A Firm as a Knowledge-creating Entity: A New Perspective on the Theory of the Firm

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The knowledge-based view of the firm views a firm as a knowledge-creating entity, and argues that knowledge and the capability to create and utilize such knowledge are the most important source of a firm's sustainable competitive advantage. Knowledge and skills give a firm a competitive advantage because it is through this set of knowledge and skills that a firm is able to innovate new products/processes/services, or improve existing ones more efficiently and/or effectively. The raison d'être of a firm is to continuously create knowledge.

1. *Introduction*

Various theories currently exist to understand a firm and its activities. However, these theories—such as neoclassical economics, transaction-cost theory, principal-agent theory and the resource-based view of a firm—are not enough to understand a firm in today's economy, in which knowledge is considered as 'the only meaningful resource' (Drucker, 1993). We have yet to establish a good understanding of how a firm can create and manage knowledge. A new theory to understand a firm, which differs 'in some fundamental way from . . . both economics and organizational theory' (Spender and Grant, 1996, p. 8), is needed.

The knowledge-based view of the firm, the most recent development in the theories of a firm, views a firm as a knowledge-creating entity, and argues that knowledge and the capability to create and utilize such knowledge are the most important source of a firm's sustainable competitive advantage (Nonaka, 1990, 1991, 1994; Prahalad and Hamel, 1990; Nelson, 1991; Cyert *et al.*, 1993; Henderson and Cockburn, 1994; Nonaka and Takeuchi,

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1995; Leonard-Barton, 1995; Kogut and Zander, 1996; Nahapiet and Ghoshal, 1998; Spender, 1996; Teece *et al.*, 1990). Knowledge and skills give a firm a competitive advantage because it is through this set of knowledge and skills that a firm is able to innovate new products/processes/services, or improve the existing ones more efficiently and/or effectively. The *raison d'être* of a firm is to continuously create knowledge.

This paper is an attempt to advance the knowledge-creating view of the firm. By introducing the concepts of 'ba' and knowledge-creating function, we argue that a firm is a dynamic configuration of ba, and it internalizes knowledge-creating activities when it can create knowledge more effectively and efficiently than the market does.

2. *Existing Theories of the Firm and the Knowledge-creating View of the Firm*

The knowledge-creating view of the firm is different from other theories of the firm in its basic assumptions that humans and organizations are dynamic beings, and in its focus on the process inside the firm.

2.1 Basic Assumptions

The knowledge-creating view of the firm is based on the view of a human as a dynamic being and a firm as a dynamic entity that actively interacts with others and the environment. In our theory of the knowledge-creating process, we define knowledge as 'a dynamic human process of justifying personal belief towards the "truth"' (Nonaka and Takeuchi, 1995). We do not view knowledge as something absolute and static, as in the case with the traditional Western epistemology (the theory of knowledge). We view knowledge as context-specific, relational, dynamic and humanistic. Knowledge is essentially related to human action. Without understanding the nature of human beings and the complex nature of human interactions, we cannot understand the theory of organizational knowledge creation.

The theory of neoclassical economics was developed on the assumption of unbounded rationality, that an economic subject is rational and completely understands its situation and advantage/disadvantage of economic transactions. According to this theory, an individual maximizes its utility and the firm maximizes its profit on the basis of perfect rationality. More recently developed theories—such as complexity economics, transaction-cost theory and principal-agent theory—are based on the assumption of bounded rationality and opportunism (Simon, 1945; Williamson, 1975, 1985). Either

way, these theories view a human as an isolated, static being, and hence are crucially limited in explaining the firm as a knowledge-creating entity.

On the other hand, the theory of organizational knowledge creation is based on the assumption that individuals and organizations have a potential to *grow together* through the process of knowledge creation. Organization is a place ('ba') where an individual transcends him/herself through knowledge creation (Nonaka and Konno, 1998; I. Nonaka, R. Toyama and N. Konno, forthcoming). When individuals interact with each other at such a place, one transcends one's own boundary, and, as a result, changes oneself, others and the place itself. Creating knowledge *organizationally* does not just mean organizational members supplementing each other to overcome an individual's bounded rationality, as is the case in the division of labor in production. In organizational knowledge creation, one plus one could be more than two. It can be also zero, if interactions among individuals work negatively.

The knowledge-creating view of the firm sees an organization as a dynamic entity as well. Some of the research on knowledge creation mainly focuses on individuals, based on the assumption that individuals are the main driving forces of creation. For example, Grant (1996) claims that knowledge creation is an individual activity and that the primary role of firms is to apply existing knowledge. However, such an argument is based on a view of knowledge and human beings as something static and inhuman. As we stated above, knowledge creation is a dynamic human process. Knowledge is created through the dynamic interactions among individuals and/or between individuals and their environments, rather than an individual who operates alone in a vacuum.

