual Corporation Reports* by *Maeil Business Newspaper* [75] is the source for sampling because it analyzes all listed companies in the Korea Stock Exchange. Therefore, the unit of analysis in this study is the organization. We adopted both interviews and mail surveys. Interviews were used to investigate the current detailed status of knowledge management. This investigation included knowledge management practices such as the number of communities of practice, the rate of use of the knowledge management system, and the cost of investment in knowledge management activities. Although interview data is not analyzed statistically, they were valuable for our interpretation.

After the interview, a questionnaire-based survey was conducted. Questionnaires were administered to a total of 1,425 middle managers in 147 organizations. Depending on each individual firm's size, five to 15 middle managers were surveyed from each firm. Middle managers were reached through their CEOs or CIOs. A typical job title of a middle manager was department chief. Middle managers were surveyed

because they played key roles in managing knowledge. Middle managers are positioned at the intersection of the vertical and horizontal flows of knowledge. Thus, they can synthesize the tacit knowledge of both top managers and frontline employees, make it explicit, and incorporate it into new products and services [82].

A multiple-item method was used to construct the questionnaires. Each item was based on a six-point Likert scale, from "very low" to "very high." Likert scales as generally used tend to underestimate the extreme positions [3]. Respondents are reluctant to express an extreme position even if they have it. They tend to please the interviewer, appear helpful, or respond in what they perceive to be a socially acceptable answer. Resorting to a scale without a midpoint seems to help mollify this social desirability bias without changing the direction of opinion [32]. The six-point Likert scale avoids a midpoint, which prevents respondents from using a neutral default option [5]. The questionnaires were written in Korean.

Research constructs were operationalized on the basis of related studies and pilot tests. The operational definitions of instruments and their related literature are summarized in Appendix A. Most of the research constructs have already been validated and used for other studies on knowledge management, organizational design, learning, or IT management. For example, formalization items have already been validated and used by Caruana et al. [14] and Rapert and Wren [89]. Self-reported items have been used to assess organizational performance [22, 25]. Although these items do not present a fully balanced scorecard, they are effective for comparing business units and industries [25]. Questionnaire items for the knowledge creation process, which were used in this study, had been validated and used by Nonaka et al. [83].

Analysis

Sample Characteristics

IN TOTAL, 451 QUESTIONNAIRES FROM 63 out of 147 firms were returned (43 percent response rate). The rates from individual firms ranged from 23 to 100 percent. Due to incomplete data, 25 responses from five firms were eliminated. Consequently, 426 responses from 58 firms were analyzed. Table 2 summarizes the respondent characteristics in terms of industry type, departments, total sales revenue, and number of total employees.

Samples are divided into three industry types: manufacturing, service, and financial business (banking, finance, insurance). The majority of these firms are in the service industry. Thirty-two firms have annual total sales revenue of $1 billion or more, and 31 firms have 1,000 employees or more. As mentioned previously, samples were collected from various middle managers.

Reliability and Validity Analysis

Table 3 presents the results of reliability and validity tests. An analysis was performed on the 36 items that measured the components of knowledge enablers; other analyses

Table 2. Respondent Characteristics

(a) Industry type

Industry type (main)	Industry type (sub)	Number of firms	Percent
Manufacturing	Machinery	5	8.6
	Electronics	3	5.2
	Chemistry	5	8.6
	Pharmaceutical	3	5.2
	Food/beverage	2	3.4
	Others	1	1.7
Financing	Insurance	5	8.6
	Banking	4	6.9
	Security	5	8.6
Service	Construction	6	10.3
	Retailing	4	6.9
	Transportation	5	8.6
	Communication	9	15.5
	Others	1	1.7
Total		58	100.0

(b) Departments

Industry	Number of firms	Departments							
		Planning	Sales	Production	Accounting	IS	R&D	Etc.	Total
Manufacturing	19	36	17	22	14	20	35	6	150
Financing	14	39	28	—	3	21	—	9	100
Service	25	67	28	—	25	41	9	6	176
Total	58	142	73	22	42	82	44	21	426

(c) Total sales revenue

Range	Number of firms	Percent
Less than $50 million	7	12.1
$50 million to below $100 million	3	5.2
$100 million to below $500 million	12	20.7
$500 million to below $1 billion	4	6.9
$1 billion to below $5 billion	25	43.1
$5 billion to below $10 billion	3	5.2
$10 billion and above	4	6.9
Total	58	100.0

(d) Total number of employees

Range	Number of firms	Percent
Less than 100	2	3.4
100 to below 200	4	6.9
200 to below 500	8	13.8
500 to below 1,000	8	13.8
1,000 to below 3,000	10	17.2
3,000 to below 10,000	9	15.5
10,000 to below 30,000	7	12.1
30,000 and above	5	8.6
Total	58	100.0

Table 3. Statistics for Reliability and Validity Tests

Measure	Acronym	Number of items	Mean	S.D.	Reliability (Cronbach α)	Convergent validity (correlation of item with total score-item)	Discriminant validity (factor loading on single factors)
Knowledge creation process	KCP	4			0.9203		
Socialization	KCS	5	3.8467	0.4241	0.8364	0.7479	0.942
Externalization	KCE	5	4.0025	0.4246	0.9146	0.7837	0.919
Combination	KCC	5	4.1721	0.4178	0.8576	0.8481	0.877
Internalization	KCI	4	3.8227	0.4041	0.8902	0.8873	0.853
Knowledge management enablers							
Collaboration	COL	5	3.9634	0.4035	0.8792	0.6974	0.812
						0.7682	0.865
						0.7420	0.847
						0.6804	0.793
						0.6838	0.800
Trust	TRU	6	3.6452	0.5964	0.8932	0.7002	0.798
						0.7230	0.815
						0.7166	0.810
						0.7410	0.828
						0.6987	0.794
						0.7082	0.804

