

“Tacit knowledge, organizational learning and innovation in organizations”

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SECTION 3. General issues in management

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Tacit knowledge, organizational learning and innovation in organizations

Abstract

Problem: We don't know how tacit knowledge, organizational learning and innovation are linked. **Research question:** What is the relation between tacit knowledge, organizational learning and innovation? **Methodology:** Conceptual generalizing. **Purpose:** To create a link between tacit knowledge, organizational learning and innovation.

Contribution:

4. The authors develop a typology for tacit knowledge and organizational learning that may help us to understand the interaction between different types of tacit knowledge, organizational learning and innovation.
5. The research of the authors shows that tacit knowledge may be said to have three faces: one conservative that limits the continuous improvement process, a second that guards an organization against imitation, and a third that promotes innovation.
6. The authors develop a theory, i.e., a system of propositions related to how do different types of tacit knowledge and organizational learning influence innovation?

Keywords: tacit knowledge, organizational learning, innovation.

JEL Classification: M10.

Introduction

Through the increasing attention directed towards ICT, we have seen a strong emphasis on explicit knowledge, but also an interest in tacit knowledge (Collins, 2010, pp. 1-15). This has put tacit knowledge (Polanyi, 1958, 2009) in the forefront of research on organizational learning and innovation (Bush, 2008; Lam, 2000, pp. 487-513; Garavan & McGuire, 2015; Donate et al., 2015; Mascitelli, 2000).

Information and communications technologies are key to innovation processes in companies today (Johannessen et al., 2001; Contini & Lanzara, 2008).

Organizational learning and innovation are dependent on access to knowledge (King, 2009, pp. 1-13; Grillitsch & Rekers, 2015). This means knowledge that is external to the business, as well as the development of new knowledge within a specific business (Gangi & Wasko, 2009, pp. 199-213). The real point, however, is that much of this knowledge is tacit, and tacit knowledge had not received attention from researchers, managers or politicians prior to the 1990s (Nonaka, 1991, 1994; Nonaka & Takeuchi, 1995; Nonaka & Ichijo, 1997).

One starting point for Polanyi (2009, p. 4) is: "...we can know more than we can tell" and, along the same lines, "...nothing that we know can be said precisely"

(Polanyi, 1958, pp. 87-88). Accordingly, the basis for Polanyi's concept of tacit knowledge is that we know more than we are able to communicate to others in the form of information. Examples of adequate methods may be mechanisms that release and combine explicit and tacit knowledge. When tacit knowledge is to be transferred from one person to another, this cannot be done completely by means of either language or images (Cannon, 2002). When a master needs to show an apprentice what he/she means, he/she will often point at the object in question, or make the apprentice aware of the significant features of a particular situation. The master may point out signs that the apprentice needs to be aware of to keep the situation under control. For example, there may be particular types of sound that indicate that one process or another is starting to go wrong. This method of defining something by pointing out a particular thing or situation is referred to by Polanyi (2009, p. 6) as ostensive definition. The transmission of tacit knowledge to an apprentice is an active creative process; it is not one of passive transmission from master to apprentice (Polanyi, 2009, p. 6). The process of apprenticeship is dependent in part on the apprentice themselves gradually finding out knowledge that the master is unable to transmit, but which becomes apparent through the situation/context at any particular time (Cannon, 2002). This active process means that the tacit knowledge possessed by the apprentice becomes different to that of the master. The apprentice integrates this tacit knowledge into their existing knowledge-base, and makes it their own. Tacit knowledge will comprise a proportion of the knowledge-base in most occupations. This applies to,

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for example, nurses, pre-school teachers, teachers, managers, artists, technicians, researchers, etc. This type of knowledge cannot be learned through formalized and codified procedures that are divorced from practice.

We will develop a typology of tacit knowledge where each type of tacit knowledge has its own implications with regard to management and innovation processes.

Tacit knowledge is the result of different types of learning processes, which we will denote here using the term “tacit knowledge processes”¹. Polanyi expresses these processes in the following way: “Tacit knowing is a process of a complex whole, a pattern which escapes when taken apart for analysis. But tacit knowing is not only involved in the process by which tacit knowledge is gained. It is also involved in the processes by which all knowledge is gained” (Polanyi, 1958, p. 49).