Neoclassical economics deals with the issue of dynamism as the problem of finding the equilibrium. It is a locus to reach a stable point, where no change occurs once the firm reaches that point. Other theories of the firm, including transaction-cost theory, also view a firm as a static information-processing machine that takes and processes information from the environment to solve the problem and adapt to the environment based on a given goal.

This is a static and passive view of organization, and fails to capture the dynamic process of knowledge creation. Instead of merely solving problems, an organization creates and defines problems, generates and applies new knowledge to solve the problems, and then further generates new knowledge through the action of problem solving (Cyert and March, 1963; March, 1991; Levinthal and Myatt, 1994). The organization actively interacts with its environment, and reshapes the environment and even itself through the process of knowledge creation. Instead of being given all the necessary information, as suggested in neoclassical economics, or instead of processing

information to overcome the information disequilibrium, as suggested by transaction-cost theory or principal-agent theory, a firm creates meaning out of information to create knowledge.

Further, it is often the case that an organization's goal is not given beforehand, but is sought out during the organization's course of action. It should be noted that there is no end to knowledge creation by the firm. There is no pre-set goal or equilibrium to reach, as new processes of knowledge creation start at the moment new knowledge has been created. The most important aspect in the theory of knowledge-creating firm is the capability to continuously create new knowledge out of existing firm-specific capabilities, rather than the stock of knowledge such as particular technology that a firm possesses at one point in time (Wilkins, 1989; Teece *et al.*, 1990; Barney, 1991; Nelson, 1991; Lei *et al.*, 1996).

2.2 The Focus of the Theories

The knowledge-creating view of the firm is also different from existing theories of the firm in that it needs to look *inside* the firm to see how it produces knowledge. The activities, strategy, structure and culture of the firm are of major concern.

The neoclassical economics theory, on the other hand, views a firm as a mere production function. The production function only deals with the relationship between inputs and outputs, and the firm itself is basically treated as a black box. Activities inside the firm are of no concern to neoclassical economists.

Transaction-cost theory mainly focuses on the boundary of the firm. It treats knowledge as a good to be transacted and hence one of the factors to decide the firm's boundary. The key concept in this view is the efficiency in making transactions internally, compared to the cost of making such transactions through market mechanisms (Williamson, 1975). According to the transaction-cost theory, a firm internalizes knowledge-creating activity if the production cost of certain knowledge is lower than the market price of the knowledge plus transaction cost.

The existing research in transaction-cost economics suggests several reasons why a market transaction of knowledge is often difficult or impossible due to the nature of knowledge. Indeed, the existence of large diversified firms and multinational firms can be explained by the high transaction cost of the knowledge (Teece, 1977, 1981, 1982).

First, the transaction cost of knowledge can be high because of its high uncertainty for several reasons. Knowledge creation itself is inherently a highly uncertain activity. The technical and commercial outcome of research

activities can hardly be known *ex ante* (Dosi, 1988). It is difficult to know in advance not only the precise cost and outcomes of different alternatives, but also what the alternatives are (Nelson and Winter, 1982). Because knowledge is highly distributed, it is also fluid and difficult to capture (Spender, 1989; Tsoukas, 1996). A firm is faced with the difficulty of deciding what it ought to know given future business opportunities and threats.

Second, some knowledge is difficult to transact due to its tacitness. There are two types of knowledge: explicit knowledge and tacit knowledge. The former is objective and rational knowledge and can be expressed in such forms as data, scientific formulas, specific actions and manuals. The latter is subjective and experiential and hard to formalize. Belief, perspective, mental models, ideas and ideals are examples of tacit knowledge. Tacit knowledge is non-transferable without the exchange of key personnel and all the systems that support them, and hence difficult to transact. Hiring new talents through the labor market enables acquisition of tacit knowledge embodied in them, though this mechanism of acquisition is rather considered as integration of the external knowledge to the internal organization. Further, organizational knowledge, embedded in organizational processes, procedures, routines and structures, cannot be transacted without transferring the body of people with established patterns of working together (D. J. Teece, forthcoming). Kim and Hwang (1992) argue that the greater the tacit component of firm-specific know-how, the more a firm will favor internalization over market transaction to transfer the technology, since internal organization enhances the firm's ability to utilize its human capital and draw on its organizational memory to transfer tacit knowledge.