Learning	LEA	5	4.2178	0.3887	0.8968	0.6702	0.783
						0.7656	0.857
						0.7063	0.813
						0.7953	0.879
						0.7942	0.878
Centralization	CEN	5	3.1524	0.4252	0.8481	0.6176	0.760
						0.6968	0.818
						0.6236	0.763
						0.6844	0.810
						0.6638	0.793
Formalization	FOR	5	3.5418	0.5295	0.8475	0.5605	0.706
						0.7175	0.840
						0.7592	0.868
						0.7265	0.846
						0.5225	0.669
T-shaped skills	TSK	5	4.2285	0.3107	0.8309	0.6973	0.807
						0.6012	0.750
						0.7037	0.829
						0.5911	0.743
						0.5747	0.732
IT support	ITS	5	4.4878	0.5552	0.8614	0.6244	0.757
						0.6292	0.760
						0.7656	0.866
						0.7021	0.823
						0.6881	0.810

(continues)

Table 3. (Continued)

Measure	Acronym	Number of items	Mean	S.D.	Reliability (Cronbach α)	Convergent validity (correlation of item with total score-item)	Discriminant validity (factor loading on single factors)
Organizational creativity	OC	5	3.8114	0.4960	0.8709	0.6744	0.795
						0.7027	0.818
						0.7044	0.821
						0.7631	0.861
						0.6428	0.770
Performance							
Organizational performance	OP	5	4.0199	0.6751	0.8661	0.7783	0.870
						0.5619	0.709
						0.7502	0.853
						0.7236	0.865
						0.6383	0.772

were performed on the 20 items for the knowledge creation processes, on the five items for organizational creativity, and on the six items for organizational performance. Cronbach's alpha is used for examining the reliability of the instruments. A higher cutoff value of 0.7 may be used because these instruments have been adopted previously [84]. All constructs had higher than 0.7 cutoff alpha value, ranging from 0.8309 to 0.9203. For convergent validity, items having item-to-total correlation scores lower than 0.4 were dropped from further analysis. One item relating to organizational performance had an item-to-total correlation of less than 0.4 and thus was eliminated from further analysis.

Factor analysis is used to check discriminant validity [64]. Because each variable was measured by multi-item constructs, factor analysis with varimax was adopted to check the unidimensionality among items. Items with factor loading values lower than 0.5 were deleted. There was one item with factor loading of lower than 0.5 for the knowledge creation processes. A factor analysis for the knowledge enablers and knowledge creation processes is shown in Table 4. Relatively high values of reliability and validity imply that the instruments used in this study are adequate. All the measures used in this study are reported in Appendix B.

Inter-Rater Reliability and Agreement Analysis

Whereas the unit of analysis in this study is the organization, the questionnaire was distributed to organizational members to measure characteristics of their organizations. Therefore, answers from the same organization should be aggregated and used as an organizational indicator. Given the perceptual nature of the measures and the conversion of individual responses into organizational indicators, inter-rater reliability and agreement analysis are necessary [118]. Inter-rater reliability is defined as an index of consistency, which represents consistency of variance among raters [66]. In contrast, agreement is defined as the interchangeability among raters, which addresses the extent to which raters make the same ratings [58].

The inter-rater reliability was assessed by the use of the interclass correlation coefficient (ICC). Because each company was rated by a different rater and their ratings were averaged, ICC (1,k) was appropriate. ICC (1,k) is calculated by one-way analysis of variance (ANOVA) [103]. James et al. [58] developed indices appropriate for within-group agreement for a set of raters rating a single target with a single item ($r_{wg(1)}$) or multiple-item scale ($r_{wg(J)}$). For our study, $r_{wg(J)}$ is adopted. Table 5 summarizes the results of inter-rater reliability and agreement. A number of management studies suggest that ICC ranging from 0. 512 to 0.991 and $r_{wg(J)}$ ranging from 0.69 to 0.96 [5, 46] are appropriate. Our results are consistent with these ICC and $r_{wg(J)}$ ranges, and thus inter-rater reliability and agreement may be guaranteed.

Regression Analysis

A multiple regression analysis tests our hypotheses. For each hypothesis, models were run for each of the dependent variables separately as shown in Figure 4. Our model is

Table 4. Rotated Factor Matrixes with Varimax Rotation

(a) Factor matrix for entire items of knowledge enablers

Variables	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
COL1	0.2595	0.3834	0.0402	**0.6452**	0.3900	0.2493	0.0138
COL2	0.4136	0.3131	0.1654	**0.6984**	0.2503	0.1557	0.0631
COL3	0.3914	0.2488	0.0801	**0.5876**	0.0718	0.0196	0.4429
COL4	0.2937	0.2625	0.2701	**0.7103**	0.1653	0.0620	0.0410
COL5	0.4018	0.2200	0.1102	**0.6679**	0.1400	0.0687	0.2986
TRU1	**0.7400**	0.2119	0.1717	0.0407	0.1987	0.1194	0.1478
TRU2	**0.6104**	0.3071	0.2406	0.1354	0.3794	0.3055	0.0482
TRU3	**0.6795**	0.1918	0.1089	0.3386	0.0698	0.0154	0.3515
TRU4	**0.8172**	0.2154	0.1290	0.0478	0.3018	–0.0397	0.0973
TRU5	**0.7670**	0.2424	0.1006	0.1379	0.2269	0.1316	–0.1373
TRU6	**0.7278**	0.2033	0.0808	0.2206	0.1661	–0.0694	0.3941
LEA1	0.0554	0.2525	0.0010	0.1941	0.0443	0.1569	**0.7438**
LEA2	–0.0022	0.1630	0.1814	0.1670	0.0204	0.2774	**0.7975**
LEA3	0.2379	0.1203	0.1724	0.4034	0.0765	0.1162	**0.6372**
LEA4	0.0550	0.2574	0.1267	0.2525	0.1811	0.2033	**0.7643**
LEA5	–0.0397	0.2345	0.1929	0.3959	0.1127	0.1375	**0.7519**

