A Theory of Organizational Knowledge Creation:
Understanding the Dynamic Process of Creating Knowledge

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In recent years many researchers have argued that knowledge and the capability to create and utilize it are the most important sources of a firm's sustainable competitive advantage (Cyert, Kurat, and Williams 1993; Drucker 1995; Nonaka 1990, 1991, 1994; Nonaka and Takeuchi 1995; Quinn 1992; Sveiby 1997; Teece, Pisano, and Shuen 1997; Toffler 1990; Winter 1986). In a world where markets, products, technologies, competitors, regulations, and even entire societies change very rapidly, continuous innovation and knowledge that enables such innovation have become important sources of sustainable competitive advantage. Quinn (1992) observed that a company's competitive advantage increasingly depends on such knowledge-based intangibles as technological know-how and an in-depth understanding of customers. Drucker (1995) argued that knowledge has become the only meaningful resource in business today. Toffler (1990) claimed that knowledge is the source of the highest quality power and the key to the shifts in power that lie ahead. Knowledge accumulated through organizational learning is an important source of a firm's sustainable competitive advantage because it is not tradable and difficult to imitate (Ernst and McDougall 1997; Grant 1996a; Nelson 1993; Prahalad and Hamel 1990). This kind of knowledge has a strong tacit dimension, is embedded in local organizational skills and routines, and is tailored to a firm’s specific needs (Dietrichs and Cool 1992; Henderson and Cockburn 1994; Leonard-Barton 1992, 1995).

Yet, despite all the attention that leading observers have devoted to organizational knowledge creation, and despite all the talk about intellectual capital and knowledge-based management, very few people understand how organizations create and manage knowledge. Management scholars recognize the need for new knowledge-based theory that differs in some fundamental way from the kinds of explicit abstract theories which have characterized both economics and organizational theory (Spender and Grant 1996:8).

Such a theory, however, has yet to be established, partly because the theory of the organization has long been dominated by the information-processing paradigm. In this paradigm, which is deeply ingrained in the traditions of Western management from Taylor (1911) to Simon (1947, 1973), the organization is viewed as an information-processing machine that takes in processes information from the environment in order to solve a problem and adapt to the environment. For example, Choo (1998) still relied on this view of the organization as its "knowing organization" model, treating knowledge creation as a mere part of the process in which an organization processes information in order to reach rational decisions based on a given goal. The problem with this
paradigm is that its view of the organization and of knowledge creation is static and passive, characteristics that preclude an adequate explanation of the dynamic process of innovation. Although the terms 'information' and 'knowledge' are often used interchangeably, there is a clear distinction between them. Information is a flow of messages, whereas knowledge anchored in the beliefs and commitment of its holder is created by that flow of information. Information provides a new point of view for interpreting events or objects. As Bateman (1979) put it, 'information consists of differences that make a difference' (p. 2). Thus, in formation is a necessary medium or material for eliciting and constructing knowledge. Information affects knowledge by adding something to it or restructuring it (Machlup 1985).

When organizations innovate, they do not merely process information. Rather, they create new information and reshape the environment through interactions with their environments (Cyert and March 1963; Levinthal and Myatt 1994; March 1992). Instead of merely solving problems, organizations create and define problems, develop and apply new knowledge in order to solve these problems, and then further develop new knowledge through problem-solving activities. An organization is not a mere information-processing machine, but an entity that creates knowledge through action and interaction. An organization actively interacts with its environment, reshaping this environment and even itself through the process of knowledge creation. Hence, the most important aspect in understanding the dynamic knowledge-related capabilities of a firm is the focus on how it can continuously create new knowledge from its existing capabilities and not on the stock of knowledge, such as a particular technology, that a firm possesses at one point in time (Barney 1991; Lei, Hitt, and Bettis 1996; Nelson 1991; Teece, Pisano, and Shuen 1997; Wilkins 1997).

Organizational learning theories have long dealt with the issue of continuous change in organizations (Doddson 1993). Organizations cope with changes in their environments and change themselves through learning. To con-
our goal in this chapter is to understand the dynamic process whereby an organization creates and manages knowledge. In the following sections we discuss the basic concepts of the knowledge-creation process in organizations, the ways in which the process is managed, and the organizational issues involved.

The Knowledge-creation Process

In our theory of knowledge-creation process, we adopt the traditional definition of knowledge as justified true belief. However our focus is on the 'justified', rather than on the 'true' aspect of belief. In traditional Western epistemology, 'truthfulness' is the essential attribute of knowledge. It is an absolute, static, and nonhuman view of knowledge. This view, however, fails to address the relative, dynamic, and human dimensions of knowledge. As Whitehead stated, 'there are no whole truths; all truths are half-truths' (Whitehead 1954: 16). Knowledge is context-specific and relational. It depends on the situation. Knowledge is dynamic for it is dynamically created in social interactions between individuals both within and across organizations. Knowledge is also human and has an active and subjective nature conveyed by such terms as 'commitment' and 'belief', which are deeply rooted in individuals' value systems. Knowledge is essentially related to human action and emotion (Scheler and Tonn, Ch. 16 in this volume). In this study we consider knowledge to be a dynamic human process of justifying personal belief toward the 'truth'—(Nonaka and Takeuchi 1995: 38).

To understand how organizations create knowledge dynamically, we propose a multi-layered model of knowledge creation (Nonaka, Konno, and Toyama 1998). In this model the three layers of knowledge creation consist of (1) tacit and explicit knowledge; (2) the platforms for knowledge creation; and (3) knowledge assets, or the inputs, outputs, and mechanisms of the knowledge-creation process.

![Fig. 22.1. Three layers of the knowledge-creation process, including tacit platforms for knowledge creation and SECI (socialization-externalization-combination-internalization processes)](Adapted from "Leading Knowledge Creation: A New Framework for Dynamic Knowledge Management," by I. Nonaka, N. Kono, and R. Toyama, paper presented at the Second Annual Knowledge Management Conference, Haas School of Business, University of California Berkeley, 22-24 September 1998.)
The SECI Process: Four Modes of Knowledge Conversion

There are two types of knowledge: explicit knowledge and tacit knowledge. Table 22.1 summarizes the qualities of these two types of knowledge. Explicit knowledge can be expressed in formal and systematic language and can be shared in the form of data, scientific formulae, specifications, manuals, and so forth. It can be easily ‘processed’, transmitted, and stored. Explicit knowledge is about past events or objects ‘there and then’, and it is oriented to a context-free theory. It is sequentially created by digital activity. Tacit knowledge, on the other hand, is highly personal and hard to formalize. As Polanyi (1966) put it, ‘we can know more than we can tell’ (p. 4). Subjective insights, intuitions, and hunches fall into this category of knowledge. Tacit knowledge is deeply rooted in action, procedures, routines, commitment, ideals, values, and emotions (Cohen and Badawy 1993; Schön 1983; Winter 1994). In addition, tacit knowledge is often ‘here and now’ in a specific, practical context of time and space (Hayek 1945). It entails an analog quality. It is difficult to communicate tacit knowledge to others because it is an analog process that requires a kind of simultaneous processing.

