The Dynamics of Organizational Knowledge: a Framework for Innovation

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Abstract

Dynamic Capabilities are considered to enable creation, deployment, and protection of the intangible assets at firm-level, in particular, assets of knowledge, but neither social nor behavioral sciences have had success in the endeavor to specify their nature and microfoundations. Distinct skills, processes, procedures, organizational structures, decision rules, and other similar concepts and labels have been acknowledged as important issues for innovative firms, which do not only adapt themselves to their business environments, but also shape those environments through innovation and inter-firm collaboration. Literature produced in recent decades about firms has not been effective in building bridges between Dynamic Capabilities and processes of Organizational Knowledge Creation. A more accurate conceptualization of Organizational Knowledge has been relatively neglected, especially if taken into account the centrality of this issue to the understanding of the elements that allow firms to search innovation and, as a result, to create sustainable competitive advantages. Organizational Knowledge is an intangible, dynamic, emerging and specific asset to each company, that does not correspond to the simple sum of knowledge of individuals of the firm, and it will be able, or not, to create sustainable competitive advantages. This paper describes a conceptual research that examines different elements of some frameworks up to now proposed to better understand the dynamics of Organizational Knowledge, and it proposes a new framework that will identify Dynamic Capabilities as an integration of different constructs, of first and second order, in the dynamics of Organizational Knowledge and not a simple set of processes, as usual. The proposed framework aims to help scholars to understand the foundations of Organizational Ambidexterity and long-run firm success. At the same time, it can help managers to delineate relevant strategic considerations and the priorities they must adopt to enhance firm performance.

Key words: organizational knowledge, innovation; dynamic capabilities; adaptive efficiency; organizational ambidexterity; organizational learning

THE DYNAMICS OF ORGANIZATIONAL KNOWLEDGE: A FRAMEWORK FOR INNOVATION

1   Introduction[1]

Dynamic Capabilities is a concept that can be understood as having evolved from the resource-based view of the firm (Eisenhardt and Martin, 2000; Teece et al., 1997) and has been described as the key to firm superior long-term achievements. They are considered to enable creation, deployment, and protection of the intangible assets at firm-level, in particular, assets of knowledge.

They are supposed to support competitive advantages (Teece, 2007), but neither social nor behavioral sciences have had success in the endeavor to specify their nature and their microfoundations. The microfoundations have been described as distinct skills, processes, procedures, organizational structures, decision rules, and other similar concepts and labels, which strengthen sensing, seizing and reconfiguring capabilities of the firm (Teece, 2007:1319).

Those microfoundations are sometimes difficult to identify and analyze, but they are acknowledged as important issues for innovative firms. These not only adapt themselves to their business environments, but they also shape those environments, through innovation and inter-firm collaboration.

Most broad literature produced in recent decades about firms, in the fields of Economics, Strategic Management, Organizational Theory, Entrepreneurship, Innovation Management and Organizational Change has not been effective in building bridges between Dynamic Capabilities and Organizational Learning processes, which should be considered processes of Organizational Knowledge Creation (Nonaka, 1994).

The dynamics of Organizational Knowledge will be understood, in the framework, proposed in this paper, as responsible for the coevolution of the two sets of organizational activities that have knowledge as their main variable:

> a) the first one, herein referred as Operational Processes of Knowledge (OPK) , the object of which is the knowledge directly involved in the

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operational competences[2] of the firm (both staff and line activities), especially knowledge of static routines, understood here as those that enable firms to replicate previously performed functions;

b) the other one dedicated to the creation and developing of processes, programs and policies to influence, correct and improve OPK, which will be identified with the notion of Organizational Knowledge Structures (OKS).

A better understanding of its dynamics will enable scholars and managers to realize Organizational Knowledge as an intangible, dynamic, emerging and specific asset to each firm, which does not correspond to the simple sum of knowledge of individuals of the firm.

An adequate synthesis between considerations in terms of individuals alone and in terms of individuals plus relations between them - overcoming the ambiguities in the usage of the term 'methodological individualism' (Hodgson, 2007) - will also enable the recognition of Organizational Knowledge as a metaphor can help to understand how firms create sustainable competitive advantages.

Some elements of different frameworks up to now proposed to better understand the dynamics of Organizational Knowledge or related concepts, specifically Winter (2003) and Argyris and Schön (Argyris, 1999) will be briefly examined, and a new framework to be proposed will take into account new and important features, as, for instance, processes of reflection, and will identify Dynamic Capabilities as an integration of different constructs, of first and second order, in the dynamics of Organizational Knowledge and not a simple set of processes, as has been the norm in literature on that subject.

This paper sets forth a theoretical account of the genesis and evolution of Organizational Knowledge, as a succession of different states of knowledge. This means that Organizational Knowledge Creation is not a cumulative process, in the usual sense of tangible goods. Creation of Organizational Knowledge does not result in a greater 'volume of knowledge', but in new states of Organizational Knowledge.

The approach here used takes into account the subjectivity of agents, normally not considered in other frameworks. The result of this discussion will be by presenting a general framework linking evolution of OKS - here not being considered equivalent to

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[2] In this paper, the terms "competences" and "capabilities" will be used interchangeably.

Dynamic Capabilities - to the improvement and evolution of OPK – of which static routines are considered part.

The central objective of this paper is to propose a simple and robust framework of the dynamics of Organizational Knowledge, that will help scholars to understand the foundations of Dynamic Capability, Organizational Ambidexterity and long-run firm success (Adaptive Efficiency), and, at the same time, it can help managers to delineate relevant strategic considerations and the priorities they must adopt to enhance firm performance.

This paper draws on insights from several academic disciplines, being organized in this introduction and five more sections. The argument proceeds as follows: the next section contextualizes the basic assumptions that will be considered in this work. Section 3 will describe four research gaps to be filled. In section 4, the problem to be faced will be better characterized. Section 5 discusses the framework for Dynamics of Organizational Knowledge and Innovation. Finally, the sixth section concludes the paper.