We know little about how tacit knowledge affects and influences innovation processes (Sheng et al., 2015). An interesting question is, thus, to what extent different types of tacit knowledge and different types of organizational learning promotes or inhibits a business’s innovation ability.

The research question we will be investigating here is: **What is the relation between tacit knowledge, organizational learning and innovation?**

To answer this question we ask three questions:

1. What is tacit knowledge and tacit knowing, and how is it linked to organizational learning?
2. How can tacit knowledge be typologized and linked to different types of organizational learning?
3. How do different types of tacit knowledge and organizational learning affect organizational learning and innovation?

1. Organizing of the paper

The paper is organized around the three research questions. First, we describe the method used, conceptual generalization, then, we start with research question one.

2. Methodology: conceptual generalization

Research falls into two main categories: conceptual generalization and empirical generalization (Bunge, 1998, pp. 3-50, 51-107, 403-411). Conceptual generalization is an investigation whereby the researcher uses other researchers’ empirical findings in conjunction with his or her own process of conceptualization in order to generalize and identify a pattern. This contrasts with empirical generalization,

where the researcher investigates a phenomenon or problem that is apparent in the empirical data, and only thereafter generalizes in the light of his or her own findings (Bunge, 1998, pp. 403-411). The starting point for the researcher in the case of both empirical and conceptual generalization will be a phenomenon or problem in the social world.

Conceptual generalization and empirical generalization are strategies that are available for answering scientific questions. Which of these strategies one chooses to use will be determined largely by the nature of the problem and “the subject matter, and on the state of our knowledge regarding that subject matter” (Bunge, 1998, p. 16).

Conceptual generalization, which is the subject of our investigation here, is “a procedure applying to the whole cycle of investigation into every problem of knowledge” (Bunge, 1998, p. 9).

The approach here is to develop a conceptual model and, then, discuss each element in the model. An analytical scheme or model is a general sociological analytical tool (Turner, 1987, p. 162), which may be used to illuminate and organize a phenomenon, event, action or process. The purpose of an analytical scheme is “the construction of abstract systems of categories that presumably denote key properties of the universe and crucial relations among those properties... Explanation of specific events is achieved when the scheme can be used to interpret some specific empirical process” (Turner, 1987, p. 162). In this article, the analytical scheme will take the form of an analytical model (Figure 1), precisely, as Turner suggests, to show relationships between properties.

An analytical scheme may be used methodologically in two ways, says Turner. One way is when an empirical event can be placed in a category in the scheme: “then, the empirical event is considered to be explained” (Turner, 1987, p. 162). The other way is “when the scheme can be used to construct a descriptive scenario, of why and how events in an empirical situation transpired, then, these events are seen as explained” (Turner, 1987, p. 162). Both these methods will be used here. In addition to Turner’s approach, we have drawn on Deleuze and Guattari’s ideas concerning how a concept can be studied (Deleuze and Guattari, 2011, pp. 6-9, 15-17), and Adriaenssen & Johannessens (2015) elaboration of conceptual generalization.

What is tacit knowledge and tacit knowing and how is it linked to organizational learning?

The distinction between explicit and tacit knowledge may be understood in relation to *wissen* (German: “knowing what”) and *können* (“knowing how”). With regard to the above, the development

¹ “Tacit knowledge processes” is here synonymous with Polanyi’s “tacit knowing”, which denotes the processes leading to tacit knowledge.

of tacit knowledge may be said to always consist of three elements: knowing, wanting to know and the practical context.

It is by becoming intimate with phenomena or problems – “dwelling in them” (Polanyi, 2009, p. 18) – that we can understand their inner meaning. In other words, it is intimacy and extensive experience of a phenomenon in its context that constitute the approach to tacit knowledge and thereby also a foundation for learning. It is precisely this sensitivity, attained through intimacy by application and execution, that leads to the development and transferral of tacit knowledge. Polanyi (2009, p. 55) expresses this in the following way: “... tacit knowing achieves comprehension by indwelling, and that all knowledge consists of or is rooted in such acts of comprehension”.