Tacit knowledge includes technical and cognitive elements. The technical elements of tacit knowledge encompass informal and hard-to-pin-down know-how, crafts, and skills. Masters, artisans, for example, develop a wealth of expertise ‘at their fingertips’ after years of experience. But it is often difficult for them to articulate the scientific or technical principles behind this knowledge. On the other hand, the cognitive elements center on what Johnson-Laird (1983) called ‘mental models’, through which human beings create working models of the world. Mental models, such as schemata, paradigms, perspectives, beliefs, and viewpoints, help individuals perceive and define their world by enabling them to make and manipulate analogies in their minds. It is important to note that the cognitive elements of tacit knowledge reflect an individual’s images of reality (i.e. what s/he is and his or her visions for the future) as he or she wants it to be. As discussed later in this chapter, the articulation of tacit mental models is a key factor in creating new knowledge.

Westerners tend to view knowledge as explicit. Japanese, on the other hand, tend to regard knowledge as primarily tacit. In reality, these two types of knowledge are complementary, and both are crucial to knowledge creation. Excessive focus on explicit knowledge can easily lead to ‘analysis by synthesis’, whereas exaggerated valuation of tacit knowledge tends to foster overreliance on past successes. Without experiences, one has difficulty gaining understanding. And unless one goes beyond experiences, universality cannot be achieved. ‘If one does not analytically reflect on experiences, the same things will be repeated over and over, with no increase in the quality of knowledge. By analyzing experiences, one understands their meaning, which can then be applied to the next experience. In this way, tacit knowledge and explicit knowledge interact and interexchange with each other in the creative activities of human beings. Understanding this reciprocal relationship is the key

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<tr>
<th>Tacit knowledge (subjective)</th>
<th>Explicit knowledge (objective)</th>
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<td>Knowledge of experience (body)</td>
<td>Knowledge of rationality (mind)</td>
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<tr>
<td>Simultaneous knowledge (here and now)</td>
<td>Sequential knowledge (there and then)</td>
</tr>
<tr>
<td>Analog knowledge (practice)</td>
<td>Digital knowledge (theory)</td>
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to understanding the knowledge-creation process. We call the interaction of the two types of knowledge 'knowledge conversion'. This conversion processes is behavioral and it is not confined within an individual. Knowledge is created through interactions between individuals with different types and contents of knowledge. Through this process of social conversion, the quality and quantity of both tacit and explicit knowledge expand (Nornaka 1990, 1992, 1994; Nornaka and Takeuchi 1995). There are four modes of knowledge conversion: (a) socialization (from tacit to explicit knowledge), (b) externalization (from explicit to explicit knowledge), (c) combination (from explicit knowledge to explicit knowledge), and (d) internalization (from explicit knowledge to tacit knowledge). Table 2a lists the factors that characterize the four knowledge conversion modes. We discuss each of these four modes in detail below.

Socialization
Socialization is the process of bringing together tacit knowledge through shared experiences. Because tacit knowledge is context-specific and difficult to formalize, the key to acquiring tacit knowledge is to share the same experience through joint activities. The quintessential example of socialization is traditional apprenticeship. Apprentices learn their craft not through spoken words or written textbooks but through observation and imitation of the weeks of their masters and through practice. Another example of socialization is the use by Japanese companies of informal meetings outside the workplace. Participants talk over meals and drinks, creating common tacit knowledge, such as a worldview, and mutual trust. Socialization also occurs outside organizational boundaries. Organizational members interact with customers or suppliers in order to share and take advantage of their tacit knowledge. Such socialization often takes place during a new product's development process.

Socialization is difficult to measure because it is the conversion of tacit knowledge. In order to promote socialization, the members first should be provided with high-quality physical experiences so that their tacit knowledge can accrue. The richness of tacit knowledge provides the context of knowledge sharing also becomes the motivating force for the generation of high-quality knowledge. Second, top, control and trust must be cultivated among members so that they can transcend the individual boundaries and share tacit knowledge.

Externalization
Externalization is the process of articulating tacit knowledge as explicit knowledge. Of the four modes of knowledge conversion, externalization is the key to knowledge creation because it creates new, explicit concepts from tacit knowledge. When tacit knowledge is made explicit, knowledge becomes crystallized, at which point it can be shared by others and can be the basis for new knowledge. Externalization comes about for, for example, when a researcher and development (R&D) team tries to clarify the concept for a new product or when a skilled worker attempts to set down his or her embodied technical skills in a manual.

The successful conversion of tacit knowledge into explicit knowledge depends on the sequential use of metaphors, analogies, and models. Metaphor is a way of perceiving intuitively understanding one thing by imagining it symbolically as another thing. Metaphor is an important tool for creating a network of new concepts. Using metaphor makes it possible to continually relate concepts that are far apart in one's mind, even to relate abstract concepts to concrete ones. The inbalance, inconstancy, or contradiction that is brought about by the association of two unlike concepts through metaphor often leads to the discovery of new meanings and even to the formation of a new paradigm. The contradictions inherent in a metaphor are then harmonized by analogy, which throws light on the unknown by highlighting the similarities of two different things. Analogy helps one understand the unknown through the known and bridges the gap.
<table>
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<th>Factor</th>
<th>Description</th>
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<tr>
<td>Socialization: from tacit knowledge to tacit knowledge</td>
<td>Managers gather information from sales and production sites, share experiences with suppliers and customers, and engage in dialogue with competitors. Managers wander about outside their firm, gathering ideas for corporate strategy from daily social life, interacting with external experts, and meeting informally with competitors. Managers find new strategies and market opportunities by wandering inside the firm. Managers create a work environment that allows peers to observe demonstrations by and the practice of novice team members in order to understand the expertise their work involves.</td>
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<td>Externalization: from tacit knowledge to explicit knowledge</td>
<td>Managers facilitate creative and essential dialogue, &quot;abductive thinking&quot;, the use of metaphors to foster concept creation, and the inclusion of industrial designers in project teams.</td>
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<tr>
<td>Combination: from explicit knowledge to explicit knowledge</td>
<td>Managers plan strategies and operations, drawing on published literature, computer simulation, and forecasting in order to assemble internal and external data. Managers create manuals, documents, and databases for products and services and gather management figures, technical information, or both throughout the company. Managers plan and make presentations in order to transmit newly created concepts.</td>
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<td>Internalization: from explicit knowledge to tacit knowledge</td>
<td>Managers engage in &quot;reflective reasoning&quot; activities with functional department through members of cross-functional development teams, overlapping product development. Managers search for and share new values and thoughts, share and try to understand management visions and values by communicating with fellow members of the organization. Managers facilitate prototyping and benchmarking and foster a spirit of challenge within the organization. Managers form teams as a model, conduct experiments, and share results with the entire department.</td>
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Note: Adapted from Nontaka et al., 1994: 344. © 1994 Elsevier Science Ltd.
between an image and a top-of-model. Once explicit concepts are created, they can then be modeled. Models are usually generated from metaphors when new concepts are created in the business context.