2   Contextualization - Main assumptions

In this paper, main basic assumptions - most of them largely discussed by other authors - are considered, as follows.

a) Although the focus of this paper is the dynamics of Organizational Knowledge developed at single firm level, it is very important to understand the concept of 'organizational arrangements' here used. Organizational arrangements will be strongly distinguished from their 'organizations'. A firm, for instance, will be considered here as one of the possible kinds of organizational arrangements, a business one, that has an organization, which changes over time.

b) The agents of organizational arrangements are ultimately human beings, either at the level of the single firm or at the inter-firm level and even at the level of the economy as a whole.

c) The 'organizational arrangements' are immersed in environments of knightian uncertainty, here understood as the classical distinction between risk and uncertainty, proposed by Frank Knight (1921).

d) As a consequence of uncertainty, entrepreneurs and/or managers must make 'informed conjectures' about the path ahead. These conjectures become working hypotheses that must be updated as new evidences emerge (Teece, 2007:1323).

e) The agents of the organizational arrangements have Bounded Rationality, as proposed by Herbert Simon, and do not make their economic choices under the paradigm of 'Rational Choice' (Grandori, 2010:1-2).

f) This paper describes a conceptual research that uses the Organizational Knowledge Creation Theory (Nonaka, 1994) as a point of departure. In this context, innovation will be understood as the result of the dynamic creation of Organizational Knowledge.

g) Innovation will be here understood as a movement of organizational arrangements in order to comply with the needs of adaptation to be successful at their changing environments (organizational learning), either a response, or an anticipation.

h) Innovative firms are here considered as those that do not only create new products, processes and systems (technical innovation), but also those that try actively to change their organizations (organizational patterns) and/or their business frameworks (Teece, 2010) to better respond to their needs of adaptation to their environments (organizational innovation), as well as those that try to influence and shape their environments (institutional innovation).

i) In linear and mechanical view of businesses – based on Taylorism and on the assembly line of Fordism - knowledge creation activities were considered to be carried out by some specialized functions. R&D, market research, strategic planning and product development, for instance.

Now, the firms have increasingly been modeled by many authors as 'living networks' and knowledge creation is no more a function of specialized departments, but is diffused across the firm. A fundamental assumption in this paper is that the competence to innovate is now a key to survival of businesses (Goldman, 2010:257).

j) After the acknowledgement of classic factors of production - land, capital and labor – modern businesses realized the need to invest in productive systems that adopt Organizational Knowledge as a factor of production. In this context, there is an ever greater need to integrate technology and management in order to act on strategic, tactical and operational levels, to bring about the revolution towards the use of knowledge, and to look for ways of dealing with this new reality through multi-disciplinary approaches. (Goldman, 2010:257)

k) Organizational arrangements develop something like an 'identity' here understood as a metaphor, which allows them to modify their organization many times, without modifying their essence.

l) It should not be acceptable to confuse metaphors or analogies about people and firms with reality. Analogies - like the one used by Nelson and Winter (1982) in chapters four and five, exploiting the parallels between individual skills and organizational routines - can be useful, but it is expected that nobody presumed into existence the human characteristics for firms.

This means that firms are abnormal contexts in which the human imagination is harnessed, but they certainly have neither minds, nor imaginations. This is a question of analogies. Sometimes they have a behavior that is easier to understand using this kind of analogies, but analogies are only analogies.

m) The here proposed framework is especially relevant to firms in business environments where the traditional elements of business success - maintaining incentive alignment, owning tangible assets, controlling costs, maintaining quality, 'optimizing' inventories (Teece, 2007:1320) - are necessary but they are unlikely to be sufficient for sustained superior firm performance.

n) Knowledge is understood here as a human construction: personal, intangible and biographically determined, and must always be differentiated from the information, no matter how sophisticated information is. It is very important not to confuse 'knowledge' - as a

dynamic skillful action, inherently context dependent - and 'information' - as static contents. Although an individual construction, knowledge is a social product. (Håkanson, 2010)

o) A clear distinction is made between knowledge (embedded in the knower) and Organizational Knowledge, a metaphor, expressed in regularities by members of organizational arrangements in social communities, i.e., 'structured groups' or networks. Thus, Organizational Knowledge is not understood here as the simple sum of knowledge of the individuals that make up an organizational arrangement in a given time.

p) For Nonaka and his various co-authors, in the construction of Organizational Knowledge Creation Theory, the organization of a firm continuously creates knowledge from the tacit knowledge of individuals and by synthesis - a dialectical process, continuous and dynamic, which is nourished by the paradoxes - makes a social conversion of tacit knowledge into explicit and vice versa. (Takeuchi and Nonaka, 2004).

By incorporating the 'tacit knowledge' concept, Organizational Knowledge Creation Theory overcame mainstream theory's tendency to equate knowledge with information, but it must be pointed out that knowledge conversion of knowledge from tacit to explicit and vice versa is a social process (Nonaka and Takeuchi, 1995).

q) First Nonaka's papers (1991, 1994) have contributed to a specific comprehension of concepts of 'tacit knowledge' and 'knowledge conversion' in organizational context. During more than twenty years of extensive academic work, Nonaka and different coauthors have shaped the development of a dynamic Organizational Knowledge Creation Theory, identifying two premises upon which that theory has been conducted. The first one is that tacit and explicit knowledge can be conceptually distinguished along a *continuum*. The term *continuum* does not mean a direct conversion is possible. The second one is that knowledge conversion explains, theoretically and empirically, the social interaction between tacit and explicit knowledge.

r) The Organizational Knowledge Creation Theory concept of tacit knowledge was inspired by, but not restricted to, Polanyi's work - based on 'Gestalt' psychology and stood for an alternative perspective to the mainstream theory of human cognition and knowledge - that appeared at the end of the 1950s and should be understood in its historical context.

Polanyi's work was so important because it analyzed the inherently personal, subjective, and process-oriented component of knowledge/knowing and, thus, provides an alternative view of the positivism, contributing to science studies.

As stated by Nonaka and von Krogh (2009:648), although Polanyi's work inspired the concept of tacit knowledge, Organizational Knowledge Creation Theory needed to expand that cornerstone to both capture social forces and recent contributions to the understanding of knowledge in management and organization theory, being a contribution to organization science and reflects the pursuit of a research agenda in this field.

s) In line with the Organizational Knowledge Creation Theory, in this paper will be adopted a epistemology based on Polanyi, which recognizes two dimensions of knowledge - tacit and explicit - and considers knowledge as only created by human beings.

Tsoukas (2005: 4) explains that for Polanyi, all knowing involves skillful action and the knower necessarily participates in all acts of understanding, and the idea that there is such a thing as 'objective' knowledge, self-contained, detached, and independent of human action (reflection), is wrong and pernicious. 'All knowing is personal knowing' (Polanyi, Prosch, 1975:44).

t) Tsoukas (2005) points out that the nature of Organizational Knowledge - and its relation to individual skills and social contexts - has been misunderstood as tacit knowledge has become popular in management studies and economics in a misunderstood way and has been insistently designed as opposed to explicit knowledge, when in fact tacit and explicit would simply be different dimensions of the same knowledge.

u) In this paper, 'Institutions' will be understood in the restricted sense of humanly devised formal and informal rules-constraints, or 'rules of the game,' — such as written law and unwritten moral norms — and are strictly distinguished from organizational arrangements.