CEN1	−0.3817	−0.0381	−0.1684	−0.1719	**−0.6308**	0.1324	−0.2894
CEN2	−0.2793	−0.0016	−0.1502	−0.3859	**−0.5859**	−0.0185	−0.4287
CEN3	−0.2668	−0.3100	−0.2074	0.0599	**−0.6104**	−0.1072	−0.3406
CEN4	−0.2997	−0.2389	−0.2800	−0.2995	**−0.7084**	−0.2618	−0.0550
CEN5	−0.2148	−0.1582	−0.1010	−0.2640	**−0.8218**	−0.1877	0.0831
FOR1	−0.1348	−0.3417	**−0.6207**	0.0127	−0.2154	−0.1858	0.1379
FOR2	−0.1767	−0.0953	**−0.8312**	−0.1211	−0.2042	−0.0563	−0.2223
FOR3	−0.2841	−0.3008	**−0.7566**	−0.2115	−0.1731	−0.1662	−0.1240
FOR4	−0.1598	0.0648	**−0.8719**	−0.0565	−0.0827	−0.1456	−0.1457
FOR5	−0.0362	−0.0253	**−0.7755**	−0.1560	0.0674	−0.1653	0.2901
TSK1	0.3081	−0.1978	0.1587	0.2654	−0.0133	**0.6024**	0.1658
TSK2	0.2185	0.0522	0.2981	0.1182	0.2443	**0.7228**	−0.1796
TSK3	0.0607	0.0292	0.3193	0.0758	0.0974	**0.7940**	0.0676
TSK4	0.1741	0.2533	−0.0515	−0.1318	0.2195	**0.6079**	0.3709
TSK5	−0.0258	0.0574	−0.1198	0.1853	−0.0699	**0.7694**	0.4034
ITS1	0.2025	**0.8320**	0.0427	0.2608	0.1448	−0.0005	−0.0537
ITS2	0.4194	**0.6828**	0.2010	0.2577	−0.0871	−0.0334	0.0928
ITS3	0.2328	**0.8263**	0.0925	0.2059	0.1708	0.1612	0.0841
ITS4	0.3585	**0.7789**	0.1619	0.0434	0.1091	0.0203	0.1986
ITS5	0.3300	**0.8032**	0.0493	0.1835	0.2099	−0.0410	0.0169

(continues)

Table 4. (Continued)

(b) Factor matrix for entire items of knowledge creation process

Variables	Factor 1	Factor 2	Factor 3	Factor 4
KCS1	0.0865	**0.5335**	0.0150	0.1482
KCS2	0.2406	**0.8193**	–0.0151	0.3668
KCS3	0.3345	**0.6029**	0.2587	0.4151
KCS4	0.3213	**0.6265**	0.4340	0.2742
KCS5	0.4823	**0.5695**	0.5394	0.3781
KCE1	**0.8070**	0.2272	0.1754	0.0512
KCE2	**0.8022**	0.3667	0.1667	0.2297
KCE3	**0.5686**	0.3688	0.3585	0.2056
KCE4	**0.7238**	0.3998	0.1822	0.0958
KCE5	**0.7551**	0.4439	0.2218	0.3200
KCC1	0.3591	0.3753	**0.5686**	0.3056
KCC2	0.2402	0.1615	**0.6951**	0.3848
KCC3	0.0583	0.2417	**0.8523**	0.0462
KCC4	0.2146	0.1566	**0.8532**	0.1629
KCC5	0.5430	0.4263	**0.6105**	0.3760
KCI1	0.1803	0.1471	0.1082	**0.8855**
KCI2	0.3560	0.1144	0.1117	**0.8200**
KCI3	0.3448	0.3970	0.3145	**0.6772**
KCI4	0.3483	0.4278	0.3420	**0.6474**

Note: Item loadings on their theoretically associated factors are highlighted in boldface.

Table 5. Results of Inter-Rater Reliability and Agreement

Variables	Indices	ICC (1,k)	$r_{wg(J)}$
Knowledge creation process	Socialization	0.6627	0.8138
	Externalization	0.6468	0.8815
	Combination	0.5252	0.8522
	Internalization	0.5285	0.8633
Knowledge management enablers	Collaboration	0.6081	0.8691
	Trust	0.8037	0.8929
	Learning	0.6863	0.8927
	Centralization	0.5632	0.8426
	Formalization	0.6983	0.8393
	T-shaped skills	0.5236	0.8203
	IT support	0.7515	0.8460
Organizational creativity		0.7390	0.8552
Organizational performance		0.8397	0.8601

not meaningful if the correlation between enablers and the knowledge creation process is not significant. Therefore, the knowledge creation process is considered as an aggregated variable, and its correlation is computed. We then test each hypothesis to find which enablers are more important for knowledge creation and which processes are more important for organizational performance.

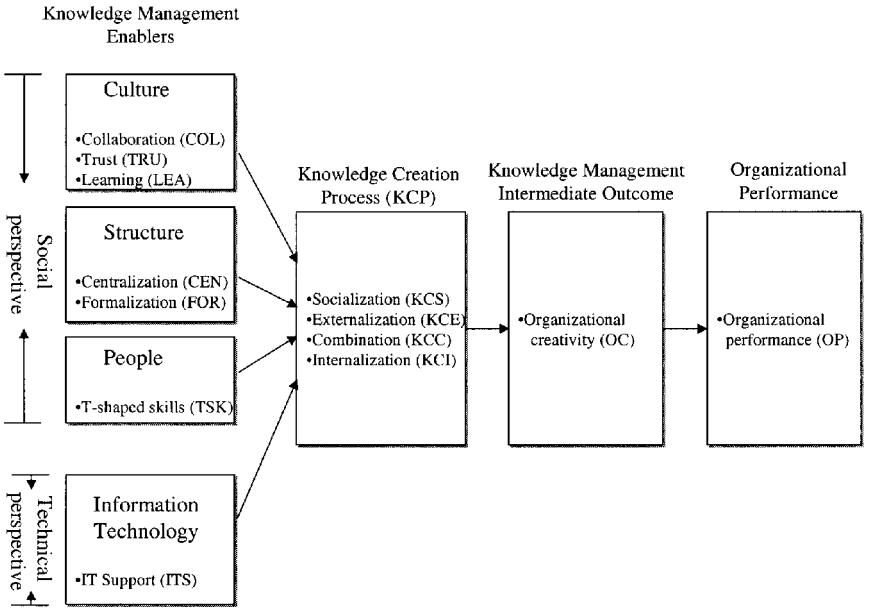
To meet the assumptions of regression analysis, we examined the linearity, constant variance, and normality [42]. Because the scatterplots of individual variables do not indicate any nonlinear relationships, the linearity is guaranteed. Plotting the studentized residuals against the predicted value shows that no variable violates the constant variance. The result from the normal probability plot and Kolmogorov-Smirnov tests indicates no violation of normality (statistic = 0.050 ~ 0.096, $p > 0.200$).