Tacit knowledge exists, says Molander (1993, p. 40), in “the action and the judgements that are carried out in relation to the action”. The word ‘and’ is crucially important here: the action and the judgements. It is not only the action or the judgements by which tacit knowledge may be understood, but also the reflection that is made before, during and after the action. This links tacit knowledge to the learning process.

There are three main processes connected to tacit knowledge: action, reflection and interaction. The action is crucial to tacit knowledge. It is through the execution of activities that players develop, transfer and integrate tacit knowledge in the social system. However, reflection is also essential if learning is to be achieved. The action is at the core of tacit knowledge, but around this core lie reflection and interaction. The interaction may be divided into two components. Firstly, there is interaction with the object, phenomenon or problem that is to be understood or solved. Secondly, there is interaction between individuals who possess knowledge of the phenomenon, object, etc. The action takes place in the moment of time. However, reflection takes place before, during and after the action. The interaction has the same time dimension as the reflection, i.e., the players interact before, during and after the action. The action, reflection and interaction are connected by the fact that the players participate and contribute in a practical learning context.

As mentioned above, tacit knowledge is developed through familiarity with a phenomenon or object; this is referred to here as the phenomenal structure of tacit knowledge. Tacit knowledge is transferred through interaction between the possessor of tacit knowledge and the individual who wants to learn; this is referred to here as the functional structure of tacit knowledge. The integration of tacit knowledge in a system or between systems is dependent on familiarity with the

context in which players are able to act and interact in relation to specific objectives; a process where learning by dialogue is the crucial element (Little, 1995, pp. 175-181; Matte & Cooren, 2015). This is referred to here as the contextual structure of tacit knowledge. The phenomenal, functional and contextual structures of tacit knowledge may be related to Polanyi’s later work (2009), where he distinguishes between “phenomenal”, “functional” and “semantic” structures of tacit knowledge.

The development, transfer and integration of tacit knowledge require action, reflection and emotional engagement. However, these three elements are only necessary conditions for the processes of this type of knowledge. In addition, the transfer and integration of tacit knowledge require that relations between players are based on trust and a positive, helping attitude; this reinforces confidence in relationships and facilitates the knowledge processes mentioned above (Amirkhani & Heydari, 2015).

Tacit knowledge is developed, transferred and integrated as a type of attention focusing on a phenomenon, function and context; it is the constant focusing over a period of time that develops awareness towards the signals that practice transmits. Polanyi (1958, p. 61) says “Like the tool, the sign or the symbol can be conceived as such only in the eyes of a person who relies on them to achieve or to signify something. This reliance is a personal commitment which is involved in all acts of intelligence by which we integrate some things subsidiarily to the centre of our focal attention”. Tacit knowledge and practice are, thus, closely related, but distinct concepts; it is developed and transferred through learning by doing, learning by using, single loop learning, double loop learning (Schön, 1987, 1988), where there exists a relationship between a master and an apprentice, an expert and a novice or one who knows and one who wants to know. This relationship is based on discipline. By discipline here we mean the word’s original meaning: learning from someone who knows.

Skills are developed through repeated practice until they become automatic or part of the skills are considered tacit knowledge; they can, then, be executed without conscious control of the separate activities, so that the doer can focus attention on a higher level of perfection. Physical activities are assimilated so they become conditioned reflexes when carried out by the expert. However, to reach this level presupposes that the development of the tacit knowledge is learned through “slow repetitive practice to set up conditioned reflex programs in the brain” (Robinson, 1996, p. 127). For certain motor skills, such as playing the piano, one might say the fingers *are the brain*: that is, the memory of how to

play is in the fingertips. Similarly, your fingers can remember how to dial a particular phone number even though you may not be able to verbalize it.

It is important to be aware of the fact that all explicit knowledge presupposes tacit components. Rolf (1995, p. 63) writes “All knowledge which is not tacit, presupposes tacit knowledge, says Polanyi”. For Polanyi, the tacit dimension is the result of pre-conceptual actions that are integrated through experience into the context. The tacit dimension represents the practical aspect of a situation.