As stated by North (1990:5), organizational arrangements ('organizations' in North´s words) are considered as 'made up of groups of individuals bound together by some common purpose to achieve objectives'.

This means that for the construction of the here proposed framework, the internal mechanisms by which organizational arrangements coerce or persuade members to act together to some degree have not been taken into account. If or not organizational arrangements have internal players and systems of embedded rules, and hence by implication they could be considered a special type of institution is not considered in the discussion here developed, despite the importance of this theme for study of institutions.

v) Finally, organizational arrangements involve networks and cannot function without rules of communication, membership, or sovereignty (Hodgson, 2006:10), in other words, Organizational Knowledge processes, programs and policies, the OKS. 'Structures' is again a metaphor, perhaps not a good one, since structures are so tangible. OKS are an important element of the framework here proposed and will be developed in the subsequent discussion.

3   Some important research gaps to be filled

Four research gaps will be addressed in the here proposed framework. They are, as follows.

3.1   Dynamic Capabilities

A Dynamic Capability would be a meta-competence that transcends operational competence (Teece, 2007, 26).

There is a large variety of approaches to define Dynamic Capabilities. For example, they can be understood as the form of how firms renew their resource base. To a more detailed historic study of the theme, see Ambrosini, Bowman and Collier (2009).

According to Danneels (2008), in dynamic capability theory, some firms are better able than others at altering their resource base by adding, reconfiguring, and deleting resources or competences. For him, the first form of dynamic capability would be the competence to build new competences.

For Teece, Pisano and Shuen (1997:524), the parameters that determine a firm´s performance are quite different from those in the standard textbook theory of the firm. For them the essence of a firm's competence and Dynamic Capabilities resides in the firm's organizational processes, that are in turn shaped by the firm's assets (positions) and its evolutionary path.

However, despite the importance of Dynamic Capabilities to better understand firm´s performance, as highlighted in the British Journal of Management Special Call for Papers on 'The Practice of Dynamic Capabilities: Theory Development and Research', the concept is still in need of theoretical and empirical development. (Ambrosini, Bowman and Collier, 2009)

As emphasized by Danneels (2010), 'there is a lack of knowledge about how Dynamic Capability is exercised, that is, how and why resource alteration modes are used'.

3.2 Adaptive Efficiency

March (1991:71) - in a today considered classical paper - distinguishes two orders of knowledge-based actions. There are those concerned with building the firm's 'stock' of knowledge (again, not a good metaphor) and those ones concerned with deploying that knowledge. He refers to the former as 'exploration' and the latter as 'exploitation' and stated that maintaining an appropriate balance between them is a primary factor in system survival and prosperity.

Other authors have tried to establish similar distinctions. Some examples are Spender´s differentiation between 'knowledge generation` and 'knowledge application' (Grant, 2006:208) and the classical typology proposed by Senge (1990), within the organizational learning literature, distinguishing between generative and adaptive learning.

Grant (2006:208) also points out two orders of action. Taking into account that knowledge creation requires specialization, while knowledge application requires diversity, he states that the essence of organizational competences would be the integration of specialized knowledge of individuals. Such integration falls into two orders of problems: cooperation and coordination.

The idea of coordination is aligned with Kogut and Zander (1992: 384), who viewed coordination as fundamentally different within the firm and between individuals transacting across markets and stated that…

> *…organizations are social communities in which individual and social expertise is transformed into economically useful products and services by the application of a set of higher-order organizing principles. Firms exist because they provide a social community of voluntaristic action structured by organizing principles that are not reduceable to individuals.*

But the more aligned with the here proposed framework idea of two orders of knowledge actions is the concept of Adaptive Efficiency proposed by North (1990) to institutional structures.

North (1990, p. 80) stated that:

> *Adaptive efficiency is concerned with the kind of rules that shape the way an economy evolves through time. It is concerned with the willingness of a society to acquire knowledge and learning, to induce innovation, to undertake risk and creative activity of all sorts, as well as to resolve problems and bottlenecks of the society through time.*

In his Nobel Lecture (1993), North concluded:

> *It is adaptive rather than allocative efficiency which is the key to long run growth. Successful political/economic systems have evolved flexible institutional structures that can survive the shocks and changes that are a part of successful evolution. But these systems have been a product of long gestation. We do not know how to create adaptive efficiency in the short run.*

Even though the concept of Adaptive Efficiency had been proposed to institutions, it is easily possible to establish an analogy between institutional structures, for societies, and OKS, for organizational arrangements.

3.3 Organizational Ambidexterity

According to the widely accepted idea of, at least, two orders of actions, Nonaka and Von Krogh (2009:647-648) suggest that the need to know when and why social practices contribute to the conservation of existing routines and the tacit knowledge associated to them - rather than to contribute to Organizational Knowledge creation and consequent innovation, creating something like a learning rigidity – will inevitably connect Organizational Knowledge Creation Theory to the emerging discussion on 'Organizational Ambidexterity' – another important metaphor.

This new research stream suggests that successful organizational arrangements achieve an apparent balance between being efficient in running today's business, while being adaptive to a changing environment ensuring that they will also survive in the future (Tushman and O'Reilly, 1996).

Underlying the question of how organizational arrangements survive in the face of change has produced a rich debate about whether organizational arrangements can adapt themselves (to learn – another important metaphor)—and, if so, how.

While most organizational arrangements are largely inert and ultimately fail, some others do learn and adapt to shifting environmental contexts. (Senge, 1990)

O'Reilly and Tushman (2007) identified two research streams related to understand how organizational arrangements learn. The first one, based on research in strategy, suggests that Dynamic Capabilities - the ability of a firm to reconfigure assets and existing capabilities - explains long-term competitive advantage. The second one, based on organizational design, argues that ambidexterity, the ability to simultaneously explore and exploit, enables a firm to adapt over time.

As suggested by them, organizational ambidexterity could be understood to act as a dynamic capability and so efficiency and innovation do not need to be strategic tradeoffs.

3.4 Organizational Knowledge

The reading of the phrase 'Organizational Knowledge Creation' can be a bit more complicated than might appear at first. There is the possibility to be talking about 'Knowledge Creation in organizational arrangements' and in this case 'Organizational Knowledge' would simply mean the knowledge available within an organizational

arrangement, a concept somewhat problematic when it comes to better understand what knowledge would be.

