



ILKKA VIRTANEN

How Tacit Is Tacit Knowledge?

Polanyi's theory of knowledge and its application
in the knowledge management theories



ACADEMIC DISSERTATION

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UNIVERSITY OF TAMPERE

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Abstract

This research discusses the concept of knowledge, particularly the concept of tacit knowledge, from two perspectives: firstly, the meaning of these concepts in Michael Polanyi's theory of knowledge from which the concept of tacit knowledge originates, and secondly, the meaning of these concepts in the knowledge management literature in which the concept of tacit knowledge has gained a significant role. Despite the important role of the concept of tacit knowledge in the knowledge management literature, it has however remained superficially studied, controversial and ambiguous concept in the research of the field. This is, on the one hand, due to the abstract nature of Polanyi's theory, and on the other hand due to the fact that the concept has been transferred in a rather straightforward way to a different kind of epistemological context. Particularly the idea of sharing of tacit knowledge that has been emphasized as an important factor from the perspective of organizations' competitive advantage in the knowledge management literature can be considered a problematic conception from the viewpoint of Polanyi's theory. In respect of the literature of knowledge management the object of analysis is particularly Ikujiro Nonaka and Hirotaka Takeuchi's conception of knowledge introduced in their theory of knowledge creation; it is not only one of the most significant theories of knowledge management, but also the most important application of Polanyi's theory in the literature of the field.

This research has two objectives, the more important of which is the enhancement of the understanding concerning Polanyi's theory of knowledge; Polanyi's theory is both clarified and expanded in this research. Polanyi's theory is approached from the perspective of cognitive science by explaining the central concepts of the theory and the examples of tacit knowing that Polanyi used in the light of recent findings in cognitive science. On the other hand, this research critically discusses the use of the concept of tacit knowledge particularly in the part of the knowledge management literature that stresses the importance of explication of tacit knowledge. This research shows that this widely adopted conception of knowledge in the mainstream knowledge management literature is internally contradictory. Moreover, it seems to imply a simplified conception of human cognition. Hence, the role of tacit

knowledge in human action seems to be different from what has been suggested in these theories of knowledge management.

Knowledge management is relatively young and developing discipline, and hence, the innermost purpose of the both objectives mentioned above is to contribute to the development of the concept of knowledge that still is not well-established in the field.

Tiivistelmä

Tässä tutkimuksessa tarkastellaan tiedon, erityisesti niin sanotun hiljaisen tiedon, käsitettä kahdesta näkökulmasta: käsitteiden merkitystä hiljaisen tiedon käsitteen luojaan, Michael Polanyin, tietoteoriassa, sekä toisaalta niiden merkitystä 1990-luvun luvun puolessavälissä yleistyneessä tietojohdamisen keskustelussa, jossa hiljaisen tiedon käsite on nostettu keskeiseen asemaan. Tärkeästä roolistaan huolimatta hiljainen tieto on kuitenkin tietojohdamisen kirjallisuudessa jäänyt pinnallisesti tutkituksi, ristiriitaiseksi ja moniselitteiseksi käsitteeksi. Tämä johtuu yhtäältä Polanyin teorian vaikeaselkoisuudesta, ja toisaalta siitä, että käsite on suhteellisen suoraviivaisesti siirretty erilaiseen tietoteoreettiseen kontekstiin. Erityisesti hiljaisen tiedon jakamista, jota tietojohdamisen kirjallisuudessa on korostettu tärkeänä tekijänä organisaatioiden kilpailukykyyn kannalta, voidaan pitää Polanyin alkuperäisen teorian näkökulmasta ongelmallisena ajatuksena. Tietojohdamisen kirjallisuuden analyysi liittyy erityisesti tässä tutkimuksessa japanilaisten Ikujiro Nonakan ja Hirotake Takeuchin käsitykseen tiedosta heidän esittämässään tiedon luonnin teoriassa, joka on yksi tietojohdamisen merkittävimmistä teorioista, mutta myös Polanyin teorian tärkein sovellus alueen kirjallisuudessa.