The overall regression model (for finding the relationship between the knowledge creation process and enablers) is significant ($F = 51.771, p < 0.000$). R^2 (0.879) suggests that 87.9 percent of the variance is explained by seven variables. The result of the collinearity test (VIF = 1.429 ~ 3.725) shows no multicollinearity problem.

Analysis Results

TABLE 6 SUMMARIZES OUR REGRESSION RESULTS. In order to provide a better presentation of significant relationships, Figure 5 has been provided. Collaboration, trust, learning, and centralization are found to be relatively significant predictors for knowledge creation.

Organizational culture variables are found to be essential for knowledge creation. Collaboration is positively related with socialization, externalization, and internalization, whereas it does not affect the combination mode. In particular, trust is a significant predictor of all knowledge creation modes. Centralization is negatively related with socialization, externalization, and internalization while it is not significantly related with combination. By contrast, formalization and T-shaped skills of members



(a) Between the knowledge creation processes and knowledge management enablers

$KCP = \alpha + \beta_1 COL + \beta_2 TRU + \beta_3 LEA + \beta_4 CEN + \beta_5 FOR + \beta_6 TSK + \beta_7 ITS + \varepsilon$
$KCS = \alpha + \beta_1 COL + \beta_2 TRU + \beta_3 LEA + \beta_4 CEN + \beta_5 FOR + \beta_6 TSK + \beta_7 ITS + \varepsilon$
$KCE = \alpha + \beta_1 COL + \beta_2 TRU + \beta_3 LEA + \beta_4 CEN + \beta_5 FOR + \beta_6 TSK + \beta_7 ITS + \varepsilon$
$KCC = \alpha + \beta_1 COL + \beta_2 TRU + \beta_3 LEA + \beta_4 CEN + \beta_5 FOR + \beta_6 TSK + \beta_7 ITS + \varepsilon$
$KCI = \alpha + \beta_1 COL + \beta_2 TRU + \beta_3 LEA + \beta_4 CEN + \beta_5 FOR + \beta_6 TSK + \beta_7 ITS + \varepsilon$

(b) Between organizational creativity and knowledge creation processes

$OC = \alpha + \beta_1 KCP + \varepsilon$
$OC = \alpha + \beta_1 KCS + \beta_2 KCE + \beta_3 KCC + \beta_4 KCI + \varepsilon$

(c) Between organizational performance and organizational creativity

$OP = \alpha + \beta_1 OC + \varepsilon$

Figure 4. Regression Equations

do not significantly affect knowledge creation. IT support is significantly related with knowledge combination only.

Knowledge creation is positively related with organizational creativity, which is positively related with organizational performance. This finding confirms that an organization can achieve strategic benefits of knowledge management through effective knowledge creation.

Discussion

Limitations

THE FINDINGS OF THIS STUDY ARE INTERESTING, but they should be considered in light of its inherent limitations. First, this study presents a snapshot research that does

Table 6. Summary of Regression Results

Variables	Knowledge creation process $R^2 = 0.879$ $F = 51.771$*** ($N = 58$)	Socialization $R^2 = 0.837$ $F = 36.553$*** ($N = 58$)	Externalization $R^2 = 0.733$ $F = 19.619$*** ($N = 58$)	Combination $R^2 = 0.658$ $F = 13.749$ *** ($N = 58$)	Internalization $R^2 = 0.714$ $F = 17.857$*** ($N = 58$)	Organizational creativity
Collaboration (H1)	**β = 0.2085** **t = 2.4901****	**β = 0.3017** **t = 3.1036*****	**β = 0.2477** **t = 1.9941***	β = –0.0694 t = –0.4938	**β = 0.2692** **t = 2.0947****	N/A
Trust (H2)	**β = 0.3525** **t = 3.5907*****	**β = 0.2379** **t = 2.0873****	**β = 0.3079** **t = 2.1140****	**β = 0.4041** **t = 2.4515****	**b = 0.3182** **t = 2.1118****	N/A
Learning (H3)	**β = 0.2138** **t = 2.2498****	**β = 0.3096** **t = 2.8054*****	β = 0.1296 t = 0.9191	β = 0.1612 t = 1.0102	**β = 0.1895** **t = 1.9985***	N/A
Centralization (H4)	**β = –0.2030** **t = –2.6745****	**β = –0.1755** **t = –2.0142****	**β = –0.2144** **t = –1.9039***	β = –0.1353 t = –1.0618	**β = –0.2025** **t = –1.7381***	N/A
Formalization (H5)	β = –0.013 t = –0.2162	β = –0.0520 t = –0.5262	β = –0.1165 t = –1.2891	β = 0.0018 t = 0.0267	β = 0.1152 t = 1.3194	N/A
T-shaped skills (H6)	β = 0.0443 t = 0.7411	β = 0.0286 t = 0.4139	β = 0.0560 t = 0.6339	β = 0.0205 t = 0.2053	β = 0.0545 t = 0.5958	N/A

(continues)

Table 6. (Continued)

Variables	Knowledge creation process $R^2 = 0.879$ $F = 51.771^{***}$ ($N = 58$)	Socialization $R^2 = 0.837$ $F = 36.553^{***}$ ($N = 58$)	Externalization $R^2 = 0.733$ $F = 19.619^{***}$ ($N = 58$)	Combination $R^2 = 0.658$ $F = 13.749^{***}$ ($N = 58$)	Internalization $R^2 = 0.714$ $F = 17.857^{***}$ ($N = 58$)	Organizational creativity
IT support (H7)	β = 0.0611 *t* = 0.8911	β = –0.0111 *t* = –0.1388	β = 0.1124 *t* = 1.2029	**β = 0.2516** ***t* = 2.1848****	β = –0.2025 *t* = –1.7381	N/A
Organizational creativity (H8) $R^2 = 0.819$ $F = 59.914^{***}$ ($N = 58$)	**β = 0.9035** ***t* = 15.7786*****	**β = 0.2957** ***t* = 2.0883****	**β = 0.2906** ***t* = 2.2281****	**β = 0.1778** ***t* = 1.8835***	**β = 0.2371** ***t* = 2.6010****	N/A
Organizational performance (H9) $R^2 = 0.402$ $F = 37.592^{***}$ ($N = 58$)	N/A	N/A	N/A	N/A	N/A	**β = 0.6338** ***t* = 6.1313*****