But there is also the possibility to be talking about an intangible, dynamic, emerging and specific asset of an organizational arrangement. It is very true that reading some authors, it is not clear which of the interpretations is being used.

For Tsoukas and Vladimirou (2001), 'Organizational Knowledge is much talked about but little understood'.

They set out to conceptualize Organizational Knowledge and explore its implications for management, by taking Polanyi's insight concerning the personal character of knowledge and fuse it with Wittgenstein's insight that all knowledge is, in a fundamental way, collective. They did this in order to show, on the one hand, how individuals appropriate knowledge and expand their knowledge repertoires, and, on the other hand, how knowledge, in structured contexts, becomes organizational.

Nonaka and his associates in the construction of Organizational Knowledge Creation Theory (for instance, Nonaka and Takeuchi 1995, Nonaka and Toyama 2003, Nonaka and Von Krogh 2009), who have adopted a broadly constructivist view of knowledge, have focused on the intra organizational processes through which Organizational Knowledge is created, and have highlighted the importance of both social practices within which new knowledge is created and social interaction through which new knowledge emerges.

Organizational Knowledge Creation Theory has proposed the Socialization – Externalization – Combination - Internalization (SECI) model, a dynamic model of knowledge creation, anchored to a critical assumption that 'human knowledge is created and expanded through social interaction between tacit knowledge and explicit knowledge' (Nonaka and Takeuchi 1995, p. 61).

For Tsoukas (2009:1), 'despite the proliferation of empirical studies and the important insights gained, more theoretical work is needed to further expand on the processes through which new Organizational Knowledge emerges'.

4   The problem to be faced

Dynamic Capabilities are sometimes difficult to identify and analyze, but they are acknowledged as important issues for innovative firms.

It is easy to note a difficulty to explain the variation in the degree of success of firms to be innovative with reference to different degrees and qualities of their Organizational Knowledge Creation, this means, in other words, their dynamics of Organizational Knowledge. A more accurate conceptualization of Organizational Knowledge has been relatively neglected, especially if taken into account the centrality of this issue to the understanding of the elements that allow firms to search innovation and, as a result, to create sustainable competitive advantages.

Another critically important research question, as pointed out by Nonaka and Von Krogh (2009:647-648), is how leadership characteristics enable ambidexterity in organizational arrangements, while O'Reilly and Tushman, researchers of Organizational Ambidexterity, also highlight the substantive role of senior teams in building Dynamic Capabilities (2007).

As stated by Teece (2007:02):

> *A framework, like a model, abstracts from reality. It endeavors to identify classes of relevant variables and their interrelationships. A framework is less rigorous than a model as it is sometimes agnostic about the particular form of the theoretical relationships that may exist.*

The problem to be faced is to build a framework for dynamics of Organizational Knowledge, which sheds new light upon the theoretical relationships that may exist between constructs like Innovation, Organizational Learning, Dynamic Capabilities, Adaptive Efficiency and Organizational Ambidexterity.

The here proposed framework and its main characteristics are analyzed in the next section.

5 A framework for Dynamics of Organizational Knowledge and Innovation

5.1 Capabilities, Routines and Knowledge in the organizational context

Although working in another context, Richardson (1972) could be considered an important precursor of the idea that firms have 'capabilities'. He showed how the activities have been undertaken by firms with relevant capabilities:

> *It is convenient to think of industry as carrying out an indefinitely large number of activities, activities related to the discovery and estimation of future wants, to research, development and design, to the execution and co-*

ordination of processes of physical transformation, the marketing of goods and so on. And we have to recognize that these activities have to be carried out by organizations with appropriate capabilities, or, in other words, with appropriate knowledge, experience and skills. The capability of an organization may depend upon command of some particular material technology, such as cellulose chemistry, electronics or civil engineering, or may derive from skills in marketing or knowledge of and reputation in a particular market. (Richardson, 1972, p. 888)

It is present in the above text the ideas - metaphors – that firms carry out their activities with 'knowledge, experience and skills' like a human being. Organizational concepts and constructs like 'practice', 'experience', 'competences', 'distinctive competences' (Selznick's, 1957), 'resources' (Penrose, 1959), 'skills', 'team production' (Alchian and Demsetz, 1972), 'learning' (Argyris, 1999; Senge, 1990), 'absorptive capacity' (Cohen and Levinthal, 1990), 'core competence' (Prahalad and Hamel, 1990), 'capabilities', 'combinative capabilities' (Kogut and Zander, 1992), 'ambidexterity' (Tushman and O'Reilly, 1996), 'Dynamic Capabilities' (Teece, Pisano and Shuen, 1997), 'intellectual capital' (Edvinsson and Malone, 1997), and other similar metaphors and analogies have challenged economists, management researchers and corporate strategy theorists long ago, in the endeavor to understand firm, in the words of Spender (1996), as a body of knowledge.

So many terms only serve to confirm the idea of Spender (1996), that knowledge has been 'too problematic a concept to make the task of building a dynamic knowledge-based theory of the firm easy'.

The conceptualization of firms as organizational arrangements that know how to do things (Winter, 1987) has been considered one of the fundamental aspects of the evolutionary perspective in economic theory (Håkanson, 2010).

In the context of evolutionary theory, routines play a central role. They are based on the behavior of the agents and, in particular, of the organizational arrangements, being central in all neo-Schumpeterian representation. Nelson and Winter (1982) note that much business behavior is not routine within the ordinary meaning of that term. As they state:

... is that most of what is regular and predictable about business behaviour is plausibly subsumed under the heading 'routine', especially if we understand that term to include the relatively constant dispositions and strategic

heuristics that shape the approach of a firm to the non-routine problems it faces' (1982:15).

The understanding of constant dispositions and heuristics as part of routines is a clear issue to differentiate them from simple procedures previously established in writing or not.

Winter (2003) founds the concept of organizational capabilities on the broader concept of organizational routines (see Felin and Foss, 2004 for a more thorough review and a skeptical look about routines). For Winter, 'an organizational capability is a high level routine, or collection of routines, that, together with its implementing input flows, confers upon an organization's management a set of decision options for producing significant outputs of a particular type'.

So, including the relatively constant dispositions and strategic heuristics, a 'routine' would be then a 'behavior that is learned, highly patterned, repetitious or quasi-repetitious, founded in part in tacit knowledge – and the specificity of objectives' (Winter, 2003).