Tutkimuksella on kaksi päätavoitetta, joista keskeisempi on Polanyin tietoteoriaa koskevan ymmärryksen lisääminen. Tässä työssä sekä selitetään että laajennetaan Polanyin tietoteoriaa. Teoriaa lähestytään kognitiotieteen näkökulmasta selittämällä Polanyin teoriassaan käyttämää käsitteistöä ja esimerkkejä hiljaisesta tietämisestä viimeaikaisten kognitiotieteen tutkimustulosten valossa. Toisaalta työssä tarkastellaan kriittisesti hiljaisen tiedon käsitteen käyttöä erityisesti tietojohdamisen kirjallisuuden osassa, joka korostaa hiljaisen tiedon eksplikoinnin tärkeyttä. Tutkimus osoittaa, että tietojohdamisen kirjallisuuden valtavirrassa yleisesti omaksuttu tietokäsitys on tietoteoreettisesta näkökulmasta sisäisesti ristiriitainen ja sen taustalta paljastuu yksinkertaistettu käsitys ihmisen kognitiosta. Niinpä hiljaisen tiedon rooli ihmisen toiminnassa näyttää olevan erilainen kuin mitä edellä mainituissa tietojohdamisen teorioissa on esitetty.

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Tampere, April 2014
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1 Introduction

Although study of knowledge has almost as long roots as the known history of mankind, knowledge has gained particularly central role in the current economic reality during the past two decades; knowledge has become a differentiating competitive factor for individuals, corporations, and nations (Wiig 1997). It has been argued that knowledge is a fundamental source of power in modern society because it represents the most cost-effective means to generate productivity (e.g. Toffler 1990). The ones that possess the most adequate knowledge have also the best possibility to gain the best results. Hence, the possession of the most resources does not guarantee success, but the most effective use of available resources. This line of thinking has spread rapidly in the organizational context since the early 1990's, and as a result, knowledge¹ is considered as the key asset leading to economic progress, competitive advantage and business success in organizations.

Knowledge management (KM), a multi-disciplined approach aimed at designing and influencing processes of making efficient use of knowledge, burst into bloom in this knowledge-centric atmosphere. KM is a relatively broad term and it does not have a generally agreed definition, but it is typically related to systematically specified process for acquiring, organizing, sustaining, applying and sharing knowledge to enhance organizational performance and to provide competitive advantage by creation of new knowledge (see e.g. Alavi & Leidner 2001, Davenport & Prusak 1998). KM has been one of the most influential organizational practices since the early 1990's (e.g. Lucier & Torsilieri 2001) and it has become a major management trend in organizations (Zorn & Taylor 2003).

At the early years the focus of KM was on information and "explicit" knowledge, that is, knowledge that could be saved, stored, processed and accessed in information systems and in novel ICT-solutions (see e.g. Tuomi 2002). It was soon discovered,

¹ There is not a commonly agreed definition of knowledge, and its characterization often depends on the discipline and context it is used in. Knowledge is, however, traditionally defined as 'justified true belief' (see e.g. Pollock & Cruz 1999). This definition has been shown to be insufficient (e.g. in Gettier 1963), but it can still be considered as some kind of starting point for discussions concerning the nature of knowledge. Issues related to definition of knowledge will be discussed more in detail in the next chapter.

however, that explicit knowledge did not have much to do with individual know-how, learning and innovations that in the end were the most valuable knowledge-processes for the organizations that intended to differentiate themselves from their competitors. Hence, the information-processing view that focused on explicit forms of knowledge did not support the creation of knowledge, because it missed creative dialogue, shared experiences and collective reflection (Nonaka 1994, Nonaka & Takeuchi 1995). The idea was that organizations could create value from knowledge assets within them. As a result the focus of KM has shifted from its early years' ICT-driven knowledge acquisition, storage and sharing to social learning and knowledge creation (e.g. Koenig 2002). One of the most significant initiators of this change was Japanese theorists Ikujiro Nonaka and Hirotaka Takeuchi's theory of knowledge creation².

