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Organizational knowledge creation: Benchmarking of existing models

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Abstract

In the knowledge based economy, knowledge asset is the main source of sustainable competitive advantage. Thus, companies should manage their knowledge. Especially, they should know how to create and apply new knowledge because it allows them to leave their competitors behind by undertaking innovative actions. Literature proposes several models of organizational knowledge creation. Each model has its strengths and weaknesses. Thus, the purpose of this paper is to demonstrate which model of organizational knowledge creation is more accurate. To solve this research question, a critical analysis of existing literature has been done. As a result, a conceptual model of knowledge creation will be proposed.

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1. Introduction

“Knowledge, competence, and related intangibles have emerged as the key drivers of competitive advantage” (Teece, 1998). An analysis of industrial and business wealth creation today might rather suggest the role of intangible assets, whereas the most important knowledge assets are the ability to continuously create new knowledge out of existing firm-specific capabilities, rather than a stock of knowledge, such as a particular technology that a firm possesses at one point in time. The implications for management are clearly quite considerable. The operation of companies must change in order to stay in tune with the new economic landscape (Quinn, Baruch & Zien, 1997). The task of every company that seeks to outperform its competitors is to be concerned with knowledge, knowledge creation, and its management. Further, there is a need to re-examine and rearrange business strategies, processes, information technologies, and organizational structures from a knowledge perspective, in order to meet the demands of the post-industrial knowledge economy (Kim, Yu & Lee, 2003). Practitioners as well as scientific researchers are aware of these changes and the requirements of the knowledge economy.

Therefore, firms increasingly manage knowledge. The age of early knowledge management adopters is over. Hundreds of organizations – large and small – want to capitalize on what they know.

For this purpose, knowledge management methods need to be purposefully selected and as a consequence, an effective knowledge management initiative will have different profiles depending on the firm specific situation. But defining the appropriate knowledge management methods remains a key challenge for most companies.

According to a model of von Krogh, Ichijo and Nonaka, the evolution of companies’ knowledge management initiatives follows three steps. (1) Firms begin their knowledge initiatives by trying to locate and capture valuable company knowledge. (2) The second step is characterized by the objective of making company knowledge easily accessible to the organization and to find new applications for existing knowledge. (3) The third stage is concerned with knowledge creation (von Krogh et al., 2000). In order to be able to take the third step – enabling knowledge creation – the first two have to be already in operation in an organization’s business process.

Thus, this paper will begin by defining the research focus and followed with a presentation and discussion on some of the existing knowledge creation models. This is followed with the proposition of a conceptual model of knowledge creation.

2. Problem Statement

Knowledge creation can result from a serendipitous event, in which knowledge is discovered unintentionally – which firms cannot rely on – or from an intentional act. A firm can work in two ways in order to gain new knowledge intentionally: recruiting knowledge by acquisition or developing new knowledge by using the existing internal knowledge. These methods are known as knowledge exploitation and knowledge exploration (Ichijo, 2002; Allard, 2004)

Knowledge exploitation or acquisition means enriching the knowledge base of a company with knowledge that already exists elsewhere. It occurs when knowledge in the external environment is identified, and possibly transformed (e.g. filtered, restructured), for use in the organization. Often, the acquired knowledge is the technical sort shared in research reports, engineering drawings,

conference publications, textbooks, and consulting manuals; often it represents general technical solutions that are freely available in the market.

Knowledge exploration or creation means enriching the organizational knowledge base that a company achieves by creating the knowledge itself. It describes the identification, and possible transformation, of knowledge from among the organization's own internal knowledge asset base.

In this regard, several authors in the field of knowledge management propose models of organizational knowledge creation: Nonaka's model, Nissen's model, Boisot's model and others. Each model has its strengths and weaknesses.

3. Research Question

The research question that we will discuss in this paper is: which knowledge creation model is more accurate in order to be followed by the practitioners and academics?

4. Purpose of the study

The number of scholars who have investigated organizational knowledge creation in detail is very limited. This section introduces and discusses contributions by authors who have dwelt on a theoretical explanation of organizational knowledge creation.

4.1. Nonaka and Takeuchi SECI Model:

Nonaka, Byosiere et al., Nonaka and Takeuchi, and Nonaka, Toyama et al. developed an organizational knowledge creation model that integrates the stream of individual and collective learning theories (Nonaka et al., 1994; Nonaka & Takeuchi, 1995; Nonaka et al., 2000). From philosophical perspective, this model proposes two dimensions: (1) Epistemological dimension explains the conversion between tacit and explicit knowledge. (2) Ontological dimension describes the passage of knowledge from individual to the group to the organization to inter-organization. The authors distinguish also between two forms of knowledge: (1) Tacit knowledge that cannot be communicated to others easily nor can be easily expressible in words. It is acquired primarily through experience. (2) Explicit Knowledge that can easily be formalized, visualized and transferred.