Tacit knowledge is the practical knowledge used to perform a task, and it is also “the knowledge that is used as a tool to handle what is being focused on” (Sveiby, 1997, p. 30). Consequently, tacit knowledge in a business context is: practical, action-oriented, experience-based, context-linked and personal, but not subjective or relative.

How can tacit knowledge be typologized and linked to organizational learning?

A nurse’s clinical insight may be said to provide an example of tacit knowledge; the results of this clinical insight may be tested and revealed empirically using quality evaluation. However, the system of elements that constitute clinical insight, i.e., the tacit knowledge processes, are not possible to detect. But there are different types of tacit knowledge; some types of tacit knowledge may be possible to communicate to others as information rules of thumb and holistic causal understanding (Figure 1), while other types are very difficult to communicate as information (intuition and pattern understanding (Figure 1)).

To sum up, some types of tacit knowledge may naturally be transferred to others as information, while other types are not transferable and cannot be stored (for example, electronically). This may have consequences in organizations: for instance, if a hospital has implemented a strategy whereby all knowledge has to be stored on electronic media, this may be very harmful for patients and knowledge development in the institution, because tacit knowledge may be turned down.

Tacit knowledge is essential for success in a number of tasks, skills and professions, such as management, sales, law, software design, medicine, education, music, computing, pottery, wine testing, and in skills related to selecting fish, tea, coffee, olives, chestnuts, etc. (Marchant & Robinson, 1999; Argyris, 1999; Sheng et al., 2015; Nishinaka et al., 2015).

Furthermore, tacit knowledge is necessary when practicing certain skills such as swimming, cycling and riding. When we speak of someone having a flair for something, a gut feeling, a good nose, an inner voice, or having skills at their fingertips, then, this more often

than not concerns a type of tacit knowledge. Perhaps, another example of tacit knowledge is when we speak of a craftsman who needs to “see” the pattern in the wood when making a Steinway piano. Does the pattern in the wood affect the tone of the piano lid? Analogous to this is the importance of understanding patterns for leaders; such a skill determines the difference between a good leader and an excellent one. The excellent leader is able to use tacit knowledge strategically when he/she gains an overview through the complexity that often characterizes today’s businesses, or the intuitive leader who “knows” what is about to happen (Donate et al., 2015). We denote in Figure 1 that it is intuition and understanding of patterns which allows the excellent leader to grasp what is innovative and what wouldn’t have been realized unless he/she had created the conditions to facilitate the practical implementation of an innovation.

In addition to level of competence, tacit knowledge may be divided into two main types: specific and strategic (Wagner, 1987)². Specific tacit knowledge refers to the practical knowledge that is useful when performing a specific task here and now, usually face to face with the another person or in direct interaction with the object/instrument, etc. Strategic tacit knowledge refers to the practical knowledge that is useful when achieving long-term goals, and being able to relate current tacit knowledge in a future and broader context; hence, the term strategic tacit knowledge.

It is reasonable to assume that different tasks in which tacit knowledge is used require degrees of both specific and strategic tacit knowledge (cf. Wagner et al., 1999). We choose two professional levels: expert and competent. We make this distinction deliberately, and, thus, choose to ignore the five-level classification of novice to expert which Dreyfus and Dreyfus introduced (1986). We choose this dichotomy for simplicity, but also because we are focusing on tacit knowledge, and the novice cannot be said to possess tacit knowledge to any large degree. The novice uses essentially algorithmic rules, instructions, and so on. The competent individual is fully trained and has some experience (5-7 years) (Simon, 1987; Kahneman & Klein, 2009), but still operates at a low level of tacit knowledge, related to the knowledgeable expert with extensive experience (7-11 years) (Klein, 1998, 2003). The competent individual masters the practical aspects in the work that has to be done, but still lacks the grasp on things and situations that the knowledgeable expert has. The expert is considered to be a person with extensive practical experience within his/her field. The

² Wagner uses the terms “local tacit knowledge” and “global tacit knowledge”. We choose for reasons of appropriateness to use terms specific and strategic, without diverging from the interpretation of Wagner’s concepts.

expert is one who masters practical aspects and he/she can also explain why his/her actions are important while putting them into a larger context. Using the four concepts of specific tacit knowledge, strategic tacit knowledge, competent, and expert, we have developed a typology of tacit knowledge shown in Figure 1 below.