Notes: Supported hypotheses in boldface type. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

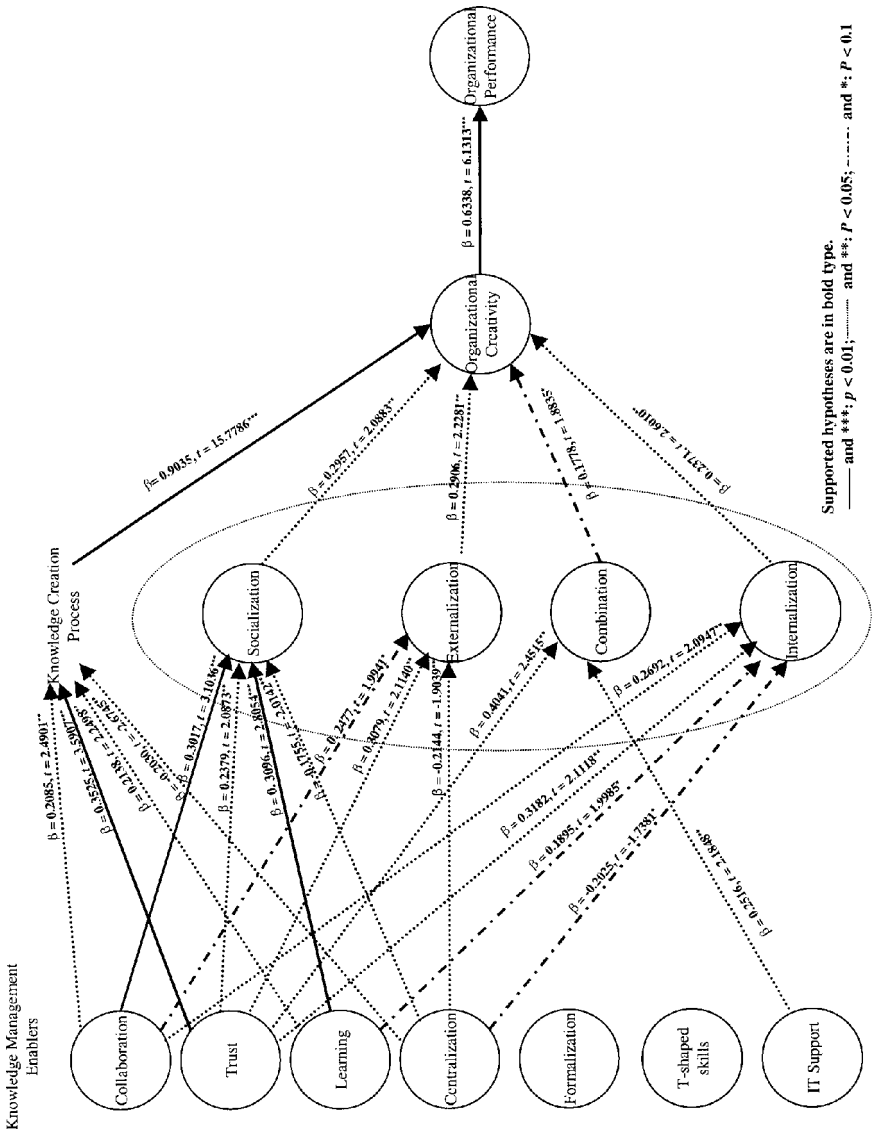


Figure 5. Significant Relationships in Regression Results

not consider feedback effects. A longitudinal study to investigate the dynamic features of knowledge management would provide further robust results. Second, it focuses on relatively large and profitable firms. The results may differ in small or venture firms. Finally, the results are limited to Korean firms. The generalizability from a Korean setting to other countries may be questionable.

Implications

Our results can help managers establish distinctive strategic positions. Knowledge management strategies can be described along two dimensions to reflect knowledge management focus [45]. One dimension refers to knowledge sharing via interpersonal interaction. The other dimension refers to the capability to help create, store, share, and use an organization's explicitly documented knowledge. The former is more affected by socialization, and the latter is more affected by combination [16]. Knowledge management strategists can sharpen weak knowledge management dimensions on the basis of enablers mentioned in our study. Table 7 highlights these implications. The following is a further discussion of these implications.

Our findings confirm that knowledge creation is associated with cultural factors such as collaboration, trust, and learning. For instance, groups are most creative when their members collaborate; members stop holding back when they have mutual trust [54]. Shaping cultural factors is crucial for a firm's ability to manage its knowledge effectively [15, 20, 35, 71]. For example, our interview with an executive of a confectionery company highlights this point. The executive pointed out that their employees did not just use the manual or other codified supports. It was noted that they preferred to depend on their own experiences and networking relationships. A trust-based culture is the foundation for their knowledge management initiative.

However, many knowledge management projects, in reality, focus on IT [19, 35, 111]. An organization may face difficulties in building its knowledge creating environment due to the lack of adequate culture despite its well-constructed IT [23, 72]. Stein and Zwass [107] insisted that successful information systems should be conditioned by a number of cultural factors such as organizational values and appropriate learning methods. Initiating knowledge management only through IT can be a risky proposition [19].

Our analysis confirms that IT support affects combination. There are several resources for a sound understanding of the impact of IT on knowledge combination [82, 100]. This finding highlights the characteristics of knowledge combination. IT is critical for codifying explicit knowledge; it provides fast feedback for explicit knowledge [69, 120]. In order to support knowledge combination, the question is not whether to deploy IT, but how to deploy it. Interestingly, our analysis also reveals that trust affects combination. This result implies that simply improving the IT infrastructure does not provide a competitive advantage for knowledge combination. Through interviews with executives in the disk industry in the United States, Scott [100] found that communication of even explicit knowledge is difficult without a solid founda-

Table 7. Summary of Implications

	Focus	Findings	Implications
Relationships between enablers and processes			
Significant	Cultural factors	Cultural factors are positively associated with knowledge creation.	Shaping cultural factors is crucial for knowledge management; Initiating knowledge management only through information technology can be a risky proposition; Managers need to establish knowledge management considering firm's culture.
	Combination	Combination is affected by IT and trust.	Information technology is critical for codifying explicit knowledge; Simply improving the information technology infrastructure does not provide a competitive advantage for knowledge combination; Managers should pay careful attention to the potential impact of information technology on knowledge combination with the consideration of trust in a firm.