According to this model, knowledge is created through the interaction of tacit and explicit knowledge, called 'knowledge conversion'. This interaction is a social process between individuals, not confined within an individual since an individual being an employee is never isolated from social interaction (Nonaka & Takeuchi, 1995). The assumption that knowledge is created through the conversion between tacit and explicit knowledge allows the postulation of four different 'modes' of knowledge conversion: Socialization, Externalization, Combination, and Internalization. A common abbreviation of all four modes is SECI, based on the initial letter of each mode.

Through the conversion process, tacit and explicit knowledge expand in both, quality and quantity, whereas the knowledge assets created are naturally different. Overall, Nonaka, Toyama et

al. propose four types of knowledge assets: sympathized, conceptual, systemic, and routine knowledge assets (Nonaka et al., 2000).

4.1.1. Socialization

Socialization occurs through an exchange of tacit knowledge by interaction between individuals. It is based on common mental models which are defined by Nonaka and Takeuchi as knowledge structures held by members of a team (Nonaka & Takeuchi, 1995). These enable the team to form accurate explanations and expectations for the task, and in turn, to coordinate their actions and adapt their behavior to the demands of the task and to other team members.

Since tacit knowledge is extremely difficult to communicate, the key to exchanging it is shared experience, which can be acquired by spending time together or working in the same environment. Also, for Socialization to flourish, people need to learn from others by observing their actions as well as their behaviors. Socialization typically occurs in a traditional apprenticeship. Apprentices learn the tacit knowledge needed in their craft through observation and hands-on experience, rather than from written manuals or textbooks.

Socialization yields sympathized knowledge assets, such as shared tacit knowledge that is built through joint hands-on experience amongst the members of the organization, and between the members of the organization and its customers, suppliers, and affiliated firms. Firms have to build their own knowledge assets through their own experiences. Their tacit nature is what makes sympathized knowledge assets the firm-specific, difficult-to-imitate resources that give a substantial competitive advantage to the firm (Nonaka et al., 2000).

4.1.2. Externalization

Externalization is a process of articulating tacit knowledge and therewith transforming it into explicit knowledge. It then takes the shapes of descriptions, concepts, or hypotheses. The explication of tacit knowledge results in crystallized knowledge, thus allowing it to be shared by others and as the knowledge loses its tacit quality it often becomes more commonly available (Allard, 2004).

An act of codifying or converting tacit knowledge into articulable knowledge is writing. For example, when we attempt to conceptualize an image, we express its essence mostly in language (Nonaka & Takeuchi, 1995). Yet, expressions are often inadequate, inconsistent, and insufficient. Such discrepancies and gaps between images and expressions, however, help promote reflection on an issue and interaction between individuals (Nonaka & Takeuchi, 1995). While Externalization triggers reflection, it is induced by collective reflection and by successive rounds of meaningful dialog at the same time. On the one hand, externalized thoughts and issues often lead to a collective feedback or reaction, reflecting and/or refining the explicated knowledge. On the other hand, reflection is necessary before Externalization is possible. Likewise, "Written speech is possible only after internal speech is well developed." (Nonaka et al., 2000)

In this dialog, the sophisticated use of metaphors can be deployed to enable team members to articulate their own perspectives, and thereby reveal hidden tacit knowledge that is otherwise hard to communicate (Nonaka et al., 1994).

Externalization outputs conceptual knowledge assets, which consist of explicit knowledge articulated through images, symbols, and language. They are assets based on the concepts held by

customers and members of the organization. Since they have tangible forms, conceptual knowledge assets are easier to grasp than sympathized knowledge assets, though it is still difficult to grasp what customers and organizational members perceive (Nonaka et al., 2000)

4.1.3. Combination

Combination is the process by which explicit knowledge is converted into new explicit knowledge. It consists of three steps: First, explicit knowledge is acquired or collected from inside and outside the organization. Second, the collected bodies of existing explicit knowledge are synthesized. They are sorted, combined, edited and processed to form new, more complex and systematic sets of explicit knowledge. The classification of explicit knowledge can also lead to new knowledge. Third, the new explicit knowledge is disseminated among the members of the organization (Nonaka et al., 2000).