In the typology, we introduce four types of organizational learning: single-loop, double-loop, deuterio and paradigmatic learning. Argyris & Schön (1978, pp. 26-29) use three of the learning concepts, but not paradigmatic learning, which here is associated from Bateson (1972, p. 303)³. We have tried to link the four types of tacit knowledge to the four types of organizational learning in order to visualize the connection between tacit knowledge and organizational learning. When we explain the typology, we go further in to the links between different types of tacit knowledge and different types of organizational learning.

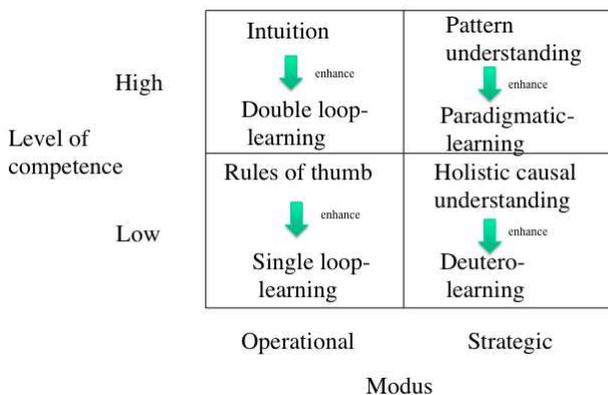


Fig. 1. Typology of tacit knowledge linked to organizational learning

We will elaborate on the different types of tacit knowledge linked to organizational learning in the following section.

Explanation of the different types of tacit knowledge and organizational learning

Rules of thumb and single loop-learning

The development of the use of rules of thumb in relation to the above figure may be said to have the following characteristics (Anzai & Simon, 1979):

- ◆ The novice first uses a method based on trial and error, resulting in many errors in relation to a set standard or performance criteria.
- ◆ On the basis of these results, which include a number or errors, the novice develops procedures for avoiding the errors, resulting in a more focused approach to problem solving.

- ◆ This results in more appropriate action being taken, based on a breakdown of the main target into various objectives.
- ◆ By organizing the various objectives, a goal-oriented action strategy is developed.
- ◆ The new strategy is structured and systematized to develop compact action procedures.

This is in line with single-loop learning. Single-loop learning is learning of rigid responses (Bateson, 1972, p. 284). This means that the same type of action later on will be comprehended in the same way.

Learning of tricks (Polanyi, 2009) is an example of single-loop learning, which looks like rules of thumb. Rules of thumb may also be developed through “learning by using” (Rosenberg, 1982).

The novice does not use rules of thumb, but rather rules. When tacit knowledge is developed in a practical context over a period of time, information is organized and structured so that the novice is gradually able to move up to a competent level (5-7 years) (Simon, 1987), but not at an expert level.

The transference of practical knowledge used by the novice rests, according to Polanyi (1946, pp. 29-30), on rules and examples. The rules are relatively easy to describe and explain to a potential beginner. This type of knowledge can be codified and implemented in various types of files, databases, etc. Tacit knowledge is based initially on such rules, but through the development of this type of knowledge, the focus shifts away from basic rules and towards being able to use certain quality criteria in action (Rolf, 1995, p. 113). When an individual has reached a competent level, he/she is able to use rules of thumb to perform the work (Wagner et al., 1999, pp. 155-183). As the individual becomes more skilled in his/her profession or with a task, the basic rules become diffuse and the individual starts to apply rules of thumb. However, one must distinguish between a rule and the conditions that must be present for the rule to work (Rolf, 1995, p. 99). A rule of thumb may be defined as “a useful principle with wide application, not intended to be strictly accurate” (Morris, 1978, p. 1134).

Rules of thumb can facilitate achievements, but they can also prevent needed change and thereby inhibit a system’s long-term survival. The effectiveness of rules of thumb in relation to tacit knowledge is, therefore, based on them being withdrawn when necessary changes are pressing.

Holistic causal understanding and deuteron-learning

The novice uses a lot of time trying to understand the causal pattern of a particular behavior, while the person with some years of experience has an overall causal understanding of the situation. The person with some years of experience is able to diagnose a situation through an immediate situational awareness.