In the 1995 Nonaka and Takeuchi presented their theory of organizational knowledge creation, according to which creation of knowledge was vitally important to modern organizations. Drawing on Michael Polanyi's philosophy, they explained that knowledge creation was based on tacit knowledge, knowledge difficult to articulate and embodied in human action. The core of the idea of creation of knowledge was the mobilization of tacit knowledge by converting it to explicit knowledge (Nonaka & Takeuchi 1995). This externalization of tacit knowledge (also referred as explication and codification of tacit knowledge) refers to the articulation of one's tacit knowledge (ideas, beliefs, intuitions etc.) into words. Since the publication of Nonaka and Takeuchi's theory externalization has become one of the most discussed KM processes (Maasdorp 2007a). Moreover, the epistemological foundation of Nonaka and Takeuchi's theory, namely the classification of knowledge into tacit and explicit, has gained a dominant role as the basis for epistemology in the KM theory (Maasdorp 2007a, Stacey 2001).

The concept of tacit knowledge is originally adopted from Michael Polanyi's theory of knowledge. The main idea of Polanyi's theory is that an act of knowing can never be fully explicit because it cannot be reduced to the elements upon which it is based; the meaning and the acceptance of an act of knowing is dependent on elements known only tacitly by the knower (Polanyi 1966). Polanyi adverts to knowledge firming processes prior to the conscious belief. As such, knower's prior experiences affect what he knows.

² While Nonaka is the main author of the theory of knowledge creation based on his publications in 1991 and 1994, Nonaka's theory has gained its paradigmatic status via the book published with Takeuchi in 1995 (Gourlay 2006).

Polanyi's philosophy cannot be strictly subsumed under any philosophical paradigm (see e.g. Gelwick 1996, Prosch 1986). He however draws from phenomenological tradition, and has important linkages particularly to Merleau-Ponty's and Heidegger's philosophy. On the other hand, Polanyi's philosophy is essentially critique towards positivist philosophy of science and objectivist theory of knowledge. Polanyi uses the term 'objectivism' in a relative broad way referring to an epistemological view that denies (or at least ignores) the personal participation of the knower in an act of knowing. He saw the core of objectivism embodied in positivism³ (Polanyi 1958).

Since the publication of Nonaka and Takeuchi's theory of knowledge creation tacit knowledge has become one of the most fundamental concepts of KM literature. However, even a brief literature review of the subject area demonstrates that different authors interpret and understand the concept in different ways. This is problematic because, on the one hand, tacit knowledge is one of the grounding concepts of KM literature, but on the other hand, the concept is not unequivocal. For this reason the concept of tacit knowledge often seems to raise more questions than provide solutions in the KM literature. Moreover, according to Polanyi's view tacit knowledge cannot be articulated. Yet the articulation of tacit knowledge is considered as a basic premise in the KM theory. This contradiction is obvious and significant, yet many times ignored in the literature, which suggests that the subject area is not adequately studied.

Although the problems are at least partly related to the young age of the field of KM, I argue that epistemological and cognitive aspects of knowing have been treated too superficially in the KM literature. The development of successful knowledge management practices requires solid theoretical background and further development of the central concepts that are under investigation. Indeed, the term 'knowledge management' has been questioned as an umbrella term for a variety of organizational activities, none of which are actually concerned with the management of knowledge (Wilson 2002). Alvesson and Kärreman (2001) remark that KM is more likely to operate as a practice for managing people or information than a practice focused on facilitation of knowledge creation. The critics argue that particularly the conception of knowledge is too broad, or the use of the term 'knowledge' actually refers to information (e.g. Alvesson & Kärreman 2001, Wilson

³ The roots of positivism are in the 19th century, in Auguste Comte's philosophy. The positivist tradition has continued later by logical empiricism, whose core was the Vienna Circle, a group of early twentieth century philosophers. It should be noted that the dominance of positivism in philosophy of science has ended for decades ago, and it has currently mainly historical value, although of very significant kind (Caldwell 1980). The term positivism nonetheless still lives in the terminology of special sciences, and is used also in the KM literature.