Third, even if the knowledge is codifiable and hence transferable, there will be problems arising from the fact that such knowledge has public good characteristics. It is difficult to evaluate the value of knowledge since the buyer needs to know the content of the knowledge to determine the value of knowledge, and once she/he knows it, she/he has acquired it without paying for it (Arrow, 1962). And the problems of appropriability also rise from the public good characteristics of knowledge (Methe, 1991). To maximize profit from it, sellers of the knowledge try to prevent buyers from applying the knowledge to other areas, or to resell it to third parties. It is, however, difficult to incorporate a clear definition of the relevant property rights and mechanisms for reinforcing those rights into a contract, especially when it deals with knowledge which has broader applications (Pisano, 1990).

However, such explanations by transaction-cost theory deal with only a part of the reasons why market transactions of knowledge are difficult or impossible. As transaction-cost theory started as a theory to explain the

transactions of tangible goods, the knowledge to be transacted is often assumed to have some degree of explicit forms, such as technologies, know-how and data. However, when we view a firm as a knowledge-creating entity, it is not enough to understand knowledge in such forms. What gives a firm sustainable competitive advantage is the capability to exploit existing knowledge, and to create new knowledge out of existing knowledge is also knowledge, rather than just a set of technologies or know-how that a firm possesses at one point in time.

Kusunoki *et al.* (1998) categorize organizational capability concerning knowledge creation into three types: knowledge base, knowledge frames and knowledge dynamics. The knowledge base includes distinctive individual units of knowledge, such as functional knowledge embodied in a specific group of engineers, elemental technologies, various information-processing devices, databases and patents. Knowledge frames capture linkages of individual units of knowledge and their priorities. For example, one could understand that the way of task partitioning between functional groups, the configuration of authority and the distribution of resources shape a certain pattern in individual units of knowledge within the knowledge base. Knowledge dynamics is the dynamic interactions of knowledge between knowledge base and knowledge frames, such as communication and co-ordination across different functional groups. Knowledge dynamics sheds light on processes of dynamic interactions in which individual units of knowledge are combined and transformed, whereas the knowledge frame captures stable pattern of linkages of knowledge. The capabilities provided by knowledge dynamics emerge from within the process of knowledge interaction.

Transaction-cost theory usually only deals with the knowledge base and fails to grasp the knowledge frames and knowledge dynamics. This is because transaction-cost theory focuses on the transactions between two parties (whether the two parties belong to the same organization or not) and rarely pays attention to the activities inside each party, i.e. production. The make or buy issue—the central concern of transaction-cost theory—is about what to make (knowledge base), not how to make (knowledge frames and knowledge dynamics). In that sense, transaction-cost theory still treats firms as black boxes that are undifferentiated from each other, as in neoclassical economics. However, what really gives a firm sustainable competitive advantage is knowledge frames and knowledge dynamics (Wilkins, 1989; Barney, 1991; Nelson, 1991). We can not understand a firm as a knowledge-creating entity without looking into knowledge frames and knowledge dynamics.

The resource-based view of a firm does look inside firms in terms of the

resources it owns. According to this view, a firm is a collection of resources, and those with superior resources will earn rents (Penrose, 1959; Teece, 1982; Wernerfelt, 1984; Conner, 1991; Mahoney and Pandian, 1992). This view treats knowledge as one such resource. Knowledge and skills are the major source of sustainable competitive advantage, since they are accumulated through organizational learning, and are difficult to imitate or non-tradable (Winter, 1987; Prahalad and Hamel, 1990; Nelson, 1991; Leonard-Barton, 1992, 1995; Henderson and Cockburn, 1994; Kogut and Zander, 1996). Transacting such knowledge through markets is often difficult or costly because they have a strong tacit dimension, are embedded in local organizational skills and routines, and are specialized to firm-specific needs (Dierickx and Cool, 1991; Henderson and Cockburn, 1994). Further, even when knowledge can be acquired through market transaction in such forms as licensing agreements or R&D contracts, a firm needs the capability to exploit and utilize external knowledge. Transferring knowledge is a complex process, and it often requires time, effort and internal resources on the recipient's side to assimilate external knowledge (Agmon and von Glinow, 1991; Rosenberg and Frischtak, 1985). It is difficult to evaluate, absorb and utilize imported knowledge if a firm does not have an internal capacity to do so (Dosi, 1988; Cohen and Levinthal, 1990; Prahalad and Hamel, 1990; Rosenberg, 1990; Chesbrough and Teece, 1996). Henderson and Cockburn (1994) argue that a firm's ability to access new knowledge from outside and integrate it into the organization is an important source of sustainable competitive advantage. Such internal capacity can be acquired only through learning-by-doing, and therefore, is non-transferable through markets (Cohen and Levinthal, 1990).