Combination

Combination is the process of connecting discrete elements of explicit knowledge into a set of explicit knowledge that is more complex and systematic than any of its parts. Knowledge is exchanged and combined through such media as documents, meetings, telephone conversations, and computerized communication networks. The reorganization of existing knowledge through sorting, adding, combining, and categorizing can create new knowledge. When a component of a company collects information from the entire organization and puts it together in a financial report, that report is new knowledge in the sense that it synthesizes information from many different sources.

Combination can also include the breakdown of concepts. For example, middle managers analyze and break down a concept, such as a company vision or a new product concept, into workable action plans, such as operationalized business plans or design tasks.

In practice, combination entails three processes. First, explicit knowledge is collected from inside or outside the organization and then combined. Second, the new explicit knowledge is disseminated among the organizational members. Third, the explicit knowledge is edited or processed in the organization in order to make it more usable. Creative use of computerized communication networks and large-scale databases can facilitate this mode of knowledge conversion.

Internalization

Internalization is the process of embodying explicit knowledge as tacit knowledge. It is closely related to learning-by-doing. Through internalization, knowledge that is created is shared throughout an organization. Internalized knowledge is used to broaden, extend, and reframe organizational members' tacit knowledge. When knowledge is internalized in individuals' tacit knowledge base through shared mental models or technical know-how, it becomes a staff asset. This sort of knowledge accumulated at the individual level is, in turn, shared with other individuals through socialization, and it sets off a new spiral of knowledge creation.

In practice, internalization entails two methods: first, explicit knowledge must be embedded in action and practice. The process of internalizing explicit knowledge actualizes concepts about or methods for strategy, tactics, innovation, or improvement. For example, training programs help trainees understand the organization and themselves. Second, explicit knowledge can be embedded through simulations or experiments in order to trigger learning-by-doing. Thus, new concepts or methods can be learned in virtual situations.

Knowledge is created through a continuous and dynamic interaction between tacit and explicit knowledge. This interaction is shaped through the SECI process, that is, through the shifts from one mode of knowledge conversion to the next: socialization, externalization, combination, and internalization. Figure 2.2 illustrates the four modes of knowledge conversion and the evolving spiral movement.

The SECI process is not confined to one ontological level, that is, to the level of knowledge-creating entities (e.g., individual, group, organizational, and interpersonal actors). The organization must tap into the tacit knowledge created and accumulated at the individual level, for tacit knowledge of individuals is the basis of organizational knowledge creation. The tacit knowledge created is organizationally amplified through four modes of knowledge conversion and is crystallized at higher ontological levels. We refer to this amplification as the "knowledge spiral". It represents a dynamic process in which the scale of the interaction between tacit knowledge and explicit knowledge increases as it moves up the ontological levels. Starting at the individual level, the spira advances through expanding communities of interaction that span sectional, departmental,
Fig. 22.2. The four modes of knowledge conversion and the evolving spiral movement

Adapted from The Knowledge-creating Company: How Japanese Companies Create the Dynamics of Innovation by R. Nonaka and Hirotaka Takeuchi, copyright © 1995 by Oxford University Press, Inc. Used by permission of Oxford University Press, Inc.

The process of organizational knowledge creation is not confined to the organization; it includes many interfaces with the environment as well. Not only does the environment receive the explicit knowledge created by the organization (e.g., technologies, products or services, values, and so on), it also supplies knowledge to be brought into a new cycle of organizational knowledge creation. Firms acquire knowledge from outside sources such as customers, suppliers, and competitors and utilize such knowledge to create their own knowledge (see Child, Ch. 20; and Heidberg and Holmström, Ch. 33 in this volume). For example, many dimensions of customer needs take the form of tacit knowledge that customers cannot articulate by themselves. A product works as a trigger to articulate such tacit knowledge. Customers give meaning to the product by purchasing, adapting, using, or not purchasing it. This mobilization of the tacit knowledge of customers will be reflected back to the organization, and a new process of organizational knowledge creation will be initiated.

Organizational knowledge creation is a never-ending process that upgrades itself continuously. A spiral emerges when the interaction between tacit and explicit knowledge is elevated dynamically from a lower ontological level to higher ontological levels. This interactive and spiral process, which we call the cross-leveling of knowledge, takes place both intra- and interorganizationaly. Through the cross-leveling of knowledge, new spirals of knowledge creation are triggered. For example, when created knowledge is presented to other departments, it can lead to the internalization of this knowledge by individuals, who thus gain tacit knowledge. Thus, an entire new SECI process can begin. In short, the continued dynamism of turning ideas into words, words into forms is a main characteristic of organizational knowledge creation.

Ba: The Foundation for Knowledge Creation

The foundation of the SECI process described above is ba (roughly meaning 'place'). Based on
a concept that was originally proposed by the Japanese philosopher Kitaro Nishida (1933/1970) and that was further developed by Shimizu (1993). He is defined in this chapter as a "context" in which knowledge is shared, created, and utilized, in recognition of the fact that knowledge needs a context in order to exist. In the process of knowledge creation, the generation and regeneration of \( b_a \) is key (Nonaka and Konno 1998; Nonaka, Konno, and Toyama 1998). \( b_a \) does not necessarily mean a physical space. It can be a physical space (e.g. an office or a business space), virtual space (e.g. E-mail, teleconference), mental space (e.g. shared experiences, ideas, ideals), or any combination of these kinds of spaces. The most important aspect of \( b_a \) is interaction. As discussed above, the power to create knowledge is embedded not just within an individual but also within the interactions with other individuals or with the environment. \( b_a \) is a space where such interactions take place. Knowledge held by a particular individual can be shared, recreated, and amplified when that person participates in \( b_a \).

\( b_a \) is an interaction means that \( b_a \) itself is knowledge rather than a physical space containing knowledge or individuals who have knowledge. Interactions between individuals, interactions between individuals and the environment, and \( b_a \) that contains such interactions are a dynamic form of knowledge. Therefore, the knowledge creation process is also the process of creating \( b_a \), of creating a boundary of new interactions.

\( b_a \) is also conceived of as the framework in which knowledge is activated as a resource. Because knowledge is intangible, without boundaries, and dynamic, and because it cannot be stored, the use of knowledge requires the concentration of knowledge resources in a certain space at a certain time. For example, when knowledge is created, the personnel possessing knowledge and the knowledge base of a company are brought together at a defined space and time, that is, \( b_a \). \( b_a \) works as the platform for the concentration of the organization's knowledge assets, for it collects the applied knowledge of the area and integrates it. Thus, \( b_a \) can be thought of as being built from a foundation of knowledge.