(continues)

Table 7. (Continued)

	Focus	Findings	Implications
Relationships between enablers and processes (continued)			
Nonsignificant	Formalization	No relationship between formalization and knowledge creation; Formalization may tend to inhibit socialization and externalization whereas it facilitates combination and internalization.	Two different aspects of formalization (formalization may inhibit tacit-related activities, but may encourage explicit-related activities); Further exploration of relationship between formalization and knowledge creation is needed (if the emphasis of externalization is on tacit knowledge, externalization may be negatively associated with formalization; if the conversion process or its technology perspective of externalization is emphasized, formalization can affect externalization positively).

Nonsignificant	T-shaped skills	No relationship between T-shaped skills and knowledge creation.	Without an environment in which T-shaped skills flourish, people with T-shaped skills will not attempt to create new knowledge. A crucial element of successful knowledge management is not T-shaped skills themselves, but the systematic management of these skills (T-shaped management systems).
	IT support	IT support is not significantly related with knowledge creation except combination.	The current state of information technology may not affect socialization, externalization, or internalization directly.
Relationships between intermediate outcome and performance			
	Organizational creativity	Organizational creativity affects organizational performance; The percentage of total variation of organizational performance explained by organizational creativity is relatively low.	Managers pay more attention to organizational creativity in order to improve organizational performance; The creativity paradox (organizational creativity is valuable, but its over-encouragement may not be always useful).

tion of trust. Managers should pay careful attention to the potential impact of IT on knowledge combination with the consideration of trust in a firm.

The nonsignificant findings in this study also bear some implication. Several studies have come to the conclusion that formalization weakens knowledge management [57, 106]. In contrast, our study shows no relationship between formalization and knowledge creation. This rather intriguing result reflects the two different aspects of formalization. According to the ambidextrous model, which is based on the distinction between the initiation and implementation stages of innovation [26, 94], formalization may inhibit tacit-related activities such as socialization ($\beta = -0.052$) and externalization ($\beta = -0.1165$), but may encourage explicit-related activities such as combination ($\beta = 0.0018$) and internalization ($\beta = 0.1152$). However, this interpretation needs further exploration because all β values are not statistically significant.

In particular, a more careful investigation of externalization is of interest. Externalization involves the expression of tacit knowledge [8]. From this perspective, a formal organizational structure may inhibit spontaneity and freedom of expression necessary for externalization [10]. In our study, the emphasis of externalization is on tacit knowledge, and thus externalization is negatively associated with formalization. However, externalization may also involve conversion of tacit into explicit knowledge [8]. The formal structure can facilitate the rapid and continuous conversion of tacit into explicit knowledge [37]. If the conversion process or its technology perspective of externalization is emphasized like Becerra-Fernandez and Sabherwal [8], we may speculate that formalization can affect externalization positively.

Many studies suggested that T-shaped skills positively influence knowledge creation [60, 70, 74]. However, our study shows no relationship between T-shaped skills and knowledge creation. This contradiction may reflect the importance of T-shaped management systems. T-shaped management systems attempt to break out of the traditional corporate hierarchy and encourage people to share knowledge [44]. However, most current formal organizational incentives encourage I-shaped skills (the deep functional expertise) in isolation [70]. Without an environment in which T-shaped skills flourish, people with T-shaped skills will not attempt to create new knowledge. It implies that a crucial element of successful knowledge management is not T-shaped skills themselves, but the systematic management of these skills.

It would be expected that technologies could facilitate knowledge creation. However, our result shows that IT support is not significantly related with knowledge creation except for combination. It seems that IT does not support all modes of knowledge creation directly. Although groupware, intranet, or videoconferencing can help collaborative works, this technologically facilitated communication cannot replace face-to-face contact for tacit-to-tacit knowledge transfer [53]. Accessing the tacit knowledge such as knowledge inside employees' heads is not possible simply by an intranet or a database [23]. That is, the current state of IT may not affect socialization, externalization, or internalization directly.

Our study shows that organizational creativity affects organizational performance ($\beta = 0.6338$, $p < 0.01$). This result is in line with previous studies [73, 102]. For example, Shani et al. [102] provided a framework linking organizational performance

and organizational creativity through a field study of the Seagate Corporation. It implies that managers pay more attention to organizational creativity in order to improve organizational performance. Although the relationship is statistically significant, the percentage of total variation of organizational performance explained by organizational creativity is relatively low ($R^2 = 0.402$). This may reflect the creativity paradox [116]. If creativity is encouraged and reinforced at the expense of operational behaviors, it may decrease organizational performance. That is, organizational creativity is valuable, but its overencouragement may not be always useful.

Conclusions

OUR STUDY IS OF INTEREST FROM BOTH theoretical and practical perspectives.

Theoretically, a framework is proposed for empirical studies to link knowledge management enablers and processes with organizational performance. This study is probably the first to establish this integrative view of knowledge management. We adopt a process-oriented perspective of knowledge by using Nonaka's creation model [82]. Our framework may be used as a stepping stone for further empirical research on knowledge management. To strengthen the feasibility of this framework, we can clarify the role of knowledge creation process (see Appendix C) and intermediate outcome (see Appendix D).

From a practical point of view, the relationships among knowledge creation, organizational creativity, and organizational performance may provide a clue as to how firms can adjust knowledge creation processes to sustain their performance. Furthermore, managers will be better able to find which enablers are critical for knowledge creation. Because firms may not manage all modes of knowledge creation, they may need robust strategies that involve trade-offs.