More importantly, Kogut and Zander (1992) argue that innovations are products of a firm's 'combinative capabilities' to generate new applications from existing knowledge. Teece *et al.* (1990) term such capability 'dynamic capability', i.e. a firm's ability to use existing firm-specific capabilities and to develop new ones. Dynamic capability provides a firm with the basis for its sustainable advantage over time. The theory of the knowledge-creating firm needs to deal with such dynamic capability. The dynamic capability to create new knowledge out of existing knowledge can be accumulated only through learning-by-doing, by actually engaging in organizational knowledge-creating activities. Since it is a firm-specific capability, it is difficult or costly for other firms to acquire or imitate, because it would require the duplication of employees, the systems, culture and norms of the organization.

However, empirical and theoretical research on the resource-based view of the firm so far has been mainly focused on how firms keep their unique resources and resulting competitive advantages through such conditions as

imperfect imitability, imperfect substitutability and limited mobility of resources (Amit and Schoemaker, 1993; Barney, 1986, 1991, Dierickx and Cool, 1989; Petraf, 1993; Wernerfelt 1984). Although it deals with the dynamic capability of the firm, the resource-based view of the firm fails to address the dynamism in which the firm continuously builds such resources. There is very little understanding on how a firm accumulates such resources (Levinthal and Myatt, 1994).

3. *A Firm as the Organic Configuration of 'Ba'*

As we stated earlier, we need to look inside the firm, as well as the boundary of the firm, to understand the true nature of the knowledge-creating firm. Viewing a firm as black box, a set of transactions or a collection of resources is not enough. In the knowledge-based theory of the firm, a firm is considered 'a social community specializing in the speed and efficiency in the creation and transfer of knowledge' (Kogut and Zander, 1996, p. 503). What, then, would determine the characteristic of such a social community? We propose the concept of 'ba', i.e. a shared context in motion, to view a firm as a knowledge-creating entity (I. Nonaka *et al.*, forthcoming). A firm can be conceptualized as a dynamic configuration of 'ba'.

Knowledge is context-specific, as it depends on a particular time and space (Hayek, 1945). Without being put into a context, knowledge is just information, not knowledge. Knowledge-creating processes are necessarily context-specific, in terms of who participates and how they participate in the process. The context here does not mean 'a fixed set of surrounding conditions but a wider dynamical process of which the cognition of an individual is only a part' (Hutchins, 1995, p. xiii). Hence, knowledge needs a physical context to be created, as 'there is no creation without place' (Casey, 1997, p. 16).

'Ba' (which roughly means 'place') is defined as a shared context in which knowledge is shared, created and utilized.[1] 'Ba' is a place where information is given meaning through interpretation to become knowledge, and new knowledge is created out of existing knowledge through the change of the meanings and the contexts. In other words, 'ba' is a shared context in cognition and action. Knowledge cannot be understood without understanding situated cognition and action (Suchman, 1987). In knowledge creation, generation and regeneration of 'ba' is the key, as 'ba' provides energy,

[1] The concept of 'ba' is based on the works of a Japanese philosopher, Kitaro Nishida (1921, 1970). The importance of place in human cognition and action has been also discussed by many philosophers, including Plato, Heidegger, Husserl and Whitehead.

quality and places to perform the individual conversions and to move along the knowledge spiral (Nonaka and Konno, 1998; I. Nonaka *et al.*, forthcoming).

'Ba' does not necessarily mean a physical space. Rather, it is a specific time and space. As we stated above, knowledge is dynamically created through the interactions among individuals and/or between individuals and their environments. 'Ba' is the context shared by those who interact with each other; through such interactions, those who participate in 'ba' and the context itself evolve through self-transcendence to create knowledge. In other words, 'ba' is an emerging relationship among individuals, and between an individual and the environment.

'Ba' lets participants share time and space, and yet it transcends time and space. In knowledge creation, it is important for participants to share time and space, as such a close, physical interaction is an important factor to sharing the context and forming a common language among participants. Also, since knowledge is intangible, boundaryless, dynamic and cannot be stocked, 'ba' works as the platform of knowledge creation, by collecting the applied knowledge of the area into a certain time and space and integrating it. However, as 'ba' can be a mental and/or virtual place as well as physical, it does not have to be bound to a certain space and time.

'Ba' exists at many ontological levels and these levels may be connected to form a greater 'ba'. Individuals form the 'ba' of teams, which in turn form the 'ba' of organizations. A firm is a collection of 'ba', which interact with each other organically and dynamically. Such organic interactions among these different levels of 'ba' amplify the knowledge-creating process.