Combination gives rise to systemic knowledge assets, which consist of systematized and packaged explicit knowledge, such as explicitly stated technologies, product specifications, manuals or documented knowledge, e.g. about customers and suppliers. A characteristic of systemic knowledge assets is that they can be transferred relatively easily. The dissemination of this knowledge is possible with media like documents or computer networks. Therefore, the use of computerized communication networks and large-scale databases can facilitate this mode of knowledge conversion (Nonaka et al., 2000).

4.1.4. Internalization

Knowledge Internalization is the process of absorbing explicit knowledge and converting it into individually-held tacit knowledge (Kale & Singh, 1999). This conversion or manifestation of explicit knowledge can be done by actually applying that knowledge, thereby absorbing and embodying it and converting it into tacit knowledge. Once this explicit knowledge is internalized into individuals' tacit knowledge bases e.g. in the form of technological knowledge, it becomes a valuable asset.

There are two different routes by which explicit knowledge can be absorbed and tacit knowledge created: (1) through personal experience in which knowledge is generated from 'real world' experiences (e.g. day-to-day work), and (2) through simulation and experimentation in which knowledge is generated from the 'virtual' or 'simulated' world (Nonaka et al., 1994). As Hatten and Rosenthal claim: "Experiments are an opportunity for knowledge creation rather than knowledge transfer" (Hatten & Rosenthal, 2000). Lessons from experience and experimentation get implicitly embedded into the minds of individuals within the firm or into organizational routines associated with performing specific tasks or actions (Kale & Singh, 1999).

Internalization produces operational knowledge assets, e.g. knowledge about project management, production processes, and new product usage. These assets consist of the tacit knowledge that is routinized and embedded in the actions and operations of the organization. Organizational routines for carrying out the day-to-day business of the organization provide an example of operational knowledge assets. In addition to this, existing practices may be improved or replaced. A characteristic of operational knowledge assets is that they are practical (Nonaka et al., 2000).

4.2. Nissen's Knowledge flow model

Nissen proposes a model built upon Nonaka's model of knowledge creation. This model introduces the notion of knowledge flow and explains how knowledge moves through the organization.

On the other hand, Nissen extended the model of Nonaka by adding two new dimensions linked to knowledge flow. (1) Life cycle: the sense of process flow or the different sequences of activities associated to knowledge flow (creation, organization, formalization, distribution, application, evolvment). (2) Flow time: length of time required (second, minute, hour, day) for knowledge to move from one person, organization, place, or time to another (Nissen, 2005).

Further, Nissen proposes that knowledge fills a continuum between the tacit and explicit endpoints instead of a simple contrast between explicit and tacit knowledge included in the epistemological dimension of Nonaka's model. This continuum allows tracing knowledge as it flows through a continuous range of explicitness (Nissen, 2002).

In addition, the author proposes that knowledge may fill a continuum along the dimension characterized by how many people are reached by the knowledge (e.g., at a particular level of explicitness, life cycle phase) instead of only a few, granular states (e.g., individual, group, organization) supported by the ontological dimension. Tracing knowledge flows across a continuous dimension similarly makes for a richer model than—and indeed subsumes—one with only a few discrete states (Nissen, 2002).

In this context of knowledge dynamics, the knowledge flow model also introduces two concepts: (1) "Heavy mass" corresponds to tacit knowledge and is characterized by slow flow and a long flow time. (2) "Light mass" corresponds to explicit knowledge and is characterized by rapid flows and short flow time (Nissen, 2005).

4.3. Boisot's information space model :

Boisot's model shows how the information extracted from a complex environment is transformed into new knowledge through a social learning cycle. The author develops a model of knowledge creation process including six specific phases : (1) **Scanning** the environment and extracting concrete information deemed to be interesting ; (2) **Codification** of information extracted from the environment which are selected and structured during this phase in order to minimize uncertainty, anomalies and paradoxes ; (3) **Abstraction** or, in more simple terms, generalization of the application of new knowledge to multiple situations specific to the organization ; (4) **Diffusion** of new knowledge - validated and codified – to the largest number of people and groups within and outside the organization ; (5) **Absorption** of the new knowledge through its use and internalization by the community ; (6) **Impact** of the new knowledge on practices, artifacts, beliefs, behavior patterns and standards of the group or community (Boisot, 1998).

These phases form a cyclic movement in the Information Space depending on the nature of knowledge: uncoded vs coded, abstract vs concrete, diffused vs undiffused.