The current findings of this study may indicate the following avenues for further research. First, an analysis of different factors such as domain knowledge [101] or other types of knowledge process may lead to interesting implications. For example, an interesting candidate is Szulanski's knowledge transfer model, which is made up of four processes—initiation, implementation, ramp-up, and integration [114]. Second, our study shows which knowledge enablers can enhance a firm's capability to manage knowledge. Appropriate knowledge management strategies may be able to facilitate these enablers. Finding these strategies may be of interest. Third, what is the effect of our findings on electronic commerce? Electronic commerce is changing the business world rapidly. The quality of knowledge management may determine a success template for electronic commerce. For example, Holsapple and Singh [50] proposed the potential benefits of applying knowledge management principles to electronic commerce. Finally, other types of performance measures may sharpen the results of our study. ROI[3] (return on ideas, return on information, and return on investment) [73] or a strategy map [63] is a good alternative.

Acknowledgments: This work was supported in part by a grant from KOSEF (98-0102-08-01-3).

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Appendix A. Operational Definitions and Related Literature

Variables	Operational definition	Related literature
Collaboration	Degree of active support and helps in organization	[54, 67, 85, 100]
Trust	Degree of reciprocal faith in others' intentions, behaviors, and skills toward organizational goals	[19, 54, 57, 68, 74, 81, 85]
Learning	Degree of opportunity, variety, satisfaction, and encouragement for learning and development in organization	[55, 62, 88, 113]
Centralization	Degree of authority and control over decisions	[14, 17, 27, 47, 89, 115]
Formalization	Degree of formal rules, procedures, and standard polices	[14, 34, 89, 106, 115]
T-shaped skills	Degree of understanding his or her own and others' task areas	[56, 60, 70, 74]
IT support	Degree of IT support for collative work, for communication, for searching and accessing, for simulation and prediction, and for systematic storing	[20, 35, 87, 90, 99]
Knowledge creation	Degree of socialization, externalization, combination, and internalization	[82, 83]
Socialization	Degree of tacit knowledge accumulation, extra-firm social information collection, intra-firm social information gathering, and transfer of tacit knowledge	[82, 83]
Externalization	Degree of creative dialogue, deductive and inductive thinking, use of metaphors, and exchanged ideas	[82, 83]
Combination	Degree of acquisition and integration, synthesis and processing, and dissemination	[82, 83]
Internalization	Degree of personal experiences, simulation, and experimentation	[82, 83]
Organizational creativity	Degree of belief that organizations is actually producing creative (novel/useful) ideas (services/products)	[5, 34, 40, 65, 119, 122]
Organizational performance	Degree of overall success, market share, growth rate profitability, and innovativeness in comparison with major competitors	[22, 25]

Appendix B. Questionnaire

(1) Knowledge management enablers

Construct	Items
Collaboration (COL; five items)	COL1: Our organization members are satisfied by the degree of collaboration. COL2: Our organization members are supportive. COL3: Our organization members are helpful. COL4: There is a willingness to collaborate across organizational units within our organization. COL5: There is a willingness to accept responsibility for failure.
Trust (TRU; six items)	Our company members . . . TRU1: are generally trustworthy. TRU2: have reciprocal faith in other members' intentions and behaviors. TRU3: have reciprocal faith in others' ability. TRU4: have reciprocal faith in others' behaviors to work toward organizational goals. TRU5: have reciprocal faith in others' decision toward organizational interests than individual interests. TRU6: have relationships based on reciprocal faith.
Learning (LEA; five items)	Our company . . . LEA1: provides various formal training programs for performance of duties. LEA2: provides opportunities for informal individual development other than formal training such as work assignments and job rotation. LEA3: encourages people to attend seminars, symposia, and so on. LEA4: provides various programs such as clubs and community gatherings. LEA5: members are satisfied by the contents of job training or self-development programs.
Centralization (CEN; five items)	Our company members . . . CEN1: can take action without a supervisor (R). CEN2: are encouraged to make their own decisions (R). CEN3: do not need to refer to someone else (R). CEN4: do not need to ask their supervisor before action (R). CEN5: can make decisions without approval (R).
Formalization (FOR; five items)	In our company . . . FOR1: there are many activities that are not covered by some formal procedures (R). FOR2: contacts with our company are on a formal or planned basis. FOR3: rules and procedures are typically written. FOR4: members can ignore the rules and reach informal agreements to handle some situations (R). FOR5: members make their own rules on the job (R).

Construct	Items
T-shaped skills (TKS; five items)	Our company members . . . TSK1: can understand not only their own tasks but also others' tasks. TSK2: can make suggestion about others' task. TSK3: can communicate well not only with their department members but also with other department members. TSK4: are specialists in their own part. TSK5: can perform their own task effectively without regard to environmental changes.
IT support (ITS; five items)	Our company . . . ITS1: provides IT support for collaborative works regardless of time and place. ITS2: provides IT support for communication among organization members. ITS3: provides IT support for searching for and accessing necessary information. ITS4: provides IT support for simulation and prediction. ITS5: provides IT support for systematic storing.

"R" indicates that the item is actually measured in a reverse fashion.

(2) Knowledge creation processes*

Construct	Items
Socialization (KCS; five items)	Our company stresses . . .
Tacit knowledge accumulation	KCS1: gathering information from sales and production sites.
Tacit knowledge accumulation	KCS2: sharing experience with suppliers and customers.
Extra-firm social information collection	KCS3: engaging in dialogue with competitors.
Intra-firm social information collection	KCS4: finding new strategies and market opportunities by wandering inside the firm.
Transfer of tacit knowledge	KCS5: creating a work environment that allows peers to understand the craftsmanship and expertise.
Externalization (KCE; five items)	Our company stresses . . .
Dialogue	KCE1: creative and essential dialogues.
Metaphor	KCE2: the use of deductive and inductive thinking.
Metaphor	KCE3: the use of metaphors in dialogue for concept creation.
Dialogue	KCE4: exchanging various ideas and dialogues.
Dialogue	KCE5: subjective opinions.
Combination (KCC; five items)	Our company stresses . . .
Acquisition and integration	KCC1: planning strategies by using published literature, computer simulation and forecasting.
Synthesis and processing	KCC2: creating manuals and documents on products and services.