The coherence among 'ba' is achieved through organic interactions among 'ba' based on the knowledge vision, rather than a mechanistic concentration in which the center dominates. 'Ba' is constantly in motion. 'Ba' is fluid, and can be born and disappear quickly. In organizational knowledge creation, various 'ba' interact with each other to evolve into a higher self. Here, the 'interfaces' among 'ba' also evolve along with 'ba' themselves. The relationships among various 'ba' can also change quickly. The relationships are not predetermined and nor are they clear. And such interactive organic coherence of various 'ba' and individuals that participate in 'ba' has to be supported by trustful sharing of knowledge and continuous exchanges between all the units involved to create and strengthen the relationships. Hence, viewing a firm as a dynamic configuration of 'ba' means that we have to view the dynamic process in which the organizational members, their interactions and the firm itself evolves through continuous organizational knowledge creation.

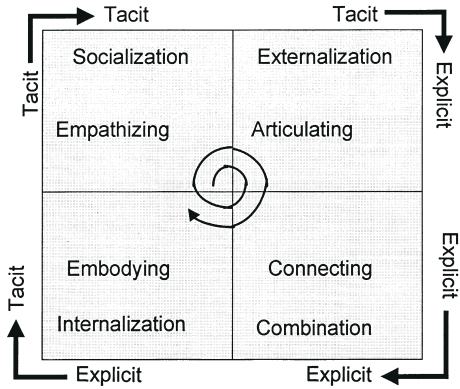

FIGURE 1. The SECI Process (adapted from Nonaka and Takeuchi, 1995).

4. *Knowledge-creating Function*

When we view a firm as a dynamic configuration of 'ba' whose boundary is both open and closed, what would determine the boundary of the firm? To answer this question, we have to turn our attention to the production process of knowledge, i.e. how a firm creates knowledge. To do so, we introduce the concept of the knowledge-creating function.

An organization creates knowledge through the interactions between explicit knowledge and tacit knowledge. We call this interaction between the two types of knowledge 'knowledge conversion'. Understanding this reciprocal relationship is the key to understand the knowledge-creating process. Knowledge is created through interactions among individuals with different types and contents of knowledge. Through this 'social conversion' process, tacit and explicit knowledge expands in terms of both quality and quantity (Nonaka, 1990, 1991, 1994; Nonaka and Takeuchi, 1995). Knowledge creation is not merely combining existing (mostly explicit) knowledge as suggested by Schumpeter (1950).

In the knowledge-creating firm, knowledge is created through the SECI spiral, which goes through the four modes of conversion between tacit and explicit knowledge (see Figure 1): (1) Socialization (from tacit knowledge to tacit knowledge); (2) Externalization (from tacit knowledge to explicit knowledge); (3) Combination (from explicit knowledge to explicit knowledge); and (4) Internalization (from explicit knowledge to tacit knowledge).

A firm can be conceptualized as a 'knowledge creation function' based on organizational knowledge creation theory. And the knowledge conversion rate, which is an indicator of this knowledge creation, is how much tacit

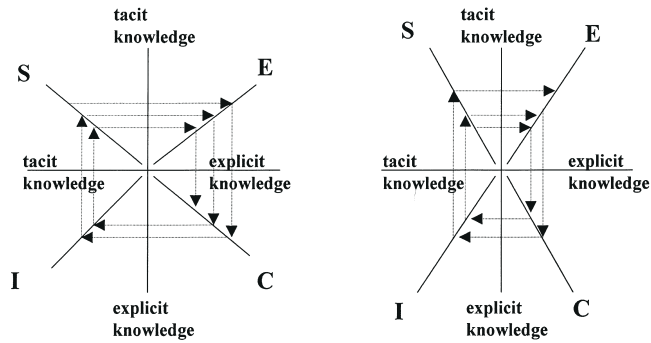

FIGURE 2. Knowledge conversion rate: contracting or expanding conversion process.

knowledge or explicit knowledge will increase against one unit increase in tacit or explicit knowledge (see Figure 2).

As stated previously, a firm creates knowledge through the knowledge spiral of SECI process. The first quadrant of Figure 2 shows that explicit knowledge created via externalization is a function of tacit knowledge. Similarly, the rest shows knowledge conversion functions with combination in the second, internalization in the third, and socialization in the fourth quadrants respectively.