2002, Donaldson 2001). A plausible theory, and a scientific discipline even less, cannot be based on fuzzy concepts.

With this research I seek to contribute to the discussion concerning the nature of knowledge in the context of KM. Hence, the focus is more on 'knowledge' than on its 'management'. The central objectives of this research are 1) to clarify epistemological, cognitive and ontological foundations of Polanyi's conception of tacit knowledge, and 2) based on the results of previous objective, to discuss and evaluate the use of the concept of tacit knowledge in the KM literature in relation to Polanyi's conception.

This research is a theoretical basic research. The primary research methods used in this research are analysis, synthesis and argumentation. My starting point is Polanyi's theory of knowledge. I seek to broaden the scope of Polanyi's theory by considering it from the perspective of cognitive science. A grounding assumption made in this research is that knowing is, before anything, a cognitive phenomenon whose understanding (and further application) is not possible if its emergence, function and cognitive basis in a deeper level are bypassed and it is only characterized superficially.

As a result of this research I argue that Polanyi's philosophy concerning human mind and knowledge is still relevant and in line with the knowledge that cognitive sciences of the 21st century have provided. Tacit knowledge is mainly related to formation of focal belief, and automated, unconscious processes. I claim that explication of tacit knowledge is not possible in the way it is presented in the KM literature (e.g. in Nonaka & Takeuchi 1995, von Krogh et al 2000, Kikoski & Kikoski 2004). The conception of knowledge on which the contemporary KM theory is based on is problematic in the sense that combining Polanyi's view on knowledge to a more objectivist theory of knowledge is shown to lead to an internally contradictory theory of knowledge. Moreover, the conception of externalization of tacit knowledge seems to imply a form of language dominance view on mind, which in turn represents a simplified conception of cognition. In conclusion, although all knowing is based on tacit knowledge, it is essentially unmanageable, and its role in knowledge creation is different from what has been presented in the mainstream KM literature. The critical approach naturally includes the responsibility to suggest justified corrections that hopefully provoke further discussion that contributes to the development of the field.

This research it belongs to the realm of information sciences, although it has strong philosophic tone. I end this chapter by briefly explaining why the subject area is important from the viewpoint of information sciences.

Data⁴, information⁵ and knowledge are fundamental concepts in information sciences. Although the study of input, storage, processing, and output of particularly data and information are in the heart of computer science, such important areas as data mining and knowledge discovery address also methodologies for the extraction of useful knowledge from data. It is often suggested in the literature that we proceed from the data to information, and further from information to knowledge. Hence, information is defined typically in terms of data, and knowledge in terms of information (Rowley 2007). This hierarchy creates impression that knowledge is a phenomenon that only appears in the higher levels of any system and is hardly involved in the processing of data and information. The impression is at least partly simplified because, in the first place, it is knowledge that must define which is the data to start with (see e.g. Tuomi 2000).

According to Floridi (2011) many information science theorists have recently adopted the general definition of information, according to which *I* is an instance of information if and only if:

1. *I* consists of one or more data;
2. the data in *I* are well-formed (i.e. the data is clustered together according to the syntax that govern the chosen system);
3. the well-formed data in *I* are meaningful (i.e. the data must comply with the semantics of the chosen system).

The second requirement of the definition suggests that in the formation of information from data the syntax of the chosen system must be initially known in order to form the data well (as well as the semantics in line with the third requirement); we have to know how the information should be structured for the purposes of the input of the data to the system. In other words, in this phase we face the problem of the representation of information because, on the one hand, the information must be transformed in the form or structure that enables its automatic processing, but on the other hand, it still must preserve the same content in this new form of representation. Finally, we have to possess knowledge of what is the most adequate way to process the data/information. In sum, all these processes necessarily

⁴ Data is typically defined as a set of discrete, objective facts about events as structured records of transactions (e.g. Davenport & Prusak 1998).