Synthesis and processing	KCC3: building databases on products and service.
Synthesis and processing	KCC4: building up materials by gathering management figures and technical information.
Dissemination	KCC5: transmitting newly created concepts.
Internalization (KCI; four items)	Our company stresses . . .
Personal experience (knowledge acquisition form real world)	KCI1: enactive liaisoning activities with functional departments by cross-functional development teams.
Experimentation (knowledge acquisition from virtual world)	KCI2: forming teams as a model and conducting experiments, and sharing results with entire departments.
Personal experience	KCI3: searching and sharing new values and thoughts.
Personal experience	KCI4: sharing and trying to understand management visions through communications with fellows.

(3) Organizational creativity

Construct	Items
Creativity (OC; five items)	Our company . . . OC1: has produced many novel and useful ideas (services/products). OC2: fosters an environment that is conductive to our own ability to produce novel and useful ideas (services/products). OC3: spends much time for producing novel and useful ideas (services/products). OC4: considers producing novel and useful ideas (services/products) as important activities. OC5: actively produces novel and useful ideas (services/products).

(4) Organizational performance

Construct	Items
Organizational performance (OP; five items)	Compared with key competitors, our company . . . OP1: is more successful. OP2: has a greater market share. OP3: is growing faster. OP4: is more profitable. OP5: is more innovative.

Note: * Linkage between knowledge creation constructs and our questionnaire items.

Questionnaire items for the knowledge creation process, which were used in this study, had been validated and used by Nonaka et al. [83]. They conducted a confirmatory factor analysis to test Nonaka's [82] organizational knowledge creation model with data collected from 105 Japanese middle managers. Results of the study suggest that the construct of knowledge creation consists of four knowledge conversion processes: socialization, externalization, combination, and internalization. All four knowledge conversion processes explain a high amount of variance in the knowledge creation

construct. Four factors constitute the process of converting tacit to tacit knowledge; accumulation of tacit knowledge, extra-firm social information gathering activities, intra-firm social information gathering activities, and transfer of tacit knowledge from the master to the different team members. Externalization process is made up of one factor. This result differs from Nonaka's theory that hypothesized that metaphor and dialogue would be retained. Combination process consists of three factors that represent a three-step sequence of data processing: acquisition and integration of information, synthesis and processing of information, and dissemination of information. Explicit knowledge in the organization may be converted into tacit knowledge (internalization) in two different ways: personal experience in which knowledge is acquired from real world, and simulation and experimentation in which knowledge is acquired from the virtual world.

Appendix C. Mediating Effect of Knowledge Creation Process

OUR STUDY HINTS THAT KNOWLEDGE CREATION process mediates between enablers and organizational creativity. However, some recent studies regard both knowledge enablers and knowledge creation process as antecedents of organizational performance [8, 35]; that is, both of them are independent variables of organizational performance. Therefore, in order to test the mediating effect of knowledge creation process, the Baron and Kenny [7] procedure is adopted. Table A1 shows this analysis result. This results in the mediation effect because the following three conditions hold. First, knowledge enablers affect knowledge creation process significantly. It has been noted that collaboration, trust, learning, and centralization affect creation. However, this is not the case with formalization, T-shaped skills, and IT support; we could not assess the mediating effect for these three enablers. Second, collaboration, trust, learning, and centralization affect organizational creativity. Third, knowledge creation process affects creativity ($\beta = 0.7042$) while the effects of the previous four enablers are reduced. For example, in the case of collaboration, its beta value is reduced from 0.2144 to 0.1316. In sum, we may point out that knowledge creation process mediates between the four enablers (collaboration, trust, learning, and centralization) and organizational creativity.

Table A1. Mediation Analysis Result

	Knowledge creation (beta values)	Organizational creativity (beta values)	Organizational creativity (beta values)
Collaboration	0.2085**	0.2144*	0.1316
Trust	0.3525***	0.3916***	0.1353**
Learning	0.2138**	0.2015*	0.1291
Centralization	–0.2030**	–0.1808*	–0.1047
Formalization	–0.0130	–0.0390	–0.0296
T-shaped skills	0.0443	0.1682**	0.1514**
IT support	0.0611	0.0949	0.0493
Knowledge creation			0.7442***

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Appendix D. Mediating Effect of Intermediate Outcome

IN ORDER TO VALIDATE WHETHER an intermediate outcome is an important predictor of knowledge management or not, another model without organizational creativity is built to explore the direct relationship between knowledge creation and organizational performance. Testing this direct relationship indicates no significant relationships except for socialization ($\beta = 0.540, p < 0.05$). This result is consistent with the previous study [18]. It implies that the intermediate outcome can help build a chain of credibility between knowledge creation and organizational performance.

Although not the focus of this study, it is of interest to note an alternative concurrent model in organization theory. This model would posit that efficiency and bureaucratic (or mechanistic) structures would chain through to organizational performance. For example, centralization can lead to efficiency because it prevents a strategic vacuum of organizations and enables the development of precise control procedures [30]. In addition, formalization has been found to lead to efficiency because it may facilitate the rapid and continuous transformation of ideas into superior products and services and enhance communication flow through their extensive monitoring and reporting requirements [36]. Similarly, standardizing business practices may encourage efficiency [48].

Related to an interplay between creativity (flexibility) and efficiency, it has been assumed that a firm must either focus on efficiency or flexibility [33, 123]. That is, flexibility (or efficiency) can only be achieved at the cost of efficiency (or flexibility). Therefore, some researchers have concentrated on improving efficiency [125] whereas others have focused on how to improve flexibility and creativity [13].

However, there are now a few studies that have suggested that it is possible to be simultaneously efficient and flexible [24, 31]. Organizations can obtain their competitive advantages through achieving efficiency by emphasizing control as well as flexibility (creativity) by creating knowledge [117]. Case studies such as Microsoft [48], Unilever [69], and NUMMI (a Toyota subsidiary) [1] have shown this simultaneous approach. These studies suggest that balancing between imposing discipline for efficiency and delegating authority to encourage flexibility and creativity provides tremendous benefits for organizations.

In summary, some studies insist that efficiency and flexibility are mutually exclusive, whereas others argue that they are perfectly compatible. Our study focuses on creativity (flexibility) only. The interplay between these creativity forces and efficiency forces should be further investigated in the field of knowledge management. For example, Krogh et al. [69] indicated that knowledge management allows an organization to improve both its efficiency and flexibility (innovation) capabilities simultaneously.