The fact that routines are founded in part in tacit knowledge is very important and must be strongly considered, because tacit knowledge is the primary basis for effective management and, at the same time, the basis for its deterioration. Argyris (1999: 54) arguments briefly, that the primary task for effective management is to define and transform, as much as possible, the behavior required to achieve the objectives into routines that work.

The routines that matter are implemented through skillful actions of individuals, based largely on tacit knowledge. For Argyris (1999: 54), such actions may become self-reinforcing of the *status quo*. When these surface, they are often embarrassing or threatening, individuals deal with embarrassment or threat with another set of skillful — hence tacit — actions. The self-reinforcing features tend to reduce inquiry into gaps and inconsistencies in the tacit knowledge. These actions would be counterproductive to effective management.

Winter (2003:991) makes clear that brilliant improvisation (*ad hoc* problem-solving) would not be a routine, and there is no such thing as a general-purpose routine.

So, in a very simple way, ´capabilities' and 'routines' are words that have been used to try to make a description of how firms know how to do things. In other words,

they are about knowledge/knowing (Duguid, 2005) and are very important for the construction of the so-called knowledge-based theory of the firm.

The nature of capabilities and routines of the organizational arrangements has been analyzed at different levels of observations, ranging from 'firm-level' learning pattern studies, as well as patterns of technological and organizational changes, up to broad cross-national comparisons and their embeddedness into broader level of industry and national institutions, being possibly 'one of the most active areas of microeconomic research with important ramifications into multiple domains of investigation, including the relationships between technological and organizational innovation, the vertical and horizontal boundaries of the firms and the role of institutions' (Coriat, Dosi and Pavitt, 2000: 3).

5.2   Operational Capabilities

Winter (2003) uses another kind of metaphor to try explaining the difference between Operational (ordinary) and Dynamic Capabilities. Using the Collis´ idea that Dynamic Capabilities govern the rate of change of ordinary (or operational) capabilities, Winter (2003) introduces a 'zero level' in the capability hierarchy, that will be used as a point of departure to the construction of the here proposed framework.

As stated by him, constants and technical issues aside, 'everything is the derivative of its integral and the integral of its derivative', so he proposes a heuristic guide available that conforms to common sense and existing practice, at least for the capabilities of firms competing in markets and to make effective use of the concept of a hierarchy of rates of change, identifying the 'zero level', the analogue of position for variables moving in space.

The proposal of Winter (2003) consists in considering a hypothetical firm 'in equilibrium', an organizational arrangement that keeps earning its living by producing and selling the same products, on the same scale and to the same customer population over time. This will characterize a stationary process that will be referred in the framework proposed in this paper as 'static routines'.

It should be clear that static routines are not actually static, because all activities of a firm involve action.

For Winter (2003), the capabilities exercised in that are the zero level capabilities, the 'how we earn a living now' capabilities. In his words, 'without them,

the firm could not collect the revenue from its customers that allows it to buy more inputs and do the whole thing over again'.

It would be possible to say that operational competences, zero-order level capabilities, respond directly by the results of a firm, as illustrated by figure 1.

Organizational Knowledge Results must consider short-term and long-run dimensions of results - for instance: financial, social, cultural, and environmental.

Insert Figure 1 about here

Naturally, zero-level capabilities involve different kinds of activities. Some of them may involve tangible goods or services. Other activities may involve intangible goods. On the other hand, all of these activities are compound of 'rich in tacit knowledge activities', but, as would be expected, activities to carry out with effectiveness the zero level capabilities or static routines should be based on predominantly communicable information, articulated or codified (Zollo and Winter, 2002), which means predominantly based on explicit knowledge. However it is worth remembering that one of the main assumptions of this work is that it is not considered such a thing as purely explicit knowledge.

As firms are immersed in dynamic environments of knightian uncertainty, neither the zero-order level capabilities are actually stationary, nor could they be. They are expected to change over time and these changes demand innovations. Some of these innovations will be here called 'continuous innovation' or 'incremental innovation', and they only reflect the necessary corrections of results, without a need to change the OKS of firm. In some cases, it is not possible to correct the results without changing the OKS of firm. In such cases, this kind of innovation will be here referred as 'radical innovation'.

It is very important not to confuse the above definitions - 'continuous innovations' and 'radical innovations' - with their usual use in technical innovation analyses, where they refer to new products, processes and services.

It should be noted that the individuals involved in OPK have a lot of knowledge and they develop daily more knowledge not yet absorbed by static routines, or even not yet realized by those individuals, because - as stated by Snowden (2002:6) – 'we only know what we know when we need to know it'.

To a better comprehension of how tacit knowledge of individuals become routines of the firm, see the chapter III of Nonaka and Takeuchi (1995), in special the five-phase process of Organizational Knowledge creation consisting of:

- ✓ sharing tacit knowledge of individuals involved in the process,

- ✓ creating concepts,

- ✓ justifying concepts,

- ✓ building an archetype (in this case, a routine), and

- ✓ cross-leveling knowledge.

The zero-order level capability showed in figure 1 corresponds in here proposed framework to OPK, which are not equal, but include the static routines. This is an important difference between here proposed framework and Winter´ framework.

5.3 Dynamic Capabilities in the framework

As already pointed out in this text, Dynamic Capabilities have been described as the key to firm superior long-term achievements.

Winter (2003), again, refers to a broad consensus in the literature that 'Dynamic Capabilities' contrast with ordinary (or 'operational') capabilities by being concerned with change. This will be the main approach to be adopted in this paper about them, since the dynamics of Organizational Knowledge are the forces that cause it to change.

Winter (2003) proposes, by contrast, capabilities that would change the product, the production process, the scale or the customers (markets) served as not at the zero-order level. For Winter (2003), new product development, as practiced in many firms, would be a prototypical example of a first order 'dynamic capability'.

The figure 2 illustrates the relation between zero-order level capabilities and first-order Dynamic Capabilities.

Insert Figure 2 about here

As an example, Winter (2003) presents the capabilities that support the creation of new outlets by McDonalds or Starbucks, focused on the domain of scale and (geographic) markets rather than product attributes. For him these examples would be 'prototypical because they unquestionably involve first order change, given the

definition of the zero-order level, and it is equally beyond question that they are highly patterned and 'routine' in many respects'.

Crucial questions about Winter (2003) are:

- ✓ to realize that his construction is a terminological framework, as recognized by himself;

- ✓ he does not consider needing superior order capabilities, as second-order level; and

- ✓ feedback and OKS are fundamental elements of the here proposed framework, not considered by him.