⁵ Information is typically defined as data that has been analyzed, displayed and is communicated through spoken language, graphic displays, or numeric tables (e.g. Dixon 2000), or simply data that has been given a context (e.g. von Krogh et al 2000, Amidon 1997).

require lots of cognitive work, design and especially knowledge of the subject area. Hence, knowledge is not only the basis of system design in computer science, but it can be associated with the design and development of any system. In fact, knowledge seems to be the starting point of any human goal-directed behavior, and in this sense the subject area of this research is universal.

The structure of the thesis is following: In Chapter 2 I introduce the theoretical background on which the research operates, namely Polanyi's epistemology and Nonaka and Takeuchi's conception of knowledge including the idea of externalization of tacit knowledge. In the Chapter 3 I present the research questions and the factors that have influenced them. Chapter 4 discusses the chosen methodology used in this research and explains how it is carried out. In chapter 5 I introduce briefly the original research papers, the themes they address and their contributions. Chapter 6 outlines the most important results, and chapter 7 the selected contributions of this research. In Chapter 8 I discuss the general implications of this research, its limitations and also future research directions. The conclusions are presented in Chapter 9.

2 Theoretical Background

In this chapter I introduce briefly the two most important theoretical starting points from the perspective of this research; first, Polanyi's epistemology from which the concept of tacit knowledge is originally adopted from, and second, Nonaka and Takeuchi's conception of knowledge presented in their theory of knowledge creation to which also the conception of externalization of tacit knowledge is related. Before that, I begin with a brief general discussion of knowledge and epistemology.

Discussions related to knowledge appear as early as in the philosophical works of Ancient Greek. Already Plato speculated that true belief and a rational explanation for holding such a belief were the conditions that must be satisfied in order for one to claim possessing knowledge. This account, namely knowledge defined as "justified true belief" has come down to modern times and is in general called as classical, or traditional definition of knowledge (see e.g. Niiniluoto 1996). Pollock and Cruz (1999) remark that although consensus is rare in philosophy, the classical definition of knowledge had exceptionally unquestionable role in philosophy until 1960's. Edmund Gettier (1963) was the first to show that a justified true belief can be false, suggesting that the classical definition of knowledge was inadequate. After this there have been attempts to supplement and modify the definition, but no indisputable solutions have been found (Pollock & Cruz 1999). Although there is no generally accepted consensus about the definition of knowledge, the classical definition of knowledge is generally some kind of a basis or at least an important point of reference for any epistemological considerations.

Different authors have classified knowledge to different types in order to clarify the nature of the concept. Bertrand Russell (1912) presented the distinction between 'knowledge by description' and 'knowledge by acquaintance'. Russell argued that knowledge by acquaintance meant having acquaintance with anything of which one is directly aware, without the intermediary of any process of inference or any knowledge of truths. Hence, acquaintance knowledge is the kind of knowledge we claim when we are familiar with for example a person or a thing. By comparison, knowledge by description referred to propositional knowledge, or 'knowledge that'. Hence, knowledge by description means facts that can be stated as declarative sentences or propositions.

Gilbert Ryle (1949) is also credited with stressing the distinction between ‘knowing how’ and ‘knowing that’; whereas ‘knowing that’ referred to propositional knowledge discussed above, ‘knowing how’ referred to knowledge of how to do something. This also corresponds to the classification of knowledge into declarative and procedural that is often made in the fields of artificial intelligence and psychology (see e.g. Anderson 1981). Hence, it is common in philosophy to distinguish among three kinds of knowledge:

1. propositional/declarative/’knowledge that’,
2. procedural/’knowledge how, and
3. ‘knowledge by acquaintance’ (Fantl 2014).

Epistemology refers to the study of nature and scope of knowledge, and it is one of the main areas of philosophy (Pollock & Cruz 1999). Bunge (1974) characterizes epistemology as a collection of opinions concerning human knowledge. Indeed, epistemology is divided to different directions based on, for instance, the position which is taken concerning possible sources of knowledge. The classical division is made between empiricism and rationalism; while empiricism stresses the role of experience based on perceptual observations in knowledge acquisition, according to rationalism knowledge is acquired by a priori processes. Constructivism, in turn, claims that knowledge is constructed based on human perceptions and former experiences, and has thus a significant subjective aspect.