Parameter δ, i.e. $d(ek)/d(tk)$, is 'the marginal propensity to knowledge conversion', and shows by how many units explicit knowledge increases when tacit knowledge increases marginally by one unit. Whether the SECI process brings about extension or reduction of knowledge depends on the extent of propensity to knowledge conversion. For example, in the case where the efficiency rate of knowledge conversion is high in any dimension of knowledge conversion, propensity to knowledge conversion exceeds 1. In such a case, the effective utilization of tacit knowledge for a new innovation takes place and spiral of knowledge conversion increases in acceleration (spiral up). However, in the case where the efficiency rate of knowledge conversion is low, the propensity to knowledge conversion is below 1, and a reduction spiral takes place (spiral down). A firm exists when the knowledge conversion rate of the firm is higher than that of the market in the long run.

5. *The Knowledge Conversion Rate*

If a proxy index to determine knowledge is properly defined, then propensity to knowledge conversion can be measured, and it would be possible to study factors that influence conversion efficiency. What factors then determine the

knowledge conversion rate of the firm? These factors are: knowledge vision, organizational form, incentive system, corporate culture and organizational routines, and leadership.

First, knowledge vision determines the mission and domain of the firm. It synchronizes the entire organization as to what kind of knowledge it has to create, and fosters spontaneous commitments of the individuals and groups that are involved in knowledge creation. In short, knowledge vision determines how organization, as well as its knowledge base, knowledge frame and knowledge dynamics, evolve in the long term. Knowledge vision also defines the value system that evaluates, justifies and determines the quality of knowledge the company creates. In a sense, it gives a firm an aesthetic view of knowledge. Together with organizational norms, routines and skills, the value system determines what kinds of knowledge are to be needed, created and retained (Nonaka, 1985; Leonard-Barton, 1995). Knowledge vision gives the direction to the knowledge conversion spiral, which cannot be found in the market other than through a price mechanism. Considering that pricing of knowledge, especially tacit knowledge, is difficult, the market mechanism does not necessarily function efficiently and effectively in giving the direction to the knowledge conversion.

Since knowledge is boundaryless, any form of new knowledge can be created regardless of the existing business structure of the company. Therefore, it is important for a firm to have a knowledge vision that transcends the boundaries of existing products, divisions, organizations and markets, and yet lets the firm focus on a certain domain.

Second, how the organization is configured and structured can promote or hinder functional interactions of the SECI process. A firm is a dynamic configuration of 'ba', and how various 'ba' are constructed and relate to each other greatly affects the efficiency in knowledge conversion. For example, it has been demonstrated that the SECI process works differently between the functional department and the project team (A. Nagata, forthcoming). It has also been demonstrated that internalization and socialization contribute high performance in the functional department, while externalization and combination contribute high performance in the project team. Therefore, building 'ba' such as project teams or functional departments, and determining how such 'ba' should be connected to each other, is an important factor in determining the firm's knowledge conversion rate.

Third, incentive systems can greatly affect the knowledge conversion rate. Traditional theories concerning employee–employer contracts have focused on the moral hazard and reverse choice due to the information gap in designing the incentive system (Radner, 1968; Akerlof, 1970; Rothschild and Stiglitz,

1976). As tacit knowledge can be a source of sustainable competitive advantage for the firm, it can raise the value of the individual who owns such tacit knowledge. However, to make such tacit knowledge that the firm can utilize, it needs to be shared by others in the form of tacit knowledge through socialization, or to be articulated so that it can be shared as explicit knowledge through externalization. Since sharing of tacit knowledge could lessen the value of the original owner of the knowledge, it is possible that such an individual might not co-operate in externalizing his/her tacit knowledge. In such a case, it is important to develop various incentive systems that motivate individuals to share their knowledge. However, such incentives can raise the cost of knowledge conversion.

Poppo and Zenger (1998) argue that the markets also have clear advantages in generating incentives that motivate knowledge formation. Groups of individuals governed by markets are more likely to directly benefit from the formation of new knowledge. However, monetary compensation is not the only incentive for an individual. The self-satisfaction of being able to create something can be a great incentive. Peer recognition and the sense of belonging are also important incentives for an individual to contribute to the organization to which s/he belongs. Osterloh and Frey (1997) argue that intrinsic motivation is very important in transferring of tacit knowledge within a firm, and firms have an advantage over the market in managing motivation.