The concept of \( b_a \) seems to have some similarities with the concept of a 'community of practice', where a member of a community learns by participating in the community and practicing their jobs (Brown and Duguid 1991; Lave and Wenger 1991; Wenger 1998). However, there are important differences between the concepts of community of practice and \( b_a \). Whereas a community of practice is a place where members learn knowledge that is embedded in the community, \( b_a \) is a place where new knowledge is created. Whereas learning occurs in any community of practice, \( b_a \) needs energy in order to become an active \( b_a \) where knowledge is created. Whereas the boundary of a community of practice is firmly set by the task, culture, and history of the community, the boundary of \( b_a \) is set by its participants and can be changed easily. Instead of being constrained by history, \( b_a \) is a here-and-now quality. It is created, it functions, and it disappears, all as needed. Whereas the membership of a community of practice is fairly stable and whereas new members need time to learn about the community of practice and become fully participatory, the membership of \( b_a \) is not fixed, for participants come and go. Finally, whereas members of a community of practice belong to the community, participants of \( b_a \) relate to \( b_a \).

Figure 22.1 illustrates the four types of \( b_a \), that is, originating \( b_a \), dialogue \( b_a \), systemizing \( b_a \), and exercising \( b_a \). Each \( b_a \) supports a particular mode of knowledge conversion and offers a platform for a specific step in the knowledge spiral process. Understanding the different characteristics of \( b_a \) and how they interact with each other can facilitate successful knowledge creation.

Originating \( b_a \) is the place where individuals share feelings, emotions, experiences, and mental models. It is primarily in this \( b_a \) that the sharing of tacit knowledge (i.e. socialization occurs and where the knowledge creation process begins. Knowledge creation that takes
place in originating Ba is characterized by physical, face-to-face interaction, for this kind of interaction is the only way to capture the full range of physical senses and psychosomatic reactions (e.g. ease or discomfort), which are important elements in transmitting tacit knowledge.

Originating Ba is an existential space in the sense that it is the world where an individual sympathizes or empathizes with others, removing the barrier between the self and others. From originating Ba emerges care, love, trust, and commitment, which form the basis for knowledge conversion among individuals.

Dialoguing Ba

Dialoguing Ba is the place where individuals’ mental models and skills are converted into common terms and concepts. It is where the conversion of tacit knowledge into explicit knowledge (i.e., externalization) occurs. Dialogue and reflection are key in the knowledge creation of dialoguing Ba. Individuals share their mental models with others through dialogues and reflect on and analyze their own mental models at the same time. To participate in a Ba is to become involved and to transcend one’s own limited perspective or boundaries. Yet, one remains analytically rational in order to apply the acquired knowledge to one’s own knowledge or perspective. Thus, in dialoguing Ba, the individual can profit from the creativity-producing synthesis of rationality and intuition.

Dialoguing Ba is more consciously constructed than originating Ba is. Selecting individuals with the right mix of specific knowledge and capabilities is the key to managing knowledge creation in dialoguing Ba, where knowledge is created through peer interactions.

Systemizing Ba

Systemizing Ba is a virtual world rather than real time and space. It is where new systemic, explicit knowledge is created through a combination of various elements of explicit knowledge. This combination of elements of explicit knowledge is most efficiently supported in a collaborative environment utilizing information technology, such as on-line networks, groupware, documentation, and data-banks. The rapid advances in information technology over the last decade have enhanced

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**Fig. 22.3. Ba, the shared space for interaction**

this conversion process. Because explicit knowledge can be transmitted to a large number of people relatively easily, the interaction that takes place in systemizing $b$ is group-to-group.

Exercise 8a

Exercising $b$ is the place where the conversion of explicit knowledge into tacit knowledge (i.e. internalization) is facilitated. Rather than teaching based on analysis, it is continuous learning and self-refinement through on-the-job training or peripheral and active participation that are stressed in exercising $b$ in order to communicate knowledge. Through such activities, certain patterns of action and thinking are continually stressed so that organizational members internalize them. The internalization of knowledge is constantly enhanced through the use of explicit knowledge in real life or in simulated applications. Exercising $b$ synthesizes transcendence and reflection through action, whereas dialoguing $b$ achieves this synthesis through thought. The interaction that takes place in exercising $b$ is on-site, which means that it shares both time and space.

The knowledge generated in each $b$ is eventually shared and forms the knowledge base of organizations. Moreover, $b$ exists at many ontological levels, and these levels may be connected to form a greater $b$. Individuals form the $b$ of teams, which, in turn, form the $b$ of an organization. The market environment then becomes the $b$ for the organization. The organic interactions between these different levels of $b$ can amplify the knowledge-creation process.

These $b$ have to be strategically coherent within the organization's vision of knowledge. In this context coherence means the organic relationships in which each part interacts with each other part, not a mechanistic concentration in which the center dominates. This interactive, organic coherence of various $b$s and the individuals who participate in them has to be supported by trustful sharing of knowledge and constant exchange between all units involved in order to create and strengthen the relationships.

Knowledge Assets

Knowledge assets, which are inputs and outputs of the knowledge-creation process, form the basis of organizational knowledge creation. Knowledge assets also influence how $b$s function as a platform for the knowledge-creation process. We define assets as firm-specific resources that are indispensable to the creation of values for the firm, and many researchers today agree that knowledge is precisely such an asset.

However, an effective system and set of tools with which to evaluate and manage knowledge assets do not exist yet. Because of the tacit nature of knowledge, the current accounting system cannot adequately capture the value of knowledge assets. There is a need to build a system for evaluating and managing the knowledge assets of a firm more effectively.

In order to understand how knowledge assets are created, acquired, and exploited, we categorize knowledge assets into four types: experiential knowledge assets, conceptual knowledge assets, systemic knowledge assets, and routine knowledge assets (see Fig. E.4).

Experiential Knowledge Assets

Experiential knowledge assets are the shared tacit knowledge that is built through hands-on experiences that we share among organizational members between organizational members and customers, suppliers, or affiliated firms, or both. Individual skills and know-how that are acquired and accumulated through experiences in a particular context at work are examples of such knowledge assets.

The tacit nature of experiential knowledge assets makes them difficult to grasp, evaluate, or trade because of this tacit nature, experiential knowledge assets are firm-specific, difficult-to-imitate resources that give a firm sustainable, competitive advantage. Firms must build their own knowledge assets through their own experience in their own context.
Experiential knowledge assets are built through a process of socialization. Therefore, an important characteristic of experiential knowledge assets is that they are human. Examples of such knowledge assets are emotional knowledge, such as care, love, and trust, physical knowledge, such as facial expressions and gestures, energetic knowledge, such as the sense of existence, enthusiasm, and tension, and rhythmic knowledge, such as improvisation and entrainment.

Conceptual Knowledge Assets

Conceptual knowledge assets are explicit knowledge articulated as concepts through images, symbols, and language. Brand equity, product concepts, or product designs are examples of such knowledge assets. Because they are explicit, conceptual knowledge assets are easier to grasp than experiential knowledge assets. Conceptual knowledge assets are built through a process of externalization. The experiential knowledge assets, which are shared tacit knowledge built through socialization, are articulated through externalization and turned into conceptual knowledge assets.