5.4 Feedback

The cyberneticists were responsible for creating important ideas and concepts on the working of systems in general, breaking the principle of linear causality and introducing the idea of circular causality (von Foerster, 1992). Feedback means the transporting of information presented in the result of any process, or activity, which returns to the origin of this process, generating the mechanism of self-regulation of the systems. The idea of feedback is central to complex thinking as well.

Heinz von Foerster (1992) articulated the distinction between a first- and second-order cybernetics, as, respectively, the cybernetics of observed systems and the cybernetics of observing systems. The here proposed framework take into account these concepts.

5.5 Organizational Knowledge Structures

The framework here proposed finds support in the idea that organizational arrangements act on dominant structures of knowledge, OKS. Those are responsible for the processes that support or modify the OPK. Strategic Planning, Human Resources Policies, Environment Policies are examples of processes that do not produce direct results, but are responsible to influence, correct and improve OPK.

Figure 3 illustrates the introduction of two fundamental elements: feedback and OKS.

Insert Figure 3 about here

Comparing figures 2 and 3, an important doubt could appear. By figure 2, Dynamic Capabilities would be first-order level element that governs the rate of change of ordinary capabilities. By figure 3, Knowledge Processes, programs and policies - corresponding to OKS - govern the rate of change of ordinary capabilities.

So, in order to construct a robust and coherent framework, it is necessary to decide if OKS are or not the same thing that Dynamic Capabilities. Fortunately, Teece (2007) clarifies that 'to govern the rate of change of ordinary capabilities is only one element of Dynamic Capabilities'. For him, 'Dynamic Capabilities certainly include this element, as well as several others'. So, it will be considered here that OKS, a first-order level element, will be only one of the elements of Dynamic Capabilities, being necessary to identify the others.

5.6   Discussion of the Framework

It is interesting to note that the figure 3 represents a framework very similar to the well-known proposed by Argyris and Schön in the 1970´s to the Organizational Learning (Argyris, 1999:68), based on Bateson's researches.

Argyris and Schön (Argyris, 1999), in a classical discussion, have introduced the concepts of single-loop learning and double-loop learning, and have described organizational behavior as being governed by the action theory, that can be divided in claimed theory and in-use theory.

Nonaka and Takeuchi (1995:44) recognize that, like people, organizational arrangements always confront new circumstances. However, for those authors, the theories of most Organizational Learning authors had until then adhered to a "behaviorist" concept. Nonaka and Takeuchi (1995:44) criticize Organizational Learning authors for still using the metaphor of individual learning. For Nonaka and Takeuchi (1995:45), the development of the Organizational Learning theory of Argyris and Schön requires the implicit or explicit assumption that an agent, internal or external to the organizational arrangement, knows at which moment and with which method to implement the double-loop learning. For them:

> *A Cartesian-like view of organization lies behind this assumption. Seen from the vantage point of organizational knowledge creation, double-loop learning is not a special, difficult task but a daily activity for the organization. (Nonaka and Takeuchi, 1995:46)*

Figure 4 introduces new elements to the here proposed framework. In special, Evolution Routines - a higher order element - would be the element that governs the rate of change of OKS.

Insert Figure 4 about here

Figure 4 represents a framework that takes into account important features, usually not considered, for instance, processes of reflection (discussions), and will identify Dynamic Capabilities as an integration of different constructs, of first and second order, in the dynamics of Organizational Knowledge and not a simple set of processes, as usual.

The comments that follow are based on Figure 4.

This paper sets forth a theoretical account of the continuous creation of Organizational Knowledge, considering its different states. This approach takes into account the subjectivity of agents, normally not considered in other frameworks. The result of this discussion will be by presenting a general framework, simplistically represented in the conceptual model of figure 4, linking evolution of OKS - here not being considered equivalent, but as one of the elements of Dynamic Capabilities - to the evolution of OPK.

It must be pointed out that in the OPK there are very different degrees of creativity and it would not be adequate to attribute different degrees of importance to OPK and OKS. Teece (2007:27), for instance, proposes to be useful to understand the role of simple administrators in contrast with entrepreneurs and managers, even though in many firms they could be classified as operational managers, in general.

For him, administrators would be responsible for the day-today operations and the associated routines. They help ensure that the enterprise is 'technically fit and they are not expected to engage in entrepreneurial activities' and gives as example that they would not be relied 'on to sense new business opportunities'. From managers is expected a more strategic thinking, even when they act in OPK.

As Porter (1996:61) claims, operational effectiveness is not strategy. Although recognizing that both operational effectiveness and strategy are essential to superior performance, for him, "operational effectiveness" tools, like total quality management benchmarking, time-based competition, outsourcing, partnering, reengineering, and change management - despite its value – are not able to translate gains into sustainable

profitability. Analyzed in the here proposed framework, operational effectiveness tools are not Dynamic Capabilities, because, in general, they only improve OPK.

According to Teece (2007:26), 'dynamically competitive enterprises don't just build defenses to competition; they help shape competition and marketplace outcomes through entrepreneurship, innovation, and semi-continuous asset orchestration and business reconfiguration'.

So, it must be taken into consideration the fact that answers to the most frequent organizational problems are not necessarily the best ones. Many of these answers are the result of the tacit knowledge of people who may not perfectly maximize because of their bounded rationality in the organizational context of uncertainty.

The here proposed framework recalls the notion of dynamic routines, which are directed to learning, with equivalent on the concept of searching behavior proposed by Nelson and Winter (1982), that designate processes genuinely associated to risks and uncertainty, achieved in a trial and error way.

Dynamic routines are capable of creating other practices, assets or competences, with the possibility of improvement or evolution, but only 'evolution routines' are able to modify the organizational arrangement and to propitiate Organizational Learning.

Thus, a static routine is a structure of regular and predictable behavior that comprises one or more processes and leads to schemes primarily characterized by repetition. Groups that adopt improvement routines, despite its sophistication, reach the incremental or continuous innovation, making the tasks being performed progressively better and faster. This corresponds to learning by doing and other forms of technological learning (single loop learning).

Repetition and experimentation are learning bases through which behaviors are constructed. The resulting static routines form the operational processes and constitute organizational memory, built based on past knowledge and experiences, enabling stored information and a first interpretation of signals from outside the firm.

When companies solve the same problem repeatedly, they develop formal and informal routines, so that they can cope with the task every time similar issues appear, minimizing the risk of failure. If they do not develop and use formal and informal routines to account for recurring tasks, they would be wasting time reinventing solutions.