In the tradition of philosophy epistemology is often considered as doctrine concerning particularly the justification of knowledge (Pollock & Cruz 1999). Therefore theories of knowledge are also classified basing on how they deal with the justification of beliefs; what kind of factors are necessary/sufficient to justify our beliefs.

The distinctions made above are examples to illustrate the multifacedness of epistemological considerations. Another significant aspect is the stance that different theories take on the role of the knowing subject. At one extreme knowledge is considered as objective facts separated from people (objectivism). At another extreme the primacy is given to human consciousness instead of objective reality; reality is generated in the human mind, which makes knowledge of it always subjective (subjectivism). The objective-subjective distinction is important in the context of this research, because both Polanyi, and Nonaka and Takeuchi have

sought to combine these opposite positions. Next I introduce these two theoretical entities, first Polanyi's theory of knowledge, and then Nonaka and Takeuchi's conception of knowledge presented in the theory of knowledge creation.

2.1 Polanyi's Theory of Knowledge

Despite the crucial position of the concept of tacit knowledge in the field of KM, there seems to be only scarce interest concerning Polanyi's philosophy in the literature (see e.g. Mooradian 2005, Tsoukas 2003, Grant 2007). Indeed, Polanyi is typically mentioned only as an original source of the concept of tacit knowledge with no further discussion of his philosophy. From the scientific perspective this is potentially harmful, because scientific concepts can rarely be used properly if they are taken out of their context without further understanding of the theoretical entirety, "the big picture", behind them. For this reason I see crucial to place Polanyi's theory to its historical context and look further back to the roots and the motivating factors of his thinking in order to understand the emergence of his ideas concerning knowledge.

2.1.1 The Emergence of Polanyi's Philosophical View

Polanyi (1891-1976) grew up in Hungary during the turn of the century, where he also started his professional career as a medical doctor. He immigrated to Germany in 1919 and changed there to the career of physical chemist, which had always been his primary interest (Prosch 1986). The economic dislocation caused by the First World War, the great inflation and the rising unemployment made Polanyi pay increasingly attention also to social and economic issues. Moreover, both Nazis and Communists threatened Germany at that time, and Polanyi watched close the development and workings of these two totalitarian systems. Due to his Jewish roots he was finally forced to leave Germany in the early 1930's and accordingly, he went to England where he joined the University of Manchester as a professor of physical chemistry (Prosch 1986).

Polanyi was particularly concerned of the views of communist theorists who claimed that pure science was a morbid symptom of a class society; according to communist view science pursued for its own sake would disappear (Polanyi 1966). Polanyi was concerned of these strengthening political movements that threatened

the liberty of individuals and independent scientific thought. According to Polanyi (1958) the freedom to uncover theoretically important truths was indispensable for science. Polanyi saw a clear connection between political extremist views and nihilism (Prosch 1986). Nihilism, was related to objectivist philosophy of science, Polanyi (1962) claimed. Since moral principles, justice and mercy could not be demonstrated in terms of scientific objectivism they were to become substituted by reason and philosophically less vulnerable ideals.

Polanyi believed that a terribly mistaken understanding of what science was had alienated men from their own powers of understanding the world (Scott 1985). He saw that current philosophic views of science and knowledge fuelled authoritarian and utilitarian movements that threatened social freedom. Hence, defending freedom in science meant defending freedom in general. Accordingly, Polanyi found himself increasingly involved in problems regarding the relation of science to society; he was convinced that the existence of free society and science rested upon freely held beliefs in ideals and principles that could not only be proved but could not even be made wholly explicit (Prosch 1986). According to Prosch, this is the way that philosopher Polanyi gradually emerged.

The target of Polanyi's most important work, "Personal knowledge – Towards a Post-Critical Philosophy", is what Polanyi calls 'objectivism': the assumption that genuine knowledge can result only from an impersonal operation of explicit rules and that truth depends on verifying observation (Allen 1990).