There are similarities between Boisot's model and Nonaka's model, especially on knowledge categories. Nonaka and Takeuchi talk about tacit and explicit knowledge where Boisot refers to coded and uncoded knowledge. Also, both models emphasize the essential role of the process of concepts creation (codification) in the dynamic of knowledge creation. Meanwhile, some

knowledge creation process could be assimilated: externalization and codification; combination and abstraction, internalizing and absorption/impact. While these similarities allow a glimpse for the complementarity between the two models, a major discrepancy exists. The difference lies in the initiation of knowledge creation process and the role of the external environment. According to Nonaka and Takeuchi, socialization and tacit knowledge sharing within a small group triggers the process (Nonaka & Takeuchi, 1995). Thus, the starting idea is a collective achievement. For Boisot, the learning cycle is triggered by an information derived from the organizational environment (scanning) and the process of knowledge creation is essentially individual (Boisot, 1998).

4.4. Other contributions :

Several authors have proposed further concepts of organizational knowledge creation, each building on the contributions of Nonaka et al.

- By adding two process steps – assimilation and dissemination – Hedlund accentuated the inter-organizational perspective of knowledge creation, treating the knowledge exchange with the outer world of the organization separately (Hedlund, 1994).

- Choo and Bontis extended Nonaka's model by introducing the concept of cultural knowledge in addition to tacit and explicit knowledge. Cultural knowledge comprises assumptions and beliefs in order to assign value and significance to new information or knowledge (Choo & Bontis, 2002).

- A second form of tacit knowledge is added by Scharmer: not-yet embodied or self-transcending tacit knowledge, which is based on esthetic experience. Building on this, he develops a double spiral of knowledge creation which is based on the conversion of explicit and self-transcending knowledge (Scharmer, 2000).

- Leonard and Sensiper adopt the duality of tacit and explicit knowledge, yet focus on tacit knowledge and its creation and development (Leonard & Sensiper, 1998).

- Allard also departs from Nonaka's model, declaring four stages of knowledge creation: discovered, codified, migratory and invisible knowledge. Clearly, this labeling represents the concentration on the output of these stages instead of the process of creation (Allard, 2004).

5. Research methods

To solve the research question, a review of the literature related to organizational knowledge creation was conducted. The results of the literature review had been critically analyzed.

6. Findings

The majority of the concepts presented above add single steps or parts to the model, adjusting it for use in specific situations, sticking to the generic elements and process steps proposed by Nonaka.

Hence, Nonaka's theory of knowledge creation is the only serious approach aiming at explaining the creation of organizational knowledge theoretically and substantiated. The fact that the theory does not neglect traditional learning theories, but rather takes their contributions as a departure point, and the fact that it has been widely accepted justifies its value (Choi & Lee, 2002).

Nevertheless, the review of several models of knowledge creation leads us to build a conceptual model of knowledge creation. Thus, we propose a multi-process dynamic model, including : knowledge sharing, knowledge capitalization, knowledge learning and knowledge integration (figure 1).



Fig.1. Multi-process knowledge creation model

6.1. Knowledge sharing

Knowledge creation relies on the capability of knowledge sharing among people across the organization. Knowledge sharing is defined as employees' knowledge, experiences and skills exchange through the whole organization (Lin, 2007).

In order to share knowledge, different routes can be followed.

First, some day-to-day management processes can foster organizational knowledge sharing such as using external agent's thoughts and viewpoints in the management process, organizing viewpoint exchange and reflection meetings and connecting the upper and lower hierarchical levels via middle managers (Saenz et al., 2009).

Second, information technology (IT) - software, telecommunication systems and computer networks - improve knowledge sharing. They facilitate information and knowledge transmission through eliminating barriers such as time and distance, making knowledge flows at high-speed and low cost.

Moreover, human relationship and interactions are at the core of knowledge sharing. People-focused knowledge sharing activities were classified into three categories: (1) Conferences, virtual conferences, presentations and workshops which bring together people from different spheres. (2) Meetings where opinion exchange occurs between participants with similar interests. (3) Storytelling in which experienced staff members viewpoints are shared to help other staff members understand unfamiliar situations (Al-Ma'aitah, 2008).

At last, several other ways may be advocated to improve thoughts and knowledge exchange: teamwork, formal and informal discussion, functional rotation, participation in seminars and employee external mobility.

6.2. Knowledge capitalization

Knowledge capitalization is a process of organizational knowledge explanation. This knowledge resides in individuals, and is not accessible since it is not transcribed in documents, databases and / or directly generated by activity. Therefore, the process of knowledge explanation leads to knowledge creation.

Some knowledge capitalization approaches can be cited such as knowledge engineering which models the knowledge holder's activity. Other approaches allow knowledge extraction from documents such as text mining in which language procedures are used to identify concepts and the relationships between them. Data mining approaches are also used for identifying knowledge based on data. Other techniques, such as traceability are used in order to keep track of the knowledge produced during the implementation of activities. In general, three major consecutive steps are involved in knowledge capitalization: (1) Localization and acquisition of knowledge; (2) Knowledge modeling; (3) knowledge Reuse (Renaud, 2008).