³ Bateson uses the concept of “calibration”. This concept may lead to unwanted associations, therefore, we introduce paradigmatic learning as we think cover Batesons concept of calibration.

The structure of tacit knowledge concerns relations between parts, details and rules – the particular *from which* our attention is directed, to the totality *to which* our attention is directed. This is also the way in which the system is composed; a relationship between the parts that constitute the whole. The parts are subsidiary in relation to our attention, but it is these that constitute our starting point. That which is primary, or that which is the focus of our attention, is the whole. Thus, the structure of the system is analogous to the structure of tacit knowledge. Attention is directed from the parts to the whole (Scott, 1996, p. 52). Holistic causal understanding is, it might be said, a part-whole perspective, or context understanding (Augier et al., 2001), not unlike the way deuterio-learning operates.

Deuterio-learning is related to immediate context understanding (Bateson, 1972, p. 294). This type of learning is linked to the competence of discriminating between different contexts in a given situation. Bateson writes about this type of learning: “a corrective change in the set of alternatives from which choice is made, or it is a change in how sequences of experience is punctuated” (Bateson, 1972, p. 294). This may be looked upon as an intelligent response upon the different contexts which can happen in a given situation. Context understanding may also be thought of as a punctuation process. Bateson writes about this process: “We suggest that what is learned – is a way of punctuating events. But a way of punctuating is not true or false. It is like a picture seen in an inkblot, it is neither true nor false. It is only a way of seeing the inkblot” (Bateson, 1972, p. 300).

Deuterio-learning may also be looked upon as a way to redefine a problem. Contrasted to problem-solutions, deuterio-learning focus problem-definition and a new framing of the problem. In this way, deuterio-learning may be understood as a foundation for innovation.

If one observes the parts (the particular) separately, then, one will lose sight of the pattern. In other words, if one changes one’s focal attention to a specific part of the whole, and, then, considers this part as if it were the whole, then, the fragments are considered as representing the whole.

It is possible to make distinctions in the phenomenon we have under our focal attention, and, thus, create information. However, it is difficult to make distinctions of the phenomenon we have under our subsidiary attention, because it is difficult to create information directly from data. The focal awareness may be seen as a field of data where we know the code and can, therefore, systematize and structure it. We can create knowledge in such fields, which we cannot with regard to the phenomenon that we have under our subsidiary attention, because the code is not known.

Subsidiary awareness and focal awareness are mutually exclusive activities. For instance, if a violin player shifts attention from the piece he/she is playing and interpreting to observing how he/she is holding the violin and playing the notes with his fingers, then, he/she will most probably lose focus and be unable to play the piece in question skilfully (Polanyi, 1958, p. 56). Focal attention is conscious, while subsidiary attention may take on varying degrees of consciousness (Polanyi, 1958, p. 92). For instance, we may be conscious of our knee if we feel discomfort or pain when running. In the same way as primary and secondary attention is something we live in and live with, this also applies to our assumptions and beliefs, says Polanyi: “When we accept a certain set of pre-suppositions and use them as our interpretative framework, we may be said to dwell in them as we do in our own body” (Polanyi, 1958, p. 60).

The novice has his/her focal attention, for example, on a hammer, while the expert has his/her focal attention on the nail. The example is intended to illustrate that focal attention shifts as a function of experience over a period of time.

It seems that basic rules, by integrating with each other, create complex system behavior, or according to Polanyi: “... the aim of a skilful performance is achieved by the observance of a set of rules which are not known as such to the person following them” (Polanyi, 1958, p. 49), and “... the relationship of the particulars jointly forming a whole may be ineffable, even though all the particulars are explicitly specifiable” (Polanyi, 1958, p. 88).

Intuition and double-loop learning

A cognitive strategy on two levels seems to operate when developing tacit knowledge based on “learning by doing” (Arrow, 1962). On the lower level, automatic perceptual motor skills are developed, linking perception of the current state directly to an appropriate action strategy. On the upper level, errors are continuously revealed in relation to specific performance aims in an area of control. Therefore, the upper and lower limits are specified or developed through practice. Future conditions are anticipated and checked through practice against previous actions. New strategies are developed continuously in relation to new limits placed on situations in practice. A general procedure is, thus, gradually developed where the player ceases to connect to the lower level where the automatic perceptual skills were developed. This is what constitutes intuition as a type of tacit knowledge; it is woven into an individual’s pattern of behavior, which can’t, or can but with great difficulty, be verbalized (Klein, 2003, pp. 26-28).