Fourth, corporate culture and organizational routines that are specific to the firm can either promote or hinder organizational knowledge creation. A firm's comparative efficiency arises through the formation of 'firm-specific language and routines' that both enhance the performance of an activity itself and aid in ensuring its efficient governance (Poppo and Zenger, 1998). How organization members view the approach to knowledge and the knowledge-creating process, and how they interact with each other, greatly affect the knowledge conversion rate. For example, love, care, trust and commitment among organizational members is important as it forms the foundation of knowledge creation (von Krogh, 1998). However, at the same time, an organization is subject to inertia and it is difficult for an organization to diverge from the course set by its previous experiences (Hannan and Freeman, 1984). Therefore, current capabilities may both impel and constrain future learning and actions taken by a firm (Petraf, 1993). Core capabilities can turn into 'core rigidities' (Leonard-Barton, 1992), or 'competence traps' (Levitt and March, 1988), which hinder knowledge creation rather than promote it. When underlying technological change is rapid, internal routines, language and embedded forms of knowledge may easily become rigidities that hamper performance (Poppo and Zenger, 1998).

Finally, as the factor to integrate the above-mentioned factors, we stress the importance of leadership. Leadership gives will and direction to the firm, which cannot be found in the market. Leaders affect the knowledge conversion rate by creating the knowledge vision, configuring various 'ba' to promote the SECI process, and fostering the organizational culture to create knowledge continuously and dynamically. Also, as knowledge is created through dynamic interactions among organizational members, synergistic interactions among top, middle and frontline knowledge practitioners are important. We argue that especially crucial to this process is the role of knowledge producers, i.e. middle managers who are at the intersection of the vertical and horizontal flows of information within and across the company, and actively interact with others to create knowledge. In knowledge creation, 'distributed leadership,' where every member of the firm can be a leader depending on the context, is the key (I. Nonaka *et al.*, forthcoming).

6. *The Cost of Knowledge Creation*

There are other costs involved in the organizational knowledge creation that determines the boundary of the firm. They are: the cost of knowledge input, the opportunity cost and the cost of time.

As knowledge is both input and output of the knowledge-creating function, there is a cost involved in acquiring and retaining the knowledge as inputs. In some cases, knowledge can be bought from the outside into the knowledge-creating process, through such methods as licensing of intellectual property rights, outsourcing of R&D, and consulting. In other cases, however, knowledge should be accumulated through the firm's own knowledge-creating activities, as market transaction of the knowledge in question is costly or impossible due to the reasons stated in previous sections. Hence, the kind of knowledge that the firm can utilize as inputs is determined by the knowledge that the firm already possesses, and the cost of acquiring knowledge through markets.

To understand the knowledge that the firm possesses, we introduce the concept of knowledge assets (I. Nonaka *et al.*, forthcoming). Knowledge assets are inputs and outputs of knowledge-creating processes. Unlike inputs and outputs in neoclassical economics, knowledge assets are often invisible, tacit and dynamic. They cannot be easily bought or sold (Teece, 1998). We have yet to have an effective system and tools to evaluate and manage such knowledge assets. We need to build a system to evaluate and manage the knowledge assets of a firm more effectively.

To understand how knowledge assets are created, acquired and exploited,

Experiential Knowledge Assets	Conceptual Knowledge Assets
Tacit knowledge shared through common experiences • Skills and know-how of individuals • Care, love, trust, and security • Energy, passion, and tension	Explicit knowledge articulated through images, symbols, and language • Product concepts • Design • Brand equity
Routine Knowledge Assets	**Systemic Knowledge Assets**
Tacit knowledge routinized and embedded in actions and practices • Know-how in daily operations • Organizational routines • Organizational culture	Systemized and packaged explicit knowledge • Documents, specifications, manuals • Database • Patents and licenses

FIGURE 3. Four categories of knowledge assets.

we propose to categorize knowledge assets into four types: experiential knowledge assets, conceptual knowledge assets, systemic knowledge assets and routine knowledge assets (see Figure 3).

Experiential knowledge assets are the shared tacit knowledge which are built through shared, hands-on experiences among organizational members, and/or between organizational members and customers, suppliers or affiliated firms. Skills and know-how that are acquired and accumulated by the individual members through experiences in a particular context at work are examples of such knowledge assets. Experiential knowledge also includes emotional knowledge (e.g. care, love and trust), physical knowledge (e.g. facial expressions and gestures), energetic knowledge (e.g. the sense of existence, enthusiasm and tension) and rhythmic knowledge (e.g. improvisation and entrainment).

Conceptual knowledge assets are explicit knowledge articulated through images, symbols and language. They are the assets based on the concepts held by customers and organizational members. Brand equity, which is perceived by customers, or concepts or design, which are perceived by organizational members, are examples of such knowledge assets. Since they have tangible form such as brand identities, product concepts/designs or explicit statements, conceptual knowledge assets are easier to grasp than experiential knowledge assets, though it is still difficult to grasp what customers or organizational members perceive.