6.3. Knowledge learning

Learning and knowledge creation are closely interrelated, and individual learning is at the core of organizational knowledge creation.

6.3.1. Collective learning

Most new knowledge today is generated in groups, e.g. in the R&D laboratory, in the engineering department, in the boardroom, and so on. The generation of much new knowledge is nonlinear in its effects – that is, small inputs of individual know-how can produce disproportionately large outputs of new knowledge – and often more so for new knowledge created by a group than for new knowledge created by an individual. The resulting whole is then worth more – and often much more – than the sum of the parts contributed by individuals. How this collective knowledge is generated can be explained by collective learning processes, which Holzkamp classifies into three types (Holzkamp, 1995):

In participative learning processes, a person participates in the knowledge of others in the group in order to continually reduce the gap between his/her own knowledge and the knowledge of other group members. Characteristically there is a hierarchy with teacher-apprentice relationships, in which the increase of the apprentice's knowledge will be considerably higher than the knowledge gain of the other members in the group.

Cooperative learning processes are characterized by an asymmetry of the members' professional knowledge, which is overcome in an exchange process. Cooperative learning presumes that the group has conjoint learning objectives, which will be achieved by bundling the different knowledge parts of the group members, where hierarchies and structural constraints hinder that exchange.

During collective or team learning processes, the knowledge available in the group is combined into new knowledge. Interactions within the group open up the opportunity to create new knowledge that none of the individual team members possessed before. As opposed to participative and cooperative learning, collective learning results in group knowledge which is more than the sum of the individual members' prior knowledge. It is assumed that there is intense communication and fruitful dialog.

6.3.2. Individual learning

There is no creation of organizational knowledge without the creation of knowledge by people and that knowledge emerges because people learn. The most influential and acknowledged theories of individual learning are behavioristic, cognitive, and social learning theories (Zemke, 2002).

The learning theory of behaviorism is based on a model with stimulus and response as the only variables. Behavioristic theorists regard the individual as a black box which receives stimuli from the environment and responds with a certain behavior, where the behavior is sustained or diminished by the positive or negative consequences of its response. Learning has occurred if there has been a change in behavior or action. Brands of behaviorism are classical, instrumental, and operant conditioning.

Cognitivist learning theory opens the black box and deals with thought processes that are between stimulus and response. It is formed by the trilogy of stimulus-organism-response, which is concerned with understanding cognitive events in the trainee during the learning process. Individual learning is not understood as the result of enhancing the response in dependence on consequences. Rather, the thought processes that are involved in the process of problem solving and/or learning are taken into account.

Social learning theory holds that learning occurs when an observer's behavior changes after viewing the action and behavior of a model. The observer's behavior is affected by the positive or negative consequences he or she sees following the model's behavior.

6.4. Knowledge integration

Knowledge integration is gathering knowledge from different sources to perform a complex task. It is a three step process: (1) acquiring knowledge to where it is needed; (2) combining the newly acquired knowledge with existing knowledge; (3) Using the resultant knowledge to accomplish a task. Therefore, knowledge integration occurs when the organization can accomplish a task or solve a problem that it could not achieve with its current knowledge. Thus, the result of knowledge integration is more than the combination of existing knowledge and acquired knowledge because new knowledge is created through combination and practical use of the combined knowledge. In addition, knowledge integration involves knowledge transfer, sharing and application (Haddad & Bozdogan, 2009).

Finally, Knowledge integration is an important process of the knowledge creation model since new practical knowledge is created out of it.

7. Conclusion

There is consensus among managers, academics, and consultants that we live in a new economic order: a knowledge-based economy, playing by a new set of rules. The exploding interest in knowledge and its management reflects the trend towards 'knowledge work' and recognition of knowledge as a principal source of economic rent. Knowledge asset become the main source of sustainable competitive advantage. Therefore, firms increasingly manage knowledge. The most important knowledge management activity is the ability to continuously create new knowledge out of existing firm-specific capabilities. This paper critically analyses the literature in the field of organizational knowledge creation models. Widely acknowledged is the work of Nonaka with changing co-authors. The majority of the other models found in the literature stick to the generic elements and process steps proposed by Nonaka, adjusting it for use in specific situations.

This paper also proposes a multi-process knowledge creation model composed of knowledge sharing, knowledge capitalization, knowledge learning and knowledge integration.

In practice, several methods are used by companies to enhance knowledge creation such as communities of practice, databases, electronic discussion forums, experience reports, experience workshops, expert interviews, knowledge broker, knowledge maps and project briefings.

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