Let's consider a thought experiment. If a leader asks one of his/her experts, who have developed an innovative idea mainly based on tacit knowledge, to document the idea so that he/she has something concrete to submit to the management and directors, this would most likely reduce an idea of perhaps a high degree of complexity to something much simpler. In other words, the knowledge that the idea is based on will be levelled out – literally, because the whole is reduced to a small part, which is, then, presented and documented using explicit knowledge. This, then, results in the expert's innovative ideas being reduced to the skill level of the novice, because the novice mainly deals with explicit knowledge (Klein, 2003, pp. 26-28, 304-305).

Double-loop learning is thought of as learning different contexts, i.e., to be able to make a distinction between them. Bateson writes about double-loop learning: "the cases in which an entity gives at time 2 a different response from what it gave at time 1" (Bateson, 1972, p. 283). The same stimulus will in double-loop learning give different answers, because the person comprehends the context.

Understanding patterns and paradigmatic learning

The expert has a better sense of the information that is contained in a pattern than a novice or beginner. The expert is more skilled at decoding patterns, and patterns which connect with other patterns. He/she is, thus, able to deal with complex situations more skilfully than a novice (Dreyfus & Dreyfus, 1986). Understanding of patterns is closely related to intuition (Welsh & Lyons, 2001). A pattern is relatively stable over a period of time and may, therefore, be considered strategic. One type of pattern understanding that most people can relate to is to sense the mood of others by just by a glance at their facial expression. Facial expression, body language and non-verbal communication may be used to interpret a pattern and relate to a situation accordingly.

Pattern understanding results from the collection of a large number of facts and, then, interpreting these over a period of time into a more or less stable structure. In other words, the expert uses patterns in a target-oriented way. However, pattern development is something else; the development of patterns is more comparable to an induction process, while understanding patterns may be seen as a strategic process that occurs emergently⁴ in the individual (Akbar & Mandurah, 2014, pp. 759-752).

⁴ Emergent means here: "Let S be a system with composition A, i.e., the various components in addition to the way they are composed. If P is a property of S, P is emergent with regard to A, if and only if no components in A possess P; otherwise, P is to be regarded as a resulting property with regards to A" (Bunge, 1977, p. 97).

Pattern understanding may be linked to paradigmatic learning in the following way. In paradigmatic learning, there is a total reorganizing of a person's way of thinking.

Bateson writes about this type of learning: "a profound reorganization of character" (Bateson, 1972, p. 303), not unlike changing of behavior in response to pattern understanding.

How do different types of tacit knowledge and organizational learning influence innovation?

Tacit knowledge, says Fleck (1996, p. 119): "is the most crucial in restricting the social distribution of knowledge, and has been widely identified as a major constraint on the diffusion of both science and technology". This is also emphasized by Basalla (1988). On the other hand, tacit knowledge is a sort of organizational 'immune' system that prevents imitation by other social systems and promotes continuous improvement (Johannessen & Olsen, 2011). The function of tacit knowledge is, then, both conservative, i.e., stabilizing the system, and also acts as a guard against imitation.

However, there are two types of tacit knowledge: rules of thumb and holistic causal understanding, both of which can slow down innovation (Johannessen & Olsen, 2011). This is because these types are closely linked to the rules, procedures and analysis; they are, thus, bound by the grip of history and experience, and operate as mechanisms that slow down the field of change.

Proposition 1: Rules of thumb and single-loop learning inhibit innovation, but promote continuous improvement.

Proposition 2: Holistic causal understanding and deuterio-learning inhibit innovation, but promote continuous improvement.

Intuition and pattern understanding encourage the innovation process. This is because these two types are connected to creativity and contextual understanding, dimensions that are prerequisites for innovation.

Proposition 3: Intuition and double loop learning promote innovation.