Unfortunately, most existing organizational arrangements are still inadequately structured to deal with Organizational Knowledge as an economic factor of production. This results in many organizational arrangements being based on command and control mechanisms, functioning as hierarchical bureaucracies, instead of considering the complexity.

On the other hand, enduring firms are characterized by, among others, cohesion and a great sense of identity, reflecting a pattern of interaction between their constituents. This capability to act in a cohesive way is understood as the main property which characterizes the emergence of 'complex behavior.' Identity, another important element of the here proposed framework, is fundamental to organizational arrangements that are always involved in changing processes and adaptation. As emphasized by Kogut and Zander (1996), `higher organizing principles' and 'the role of social identity' are the basis for coordination.

Single loop learning is an element of the framework and occurs when an organizational arrangement finds a failure that can be solved using its current OKS. The OKS, responsible for Organizational Knowledge processes, programs and policies of organizational arrangement, are generally not questioned in that case. This kind of routine - per definition - is not characterized as Dynamic Capability, because they do not govern the rate of change of OPK. They only modify some elements of established routines. That means that the organizational arrangement is looking for creation of knowledge that can lead to continuous innovation.

Of course, in discussions of first-order, OKS prevail over improvement routines.

The double-loop learning occurs when the correction of a certain disturbance requires modification in the dominant OKS. In other words, when organizational arrangements face deeper questioning processes and other actions are required, evolution must occur.

Double-loop learning results in a change of the organizational arrangement and its OKS. That means that the organizational arrangement is looking for creation of knowledge that can lead to radical innovation.

The second-order level capabilities, here identified as evolution routines are an element of Organizational Knowledge Management (KM)[3] meta-process, which should be a process involving multidisciplinary critical reflection, updated continuous and systematically, and made clear to all workers in the organizational arrangement. The focus of KM is intangible assets of knowledge. Thus, the KM meta-process should not be compared to OPK. It should be focused in improvement of OKS.

Unfortunately, the phrase KM has been the target of many different and dubious interpretations, ranging from the simple administration of trainings – which would be an OPK - to the capture, storage and retrieve - in digital media - of useful information to OPK.

As suggested by Tsoukas and Vladimirou (2001) , KM would be 'the dynamic process of turning an unreflective practice into a reflective one by elucidating the rules guiding the activities of the practice, by helping give a particular shape to collective understandings, and by facilitating the emergence of heuristic knowledge'. In the here proposed framework, KM comprehends two kinds of routines – improvement and evolution.

Other important element of the proposed framework is Competitive Intelligence (CI), which is understood here ideally as a systematic process of collecting information in a business environment. It should be an ethical process, in order to preserve a company's image among its competitors and clients, allowing a very clear definition of its strategic view and of its market position.

The concept of CI is something similar to *stimuli* proposed by Zollo and Winter (2002). The CI in the here proposed framework would be an integral part of KM, being directly responsible that KM would not be reduced, in any way, to a stimulus-response process, and being capable of developing new knowledge structures.

In relation to innovation, it is important to note that nowadays it is not enough for organizational arrangements only to improve continuously. Something must make them different. This is what makes radical innovation more than an option; it is a necessity. Denning (2005) says that the fact that no modern theory on innovation offers any clue as how to achieve it suggests that it is being looked for in the wrong places.

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[3] It will used in this paper the label KM to designate the meta-process of Organizational Knowledge Management, which must not be confused with operational actions or improvement routines usually understood as Knowledge Management, but that, in general, are information management.

It is worth noting that Winter (2003) points out that the 'zero level' is only locally defined and gives an interesting example stating that for a firm that does its own R&D, the producing and selling the product is zero order activity and for an independent R&D lab, developing new products is zero order activity. On the other hand, in the here proposed framework, even for a firm that does its own R&D, this kind of activity would not be automatically classified as a first-order level. The definition of R&D policies and some elaborated R&D activities would be defined as OKS, but some usual activities of R&D, which do not change OKS, would be considered zero order activity.

In short, the proposed framework is founded on the idea that organizational arrangements are ruled by their organizational identities, attempting to put into practice their knowledge processes, programs and policies, by executing routine tasks.

The conceptual model represented in figure 4 indicates that starting from OPK, results are reached, and they must be analyzed closely by the stakeholders, quantitatively and qualitatively. The deviation of desired outcomes must be observed and communicated to the organizational arrangement. The analyzed failures work as feedback and, together with perceived stimuli using CI, are capable of detecting mistakes and necessities of enhancing in the OPK or in OKS, contributing to improve efficiency, efficacy and effectiveness of the firm, that would correspond to its Organizational Ambidexterity.

The CI complements the framework by collecting information of activities developed by competitors, of general business trends, as well as the participation in value networks composed firms, clients and strategic partners (suppliers, distributors, services providers, regulators) with the objective of facilitating the creation of Organizational Knowledge, starting from information and data coming from not only the analysis of the results themselves.

Thus, through Organizational Intelligence, two types of learning can be generated: the single loop, which leads to changes in the way of acting, keeping the dominants OKS, or the double-loop, which leads to fundamental changes in the OKS, allowing necessary change to adaptation (Organizational Learning). It must be clear that, single- and double-loop learning would be a daily activity for a knowledge-creating company.

6   Conclusions

Twenty years ago, Nonaka (1991:96) proposed that '… despite all the talk about "brainpower" and "intellectual capital," few managers grasp the true nature of the knowledge-creating company - let alone know how to manage it'. For him, the reason would be that 'managers misunderstand what knowledge is and what companies must do to exploit it'.

Today, there is not yet general consensus that "knowledge is not a 'thing', or a system, but an ephemeral, active process of relating" (Stacey, 2001:3). If this view would be taken, managers, economists, organizational strategists and others would know that, as stated by Stacey (2001:3), 'no one, let alone a firm, could own knowledge'.

Knowledge itself cannot be neither stored, nor used as a structure, since it is ever in construction. Certainly, knowledge cannot be managed, at least, in the usual sense of the word 'management'.

The framework presented in this paper analyzes knowledge, in all its complexity, as a variable, hence dynamic, and Organizational Knowledge as a metaphor, that assumes different states, which are functions of knowledge available to the correspondent organizational arrangement.

The proposed framework builds bridges between Dynamic Capabilities, Organizational Ambidexterity, Adaptive Efficiency and Organizational Learning processes, here considered processes of Organizational Knowledge Creation.