Systemic Knowledge Assets

Systemic knowledge assets are systematized and packaged explicit knowledge. Explicitly stated technologies, patents, licenses, product specifications, manuals, and documented information about customers and suppliers are examples of such knowledge assets. When academics and practitioners talk about knowledge assets, they often mean systemic knowledge assets. A characteristic of systemic knowledge assets is that they are made explicit as documents or data through a process of combination and therefore are transferable. This transferability means that conceptual knowledge assets can be purchased or sold. It also means that they can be hidden. Protecting these assets through legal and other means is an important and urgent issue for a firm that bases its competitive advantage on this type of knowledge asset.

Routine Knowledge Assets

Routine knowledge assets are the tacit knowledge that is routinized and embedded within the actions and practices of an organization. Know-how, organizational routines, and
Managing the Knowledge-creation Process

In the previous section, we presented a model of the organizational knowledge-creation process, illustrating and explaining its constituents: SECI, ba, and knowledge assets. An organization, building on its existing knowledge assets, creates new knowledge through the SECI process that takes place in ba. The knowledge created then becomes part of the knowledge assets of the organization and the basis for a new cycle of knowledge creation. The key to engaging in this dynamic process of knowledge creation is to manage the three layers effectively. For this reason we now turn our attention to the question of how such knowledge creating task can be accomplished.

The knowledge-creation process cannot be managed in the traditional sense of 'management', which centers on controlling the information flow (von Krogh, Nonaka, and Ichijo 1995; Nonaka and Takeuchi 1995). The management process that fits organizational knowledge creation differs decidedly from traditional management models such as the top-down and the bottom-up models. But the top-down model, with its foundation in bureaucracy, and the bottom-up model, with its emphasis on autonomy, fail to grasp the dynamic dimension of organizational knowledge creation. In these models, knowledge is seen as something to be created by individuals, and the creation of knowledge through interactions between individuals or between individuals and the environment is ignored (Child and Heavey, Ch. 1 in this volume). In order to capture the dynamic nature of organizational knowledge creation, we propose another model, the middle-down-up model.

The middle-down-up management model is suitable primarily to promoting the efficient creation of knowledge within business organizations. It is neither top-down nor bottom-up. In middle-down-up management, middle managers, who are often leaders of a team or a task force, play a key role in facilitating the organizational culture in carrying out the daily business of the organization are the examples of such knowledge assets. Routine knowledge assets are created and shared by the organization through a process of internalization. Through continuous exercises, certain patterns of thinking and action are reinforced and shared among organizational members. Hence, routine knowledge assets are practical knowledge. Sharing the backgrounds and 'stories' of the company also helps form routine knowledge.

Knowledge assets form the basis of the knowledge-creation process. Hence, to manage the creation and exploitation of knowledge effectively, a company needs to 'map' its stocks of knowledge assets (Reinhart, Bornemann, Pawlowski, and Schneider, Ch. 16 in this volume). However, cataloging existing knowledge is not enough. It is important to understand that knowledge assets are dynamic, for new knowledge assets can be created from existing ones. Knowledge assets are both inputs and outputs of an organization's knowledge-creation activities. For example, experiential knowledge about customers' needs, through socialization and externalization, may become explicit conceptual knowledge about a new product concept. Such conceptual knowledge then turns into systemic knowledge through combination. For example, a new product concept guides the combination phase, in which newly developed and existing component technologies are combined in order to build a prototype. Systemic knowledge, such as a simulated production process for the new product, turns, through internalization, into routine knowledge for mass production. The routine knowledge then triggers a new spiral of knowledge creation. For example, the routine tacit knowledge that line workers have about the new production process can be socialized and can thereby initiate a new spiral of knowledge creation for improving the process.
Two Types of Traditional Management Models: Top-down and Bottom-up

In this section we describe the characteristics of top-down and bottom-up models as conceptualized by management scholars. Top-down management is basically the classic, hierarchical model. In this model, the organization is viewed as a bureaucratic information-processing machine, which functions through the division of labor and hierarchy (Simon 1947; Taylor 1911) rather than through a knowledge-creating entity. Simple and select information is passed up the pyramid to top managers, who then use it to create plans and orders, which are passed down through the hierarchy. Top managers create basic managerial concepts and break them down hierarchically so that they can be implemented by subordinates. Top managers' concepts become operational conditions for middle managers, who then decide how to put the concepts into practice. Middle managers' decisions, in turn, constitute operational conditions for lower managers, who implement the decisions of the middle managers. If this model is to work, the concepts held by top management should not be ambiguous or equivocal; they should be strictly functional and pragmatic.

This traditional model is based on an implicit assumption that information and knowledge are processed most efficiently through a tree structure. The division of labor within this kind of bureaucratic organization is associated with a hierarchical pattern of information-processing. Moving from the bottom to the top, information is processed sequentially, so that people at the top only receive simple, processed information. Moving in the reverse direction, information is processed and transformed from the general to the particular. It is this deductive transformation that enables human beings, with their limited information-processing capacity to deal with a mass of information. In this model information-processing by middle and lower members of the organization is of minor relevance to knowledge creation. Only top managers are allowed to and supposed to be able to create information. Moreover, information created by these top managers exists for the sole purpose of implementation. In this model, information is a tool rather than a product.

In the bottom-up model, on the other hand, information is typically created by middle and lower managers, not top managers. In this model, top managers give few orders and instructions, serving rather as sponsors for individual employees who function as intracompany entrepreneurs (Nonaka and Konishiwa 1987; Pinchot 1980). Knowledge is created by these individual employees at the forefront of business. However, as in the top-down model, this model is also anchored to the critical role of the individual as an independent, separate actor. There is little direct dialogue with other members of the organization, either vertically or horizontally. Autonomy, not interaction, is the key operating principle in this model.

As pointed out in the previous section, intense interactions among organizational members are a key to organizational knowledge creation. However, such interactions hardly take place in the military-like hierarchy of the top-down model or between the autonomy-driven individuals of the bottom-up model. Furthermore, notions such as fluctuation and chaos are not permitted in the top-down model, and are incarcrated within individuals in the bottom-up model. The fact that individuals, not teams or groups, are the primary knowledge creators is potentially problematic. In the top-down model, there is the danger of depending too much on a few top managers. In the bottom-up model, because knowledge creation depends on the patience and talent of a particular individual, knowledge creation tends to be
Middle-up-down Management for Knowledge Creation

Given the limitations of the top-down and bottom-up models, we suggest a third kind, the middle-up-down management model, as the most suitable for knowledge creation. Unlike the two models discussed above, the middle-up-down model portrays all members of the organization as important actors who should work together horizontally and vertically (Nonaka 1994; Nonaka and Takeuchi 1995). The model is characterized by the wide scope of cooperative relationships and interactions between top, middle, and lower managers. Especially important in this model is the role of middle managers, who work as knowledge-producers, in streamlining the process of organizational knowledge creation. Table 22.3 provides a summary comparison of the three models in terms of their knowledge creation, resource allocation, structural characteristics, process characteristics, knowledge accumulation, and inherent limitations.