Proposition 4: Pattern understanding and paradigmatic learning promote innovation.

Analysis and implications

Tacit knowledge is bounded by a negative feedback factor, thus, it promotes innovation only to a certain level and, then, declines. Solow (1997, p. 25) denotes this phenomenon as "bounded learning by doing". We, however, go a step further and assume that certain types of tacit knowledge have this effect on innovation.

Learning by doing, using and experimenting is here seen as generalized tacit knowledge. The more this generalized tacit knowledge is conservative, the more it is bounded by the negative feedback factor, and vice versa. The negative feedback factor functions here in a way that stabilizes the system and hinders innovation to change it. Imitation is part of continuous improvement and innovation, but only to a certain degree, because tacit knowledge is difficult to imitate. Tacit knowledge, then, functions as a guard against imitation.

The generalized tacit knowledge in organizations can raise productivity to a higher level compared to competitors, because it can't be purchased in the market; it has to be developed inside an organization, as a general rule. Thus, tacit knowledge may be said to have three faces: one conservative that limits the continuous improvement process, a second that guards an organization against imitation, and a third that promotes innovation.

The greater the intensity in the process of learning by doing, using and experimenting, the greater the productivity gained from the processes in an organization. Thus, tacit knowledge plays a central role in the productivity of firms, both in steady state situations and even more so in a hypercompetitive market.

Since continuous improvements, innovations and the implementation of new technologies occur at different rates, they are connected non-linearly. The turbulent situation exists not only in the hypercompetitive market, but also inside organizations. To dampen internal turbulence, the conservative element of tacit knowledge is in operation.

The rate of productivity is limited by the rate of technological progress, continuous improvements and innovations. Continuous improvement, however, is linked to the stock of human capital (knowledge).

In this paper, we have argued that certain types of tacit knowledge and organizational learning, inhibit innovation, because they are related to a conservative element of tacit knowledge. However, these types of tacit knowledge and organizational learning can promote continuous improvements.

In the article, the types of tacit knowledge that we have termed intuition and understanding of patterns may be said to promote innovation, because they are connected to double-loop learning and paradigmatic learning creativity, which are linked to contextual understanding and deep specialization; dimensions that are prerequisites for innovation.

Understood in this way, the typology of tacit knowledge and organizational learning (Figure 1) is an active tool for managing organizations towards, respectively, continuous improvement and innovation.

Conclusion

The typology (Figure 1) and the propositions may be the answer to our research question. Used by management, it can help to clarify the information vacuum that exists in strategic processes between decision makers and those who possess various kinds of tacit knowledge. If one, in the context of strategy, does not pay attention to tacit knowledge, but bases activities on documented explicit knowledge, one risks using the knowledge of novices as a premise and not the knowledge of experts. It, thus, reduces the organization's forum of knowledge, which becomes concerned mainly with the novice's level of knowledge. In this context, one may say that explicit knowledge is an island surrounded by and based on tacit knowledge processes and tacit knowledge. The statement that one is no stronger than one's weakest link is realized with full effect in such a strategy. The organization employs in this way a small part of the knowledge that is available within the organization in its strategic processes, and becomes worse off than it really needs to be. One could say that organizations in this way are dumber than they have to be.

For Polanyi, tacit knowledge processes are the dominant principle of all knowledge. Tacit knowledge processes rely on focus and perception of a system of details which we cannot specify or test scientifically. However, this does not apply to tacit knowledge, resulting from tacit knowledge processes. Tacit knowledge is objective in the sense that it may be tested with regard to its consequences, although the tacit knowledge processes may not be tested. The logic of this is as follows: if knowledge has a function, it must also have an effect, and if it has an effect, then, it must be possible to discover this effect.

Tacit knowledge can, in some cases, be a key barrier to innovation, such as when an organization introduces a new production method or when a new product is being developed. This is because tacit knowledge usually is part of a long term learning process in a specific context, embodied in the structure of thinking, the way of thinking and, consequently, functioning as a conservative element with regard to innovation.

Further research

We have suggested the direction of the relationships between the various types of tacit knowledge and innovation. A larger empirical investigation is obviously required to develop and test hypothesis on the basis of the propositions that is suggested.

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