Systemic knowledge assets are systematized and packaged explicit knowledge, such as explicitly stated technologies, product specifications, manuals or documented information about customers and suppliers. Legally protected intellectual properties such as licenses or patents also fall into this category.

Routine knowledge assets are the tacit knowledge that is routinized and embedded in the actions and practices of the organization. Know-how,

organizational routines and organizational culture in carrying out the daily business of the organization are examples of such knowledge assets. Through continuous exercises, certain patterns of thinking and action are reinforced and shared among organizational members.

These knowledge assets determine the firm's boundary by determining the cost of inputs for the knowledge-creating process, and at the same time, the firm's knowledge-creating process determines how the knowledge assets are built over time. Such path dependency (David, 1985; Barney, 1991) of the knowledge-creating process leads to another cost: the opportunity cost of knowledge creation. A firm can acquire certain knowledge through markets, given that the knowledge is tradable. However, acquiring knowledge from outside often means that it would deprive the firm the opportunity to learn and build up related knowledge that could have been gained if the firm chose to create the knowledge on its own. The related knowledge, which is often tacit, or the knowledge of how to build such knowledge, i.e. dynamic capability, can be far more valuable than the cost initially saved by acquiring a certain knowledge from outside.

On the other hand, building one's own knowledge does come with another cost, i.e. time. Compared to acquiring an existing knowledge from outside, building up knowledge assets through a firm's own knowledge-creating process takes time, and hence is costly. The opportunity cost is especially high when the industry that the firm is in is rapidly changing (D. J. Teece, forthcoming).

7. *Conclusion*

In this paper we have discussed how a firm can be viewed as a knowledge-creating entity, as existing theories of the firm fail to capture the most important activity of the firm, i.e. knowledge creation. A firm creates knowledge continuously and dynamically though the SECI process, in which tacit knowledge held by individuals is converged and amplified by the spiral of knowledge through socialization, combination, externalization and internalization of knowledge. The boundary of the firm is determined by the knowledge conversion rate and the cost of knowledge creation, i.e. how efficiently a firm can create knowledge out of existing knowledge through the SECI process, compared to the market and other firms. The relative efficiency in knowledge conversion is what gives the firm rent.

The knowledge conversion rate is determined by such factors as knowledge vision, organizational structure, incentive systems, corporate culture and routines, and leadership. Especially important is the role of leadership, which

integrates other factors to lead the firm to create knowledge continuously and dynamically.

In the knowledge-creating view of the firm, it is important to look inside the firm, instead of just looking at it as a black box as neoclassical economics theory does, or only concerning the boundary of the firm as transaction-cost theory does. Resource-based views of the firm and the principal-agent theory are based on the view of the firm as an information-processing entity, and fail to capture the dynamic process of knowledge creation. We propose to view the firm as a dynamic configuration of 'ba'. 'Ba' gives shared contexts to the SECI process, which is necessary to create knowledge out of information and existing knowledge. The knowledge assets of a firm are mobilized and shared in 'ba', so that new knowledge can be continuously created.

Viewing a firm as a dynamic configuration of 'ba' means that we have to think the issue of a firm's boundary from other viewpoints than the issue of ownership. The existing theories of the firm have been dealing with the issue of ownership when they tried to answer the 'make or buy' question. Transaction-cost economics deals with the issue of the ownership of production facility. Resource-based views of the firm deal with the issue of the ownership of important resources. Principal-agent theory deals with the issue of the ownership of the right to use one's capability for a certain period of time. Hence, it is easy to observe the boundary of the firm, according to these theories, as the boundary of the firm means the boundary of ownership.

The theory of the knowledge-creating firm also deals with the issue of ownership, as it concerns the ownership of knowledge-creating capability, knowledge assets and knowledge-creating individuals. However, the theory of the knowledge-creating firm also deals with something that cannot be owned by anyone. Knowledge is created through interactions among individuals, and such interactions cannot be owned even by the participants of the interactions.

A firm as a dynamic configuration of 'ba' means that a firm is a place to generate and facilitate such interactions. Hence, on this view, it is difficult to observe the boundary of the firm from the outside, as it is difficult to observe the interactions that can change quickly. What determines the boundary of the firm is not the legal ownership of some assets, but how well a firm can facilitate such interactions, in other words, how well a firm can build and energize 'ba'. Hence, to observe a knowledge-creating firm, one has to look into a firm more closely, instead of just looking at who owns what. Such things as the knowledge vision, culture, organizational routines and leadership, which have been considered as issues for organizational theorists, should be considered when one tries to deal with the issue of a knowledge-creating firm.

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