In the middle-up-down model, top management articulates visions, which provide direction. Middle managers, working as knowledge-producers, translate these visions into more concrete concepts, which are to be realized in the fields. Whereas top management articulates the dreams of the firm, frontline employees and low-level managers look at its reality. The gap between these two perspectives is narrowed by and through middle managers. In other words, top management's role is to create a grand theory, whereas middle management, as knowledge-producers, creates a middle-range theory that can be empirically tested within the company with the help of frontline employees. Knowledge is created through such interactions and then disseminated through the company.

Top and middle management take up a leadership role in knowledge creation by working on all three layers of the knowledge-creation process. They provide knowledge vision, develop and promote the sharing of knowledge assets and create and encourage knowledge, and enable and promote the continuous spiral of knowledge creation (see Fig. 22.3). Especially important is the provision of the knowledge visions, which affects all three layers of the knowledge-creation process.

Providing Knowledge Vision

In order to create values through knowledge-creation activities, an organization needs a vision that orients the entire organization to the knowledge of what it must acquire and wins spontaneous commitment by the individuals and groups involved in knowledge creation (Giere, Marx, and Teile, Ch. 12; Stopford, Ch. 17 in this volume). To create knowledge, organizations should foster the environment of its organizational members by formulating the organizations' intentions, for commitment underlines human knowledge-creating activity (Polanyi 1962). It is top management's role to articulate this knowledge vision and communicate it throughout and beyond the company.
Table 22.3. Comparison of three management models of knowledge creation

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Management model</th>
<th>Top-down</th>
<th>Bottom-up</th>
<th>Middle-up-down</th>
</tr>
</thead>
<tbody>
<tr>
<td>Who</td>
<td>Agent of knowledge creation</td>
<td>Top management</td>
<td>Entrepreneurial individual</td>
<td>Team (with middle managers as knowledge-producers)</td>
</tr>
<tr>
<td></td>
<td>Top management role</td>
<td>Commander</td>
<td>Sponsor/mentor</td>
<td>Catalyst</td>
</tr>
<tr>
<td></td>
<td>Middle-management role</td>
<td>Information-processor</td>
<td>Autonomous entrepreneur</td>
<td>Team leader</td>
</tr>
<tr>
<td>What</td>
<td>Accurated knowledge</td>
<td>Explicit</td>
<td>Tacit</td>
<td>Explicit and tacit</td>
</tr>
<tr>
<td></td>
<td>Knowledge conversion</td>
<td>Partial conversion</td>
<td>Partial conversion</td>
<td>Spiral conversion of the SECI process</td>
</tr>
<tr>
<td></td>
<td>on combination and</td>
<td>focused on combination</td>
<td>focused on socialization and</td>
<td></td>
</tr>
<tr>
<td></td>
<td>internalization</td>
<td>and manuals</td>
<td>internalization</td>
<td></td>
</tr>
<tr>
<td>Where</td>
<td>Computerized database</td>
<td>Embedded in Individuals</td>
<td>Organizational knowledge base</td>
<td></td>
</tr>
<tr>
<td></td>
<td>and manuals</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flow</td>
<td>Organization</td>
<td>Hierarchy</td>
<td>Project team and internal network</td>
<td>Hypertext</td>
</tr>
<tr>
<td></td>
<td>communication</td>
<td>Orders and instructions</td>
<td>Self-organizing principle</td>
<td>Dialogue and use of metaphor and analogy</td>
</tr>
<tr>
<td></td>
<td>Chiasm/fluxation</td>
<td>Not permitted</td>
<td>Permitted</td>
<td>Create and amplify</td>
</tr>
<tr>
<td></td>
<td>Weakness</td>
<td>Great dependence on top management</td>
<td>Time-consuming process, costs of coordinating individuals</td>
<td>Physical exhaustion, redundancy costs</td>
</tr>
</tbody>
</table>

A knowledge vision defines what kind of knowledge the company should create in what domain. It gives direction to the knowledge creation process and to the knowledge created by it. In short, it is a vision that determines how an organization and its knowledge base will evolve in the long term. Because knowledge is without boundaries, any form of new knowledge can be created regardless of the company’s business structure. It is therefore important for top management to articulate a knowledge vision that transcends the boundaries of existing products, divisions, organizations, and markets.

A knowledge vision also defines the value system according to which one evaluates, justifies, and determines the quality of knowledge that the company creates. Together with
organizational norms, routines, and skills, the value system determines what kinds of knowledge are needed, created, and retained (Leonard-Barton 1992; Nonaka 1994).

Serving as a bridge between the visionary ideals of the top management and the chaotic reality of organizational members on the front-line, middle management then has to take the values and visions created by top management and break them down into concepts and images that can effectively guide the knowledge-creation process. Middle managers work as knowledge-producers in order to remake reality, or produce new knowledge according to a particular company’s vision.

Researching on visionary companies, Porras and Collins (1994) found that an excellent and clear vision gives a company a sustainable competitive advantage. Many of the visionary companies have values that are closely related to thought and activity principles that relate to knowledge creation. For example, at J&M, the evaluation standard ‘Thou shalt not kill ideas for new products’ has been established as a fundamental part of company ideology and an essential part of company culture. Motorola continues to focus on the value ‘stimulate the latent creativity of the employees.’ Kao emphasizes the ‘pursuit of the truth’ beyond the pursuit of profit. Honda bases its management on the ‘respect for theory’ and firmly denies that there is any value attached to great effort unless it is grounded in ‘a correct theory.’ The value articulated by Sharp—‘Do not imitate. Create Products that are imitated’—harks back to its founders, who recognized the importance of creativity.

Developing and Promoting the Sharing of Knowledge Assets

Building on the knowledge vision of the company, top management must facilitate dynamic
knowledge creation by taking a leading role in managing the three layers of the knowledge-creation process. First, top management must develop and manage the knowledge assets of the company, which form the basis of its knowledge-creation process. Recently, many companies have created a position of Chief Knowledge Officer (CKO) to oversee the management of their knowledge assets (Davenport and Prusak 1998). CKOs evaluate and manage the development, acquisition, and exploitation of companies' knowledge assets, just as Chief Financial Officers (CFOs) manage the tangible assets of companies. However, the role of CKOs so far has been limited mostly to managing knowledge assets as a static resource to be exploited. Top management has to play a more active role in facilitating the dynamic process of creating knowledge from knowledge.

Because knowledge is without boundaries, top management has to redefine its organization in terms of the knowledge it owns rather than in terms of existing definitions, such as technologies, products, and markets. Top management and knowledge-producers can take an 'inventory' of their knowledge assets and then form a strategy based on the knowledge vision to build, maintain, and utilize these knowledge assets effectively and efficiently.

Knowledge assets, especially routine knowledge assets such as organizational routines and organizational culture, could hinder knowledge creation as well (Berthoin Antal, Lenhardt, and Rosenbrock, Ch. 39 in this volume; Leonard-Barton 1992; Levitt and March 1988). Inertia makes it difficult for an organization to diverge from the course set by its previous experiences (Hannan and Freeman 1984). Hence, leaders should be careful not to let a firm's knowledge assets become hindrances.