The dynamics of Organizational Knowledge is understood, in the framework proposed in this paper, as responsible for the coevolution of two organizational sets of routines that have knowledge as their main variable: OPK and OKS

OPK produce operational competences, which have as outcome the 'Organizational Knowledge Results'. OPK are understood as zero-order level capabilities, in the here proposed framework. They are compound by static routines and all the knowledge/knowing not yet absorbed by them.

The framework proposes that, in the firm-level, OPK can be changed by three kinds of dynamic meta-processes.

The first one is a first-order level element, the OKS, which correspond to the Organizational Knowledge processes, programs and policies - rich in tacit knowledge. The OKS define the visions, which make possible the changing of the organization of the organizational arrangement.

The second one, improvement routines, does not alter the OKS, only directly correcting the OPK, via a reflection of first-order, being focused in explicit knowledge, either codified, or articulated. In general, it is characterized as Information Management, and it is not an element of Dynamic Capabilities.

The third one is a second-order level element, evolution routines, which try to improve the OKS, via a reflection of second-order, being focused in tacit knowledge. This meta-process would be the main part of KM – an element of Organizational Intelligence – and is being characterized as an element of Dynamic Capabilities.

In the proposed framework, Dynamic Capabilities would be a result of a combination of first- and second-order level elements and not only a simple meta-competence. In other words, there would not be different orders of Dynamic Capabilities, but Dynamic Capabilities would be compounded of elements of first-and/or second-order level.

With the introduction of the concepts of OKS and Evolution Routines, an important piece of the puzzle of Dynamic Capabilities fits into place. The division proposed by North (1990, 1993) between allocative and adaptive efficiency corresponds to the division between focus on explicit (communicable) and focus on tacit knowledge. It is the predominantly tacit knowledge embedded in OKS that determines how well, or how poorly, predominantly explicit knowledge of static routines, in form of communicable information will be used and recombined by the OPK.

In conclusion, the consideration of first- and second-order elements of the dynamics of Organizational Knowledge will help scholars to better understand the foundations of Dynamic Capability, Organizational Ambidexterity and long-run firm success (Adaptive Efficiency). At the same time, it will help managers to distinguish first- and second-order tools and to delineate relevant strategic considerations, in order to define the priorities they must adopt to enhance long-term firm performance.

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FIGURES

FIGURE 1

Relation between results and zero-order level capabilities
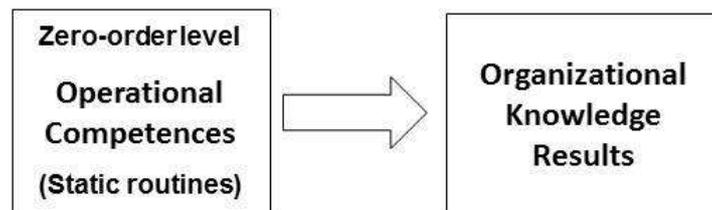
FIGURE 2

Relation between results, zero and first-order level capabilities, according to Winter (2003)
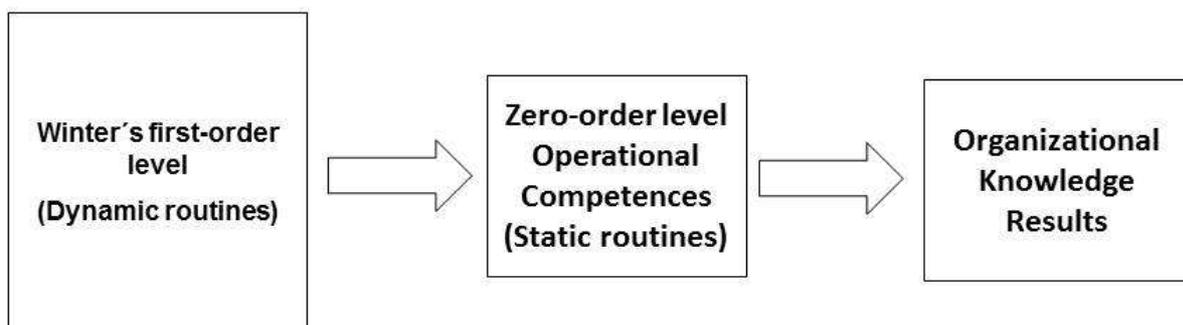
FIGURE 3

Introducing Feedback and Organizational Knowledge Structures
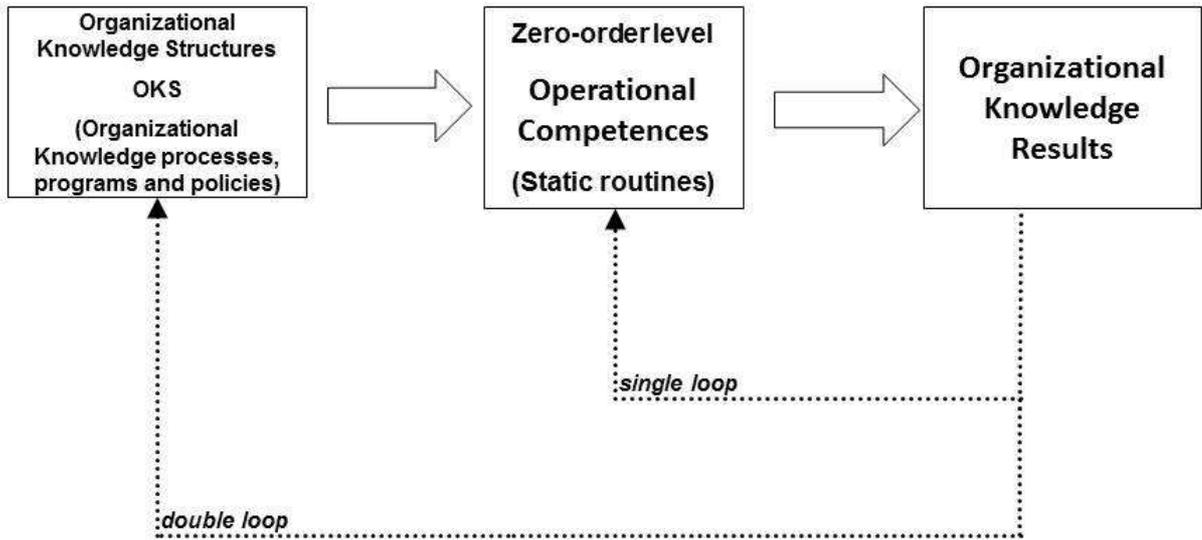
FIGURE 4

Dynamics of Organizational Knowledge – Conceptual Model