**Building and Energizing Ba**

Ba can be spontaneously created, or it can be built consciously. Top management and knowledge-producers can facilitate knowledge creation by providing physical space, such as meeting rooms, or cyber space, such as a computer network. They can also facilitate knowledge creation by promoting interactions between organizational members, using such means as a task force. It is also important for managers to find and utilize spontaneously formed ba, which change or disappear very quickly.

However, building or finding ba is not enough for a firm to manage the dynamic process of knowledge creation. Ba should be 'energized' so that individuals or the organization can create and amplify knowledge through the SECI process. To energize ba, knowledge-producers must therefore supply the necessary conditions, including autonomy, creative chaos, redundancy, requisite variety, love, care, trust, and commitment.

**Autonomy**

Autonomy is important in motivating organizational members to create new knowledge. Autonomy can be a source of unexpected knowledge as well. By allowing the members of an organization to act autonomously, the organization may increase the chance of accessing and utilizing the knowledge held by its members (Grant 1996, B. Wruck and Jensen 1994).

Self-organizing teams can be used as powerful tools with which to create autonomy within firms. The use of cross-functional teams that link members from a broad cross-section of different organizational activities is very effective in the process of innovation (Clark and Fujimoto 1992; Imai, Nonaka, and Takeuchi 1985). At NEC, autonomous teams have been used to foster the expansion of NEC's technology program. To develop strategically important products, Sharp uses the 'Urgent Project System', in which the team leader is given sole responsibility for the project and the power to recruit any necessary personnel.

**Fluctuation and Creative Chaos**

Fluctuation and creative chaos stimulate the interactions between the organization and its environment. Fluctuation is characterized by 'order without recursiveness', which is different from complete disorder. It is order whose
pattern is initially hard to predict (Gleick 1987). Examples include changes in market needs, the growth of competing companies, and challenges given by top management.

When fluctuation is introduced into an organization, its members face a 'breakdown' of routines, habits, or cognitive frameworks. Such breakdowns, or unlearning, are important, for they give one an opportunity to reconsider one's own fundamental thinking and perspective (Hedberg 1981; Hedberg and Wolff, Ch. 34 in this volume; Winsograd and Flores 1986). The continual process of questioning and reevaluating existing premises, of unlearning by individual members of the organization fosters organizational knowledge creation. Thus, an environmental fluctuation often triggers breakdown within an organization, a situation out of which new knowledge can be created. Some have called this phenomenon the creation of 'order out of noise' or 'order out of chaos' (Prigogine and Stengers 1984; von Foerster 1984).

Chaos is generated naturally when an organization faces a real crisis, such as a declining market. It can also be generated intentionally when the organization's leaders try to evoke a sense of crisis among organizational members by proposing challenging goals or ambiguous visions. For example, Wal-Mart encourages its employees 'to oppose fashion and to overthrow common thinking.' This intentional chaos, referred to as 'creative chaos,' increases tension within the organization and focuses the attention of organizational members on defining the problem and resolving the crisis situation.

Redundancy

The term 'redundancy' may sound like something to avoid because of its connotations of unnecessary duplication, waste, and information overload. However, redundancy is absolutely essential if the knowledge spiral is to take place organizationally. Redundancy here means the existence of information that goes beyond the immediate operational requirements of organizational members. In business organizations, redundancy refers to intentional overlapping of information about business activities, management responsibilities, and the company as a whole.

Redundancy of information promotes the knowledge-creation process in two ways. First, sharing redundant information fosters the sharing of tacit knowledge because one's sense of what others are trying to articulate better is often improved if a great amount of information is shared in the effort to form the basis for common understanding. Redundancy is especially important in the concept-development stage, when it is critical to articulate images rooted in tacit knowledge. Redundant information enables individuals to invade each other's functional boundaries and to offer advice or provide new information from different perspectives. In short, redundancy of information brings about 'learning by intrusion' into each individual's sphere of perception.

Second, redundancy of information helps organizational members understand their position in the organization by letting them see themselves from the outside. Thus, redundancy of information influences their direction of thinking and action and provides the organization with a self-control mechanism that keeps it heading in a certain direction.

Redundancy of information is also a prerequisite for the 'principle of redundancy of potential command' (McCulloch 1966), according to which each part of an entire system has the same degree of importance and has the potential to become the leader of the system. Even within a strictly hierarchical organization, redundant information helps build unusual communication channels. Thus, redundancy of information facilitates the interchange between hierarchy and nonhierarchy. At Mazda Seikaku, different people take turns in leadership during the course of a project. The member who best fits the issues or problems steps into the center of the team and drives the project forward, guaranteeing the right person in the right place for each phase of the project. These handovers are possible because team members have overlapping information and thus are well able to recognize the strengths of their colleagues. By rotating specialists between different positions and roles
within the team (leader, support, and so forth), specialists gain both additional knowledge in related fields and management skills and knowledge specific to different roles in teams and leading functions. In short, redundancy is created in order to support innovation by sharing knowledge and hence by generating highly specialized generalists in technical areas and highly generalized specialists in management and leadership.

There are several ways to build redundancy into an organization. One is to have different functional departments work together in a “fuzzy” division of labor (Takeuchi and Nonaka 1986). Another way is to foster internal competition. Some companies divide the product development team into competitive groups that develop different approaches to the same project. Competing groups then argue over the advantages and disadvantages of each of their approaches so that they eventually develop a common understanding of the “best” approach. Internal competition encourages the team to look at a project from a variety of perspectives. Yet another way to build redundancy into an organization is the “strategic rotation” of personnel. This kind of rotation helps members of an organization understand its business from multiple perspectives, making organizational knowledge more “fluid.” It also enables each employee to diversify his or her skills and information sources. This additional information held by individuals across different functions helps the organization expand its knowledge-creating capacity.

Redundancy of information does have its costs. It increases the amount of information to be processed and can lead to information overload. It also increases the cost of knowledge creation, at least in the short run. One way to deal with these problems is to make clear where necessary knowledge and information can be located.

Requisite Variety

Requisite variety helps a knowledge-creating organization strike a balance between order and chaos that is necessary for knowledge creation to take place. In order to deal with challenges posed by the environment, the internal diversity of an organization has to match the variety and complexity of the environment (Ashby 1956). To cope with environmental changes, which are impossible to predict completely, an organization must possess requisite variety, or minimally internal diversity, which should be at a minimum for organizational integration (order) and at a maximum for effective adaptation to environmental changes (chaos). Requisite variety can be enhanced by combining information differently, flexibly, and quickly and by providing equal access to information throughout the organization. When information differentials exist within an organization, organizational members cannot interact on equal terms. That inequality hinders the search for different interpretations of new information. Organizational members should be able to know where information is located, where knowledge is accumulated, and how information and knowledge can be accessed at the greatest speed. Kao Corporation, Japan’s leading maker of household products, utilizes a computerized information network to give every employee equal access to corporate information, which then serves as the basis for exchanges of opinion between various organizational units.

Love, Care, Trust, and Commitment

In order for knowledge (especially tacit knowledge) to be shared and for the knowledge-creation process to occur, there needs to be strong love, caring, and trust among organizational members, for these qualities are the foundation of knowledge creation (von Krogh 1990; von Krogh, Nonaka, and Ichijo 1995). To foster such love, care, trust, and commitment, knowledge-producers need to be highly insulated and committed to their goal. They also need to be selfless and altruistic. If a manager tries to monopolize the knowledge created by an organization or takes credit for other members’ achievements, it destroys the love, care, trust, and commitment among organizational members. Knowledge-producers should also be positive thinkers and should avoid having or
showing negative thoughts and feelings. Creative and positive thoughts, imagination, and a drive to act are important characteristics of a good knowledge-produce.

Promoting the SECI Process
Taking the direction given by the knowledge vision, knowledge-producers must facilitate organizational knowledge creation by furthering all four modes of knowledge conversion, although their most significant contribution is made in externalization. An empirical study has shown that middle managers of high-performing firms spend more hours in externalization than middle managers of low-performing firms (Shakai Keizai Seisanrei Honbu 1998). Middle managers synthesize the tacit knowledge of both frontline employees and top management, make it explicit, and incorporate it into new technologies, products, or systems. To do so, knowledge-producers need to create their own concepts and express them in their own words. One effective method of concept creation is 'reflection in action'. As Schön (1987) explained, when a person reflects while in action, he or she becomes independent of established theory and technique and is able to construct a new theory about the unique case.

The effective use of language is another way to facilitate knowledge conversion processes. Language includes tropes (such as metaphor, metonymy, and synecdoche); the 'grammar' and 'context' of knowledge; and nonverbal visual language, such as design. Each of the four modes of knowledge conversion requires different kinds of language in order for knowledge to be created and shared effectively. For example, nonverbal language, such as body language, is essential in the socialization process, for tacit knowledge cannot be expressed through articulated language. Conversely, clear, articulated language is essential in the combination process, for in this process knowledge has to be disseminated and understood by many people. In externalization, tropes such as metaphor, metonymy, and synecdoche are effective for creating concepts out of vast amounts of tacit knowledge. Hence, knowledge-producers need to carefully choose and design language to promote the SECI process.

Another important task for knowledge-producers is to facilitate the knowledge spiral across the different conversion modes and across the different organizational levels. It is the middle managers who facilitate the cross-leveling of knowledge to other departments of organizations. In order to facilitate the creation of knowledge effectively, knowledge-producers need to improvise and facilitate improvisation by all the people participating in the process. Improvisation is an important factor in dynamic knowledge creation, especially when it is focused on tacit knowledge (Nelick 1993).

The Organizational Structure for Knowledge Creation
In the previous sections, we discussed how knowledge is created through a dynamic knowledge-creation process and that process can be best managed through middle-up-down management style. For effective knowledge creation, we need an organizational structure that can support this knowledge-creation process. We propose that a new organizational structure, called 'heterarchy', organization, is best suited to creating knowledge efficiently and effectively (Nonaka, Konno, and Konaka 1995; Nonaka and Takeuchi 1995).

For most of the twentieth century, organizational structures oscillated between two basic types: bureaucracy and task force. Bureaucratic structure is based on the division of labor and a hierarchical distribution of authority and responsibilities (Stimson 1947; Weber 1922). It is a highly formalized, specialized, centralized structure and is largely dependent on the standardization of work processes for organizational coordination. Bureaucracy is suited to conducting routine work efficiently on a large scale when conditions are stable. However, it does not work well when it faces uncertainty and radical, rapid change. Hence, firms with bureaucratic organizational structures
encounter difficulties in creating new knowledge when they face 'radical uncertainty,' for they 'do not, they cannot, know what they need to know' (Younkas 1996: 2). Other costs of bureaucracy include intragroup resistance, red tape, friction, sectionalism, the baffling of individual initiative, the shrinking of employees' sense of responsibility, and the problem of means becoming objectives (Gouldner 1960; Merton 1938; Selznik 1949).

The task force, conversely, is a flexible, adaptable, dynamic, and participatory organizational structure. The task force is an institutionalized team or group that brings together representatives from a number of different units for intense work on a flexible basis. In many cases to deal with a temporary issue. However, the task-force organizational structure has its own weaknesses as well. Because of its ad-hoc nature, the task force is not appropriate for exploiting and transferring knowledge continuously and widely throughout an entire organization. When composed of many different small-scale task forces, an organization becomes incapable of setting and achieving its goals or vision at the corporate level.

Thus, dissimmetry is more efficient and effective in implementing, exploiting, and accumulating new knowledge, whereas the self-organizing task force is more effective in generating new knowledge. A knowledge-creating organization should pursue both the efficiency of a bureaucratic organization and the flexibility of a task-force organization. In short, some combination of the two is needed to provide a solid basis for knowledge creation. We refer to such an organization structure as a hypertext organization.

The critical factor for the design of the hypertext organization lies in coordinating time, space, and resources in such a way as to achieve requisite variety. As illustrated in Fig. 22.6, the hypertext organization can be visualized as an organization with three layers: the knowledge base, business system, and project team. The bottommost layer of the hypertext organization is the knowledge-base, which embraces both tacit knowledge associated with organiza-

![Fig. 22.6. The hypertext organization](image-url)

Adapted from 'Chiiki Besu Seiki' [The Knowledge-Based Organization], by I. Nomaka and H. Takashis, Business Review, 41/1 (1993), 27. © 1993 Adapted with permission.
Conclusion

In this chapter, we have discussed how organization creates the dynamic process of knowledge creation. We have proposed a new, multilayered model of knowledge creation in order to understand the dynamic nature of knowledge creation and to manage the process effectively. Three layers of knowledge assets, bu, and the SECI process must interact with each other organically and dynamically. The knowledge assets of a firm are mobilized and shared in bu, where the tacit knowledge held by individuals is converted and amplified by the knowledge spiral through the socialization, externalization, combination, and internalization of knowledge.

We have also discussed the role of managers in facilitating the knowledge-creation process. Creating and understanding the knowledge vision of the company, understanding the knowledge assets of the company, facilitating and utilizing bu effectively, and managing the knowledge spiral are all important tasks that managers have to perform, especially important is the role of the knowledge producers, the middle managers who are at the center of this dynamic knowledge-creation process. We have proposed middle-up-down management and hypertext organization as the effective management system and organizational structure that can support this knowledge-creation process.

In focusing mainly on the organizational knowledge-creation process that takes place in companies, we have described it as the dynamic interaction not only between organizational members but also between organizational members and the environment. The latter dimension of this interaction underlines the fact that the knowledge-creation process is not confined within the boundaries of a single company. The market, where social interaction brings together the knowledge held by companies and that held by customers, is also a place for knowledge creation. In addition, the aggregated creation of knowledge by groups of companies is possible. If we were to raise the level of analysis further, we would arrive at the discussion on how so-called national systems of innovation can be built. The next step, then, is to examine how companies, governments, and universities might intervene in order to facilitate knowledge creation in the future.


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