Objectivism presupposed that

1. there are objective state of affairs that are independent of human mind;
2. the method of accurate observation immediately given sense data without reference to personal participation, expectations, values or hopes is of the utmost importance;
3. the final arbiter of scientific theory is a controlled experiment (Prosch 1986).

Objectivism further presupposed that perfectly objective knowledge would gradually emerge by means of these formal criteria and exact logical structure of scientific inquiry. But Polanyi (1962, p. 254) remarked:

"For we can derive rules for observation and verification only from examples of factual statements that we have accepted as true before we knew these rules; and in the end the application of our rules will necessarily fall back once more on factual observations, the acceptance of which is an act of personal judgment, unguided by any explicit rules."

Hence, the criteria for scientific and logical knowledge claims cannot themselves be established by means of explicit rationalization (Gill 2000).

Polanyi could not accept objectivism/positivism since it rejected intuitional attempts to gain knowledge and claimed that all the unverifiable sentences were meaningless (the principle of verification in logical empiricism). He concluded that the prevailing conception of science that was based on the disjunction of subjectivity and objectivity was wrong. Instead, he argued that into every act of knowing there enters a personal contribution of the knowing subject, which is a vital component of knowledge (Polanyi 1962). Hence, science could not meet the objectivist ideal because its rules and methods could not be explicitly stated but required personal engagement of the scientist himself (Allen 1990). More specifically, he argued that the entire scientific enterprise presupposed

1. a belief that knowledge of reality was possible;
2. a personal commitment to the search for truth;
3. an affirmation of the reliability of human cognitive capacities;
4. a reliance on the imagination (e.g. for the creation of hypotheses);
5. an acknowledgement that that scientific truth was the result of social interaction and convention (Gill 2000).

Modern man's penchant for exactitude and precise statements was misleading in the sense that, according to Polanyi, human thought functioned by quite different principles (Prosch 1986). This is the idea whose development gradually became the primary interest to Polanyi, and that was the guiding principle in his epistemology.

2.1.2 Discovery

Polanyi (1962) was convinced that the most significant part of science was discovery⁶. Discovery did not, however, fit well objectivist view since the objectivist conception of science stressed the importance of verification and proof. Verification referred to a principle, according to which a sentence had empirical meaning only if

⁶ Most philosophical discussions of scientific discoveries focus on the generation of new hypotheses that explain phenomena and the observations related to them (Schickore 2014). However, the concept is not unequivocal, because it is used to refer to both the outcome and the procedure of inquiry. To Polanyi discovery seem to have meant a successful scientific inquiry in general—as Polanyi explained it, it meant to see things that no human being had seen before (Polanyi 1962).

it was capable of complete verification by observational evidence (Caldwell 1980). An acceptable proof for any scientific statement had to be either logical or empirical. Hence, Polanyi (1962) claimed that discovery had been either ignored or misinterpreted in modern theories of science (within Polanyi's time this idea was novel, nowadays this confrontation is somewhat obsolete). Polanyi believed that the better the process of discovery of new truths was understood, the better understanding of science would emerge. Polanyi had worked for years among the men who were pioneering radically new understanding of universe, such as Albert Einstein, which had apparently affected his view (Scott 1985). Einstein (1935, p. 125) wrote:

“The supreme task of the physicist is the search of those highly universal laws from which the picture of the world can be obtained by pure deduction. There is no logical path leading to these laws. They are only to be reach by intuition, based upon something like an intellectual love.”

Polanyi (1962) remarked that things are not labeled as ‘evidence’ in nature, but are accepted as such by observers. Thus, discovery was essentially about scientist's skill of seeing which matters are significant. In other words,

“Theories of scientific method which try to explain the establishment of scientific truth by any purely objective formal procedure are doomed to failure.” (Polanyi 1962, p. 135).

If all knowledge was explicit, true discoveries were not possible. Since this was not the case, Polanyi held that we had to have tacit knowledge of which we could not give an explicit account (Prosch 1986). In the pursuit of discovery we are guided by personal, tacit knowledge “by sensing the presence of a hidden reality toward which our clues are pointing” (Polanyi 1966, p. 23). Polanyi (1962) argued that the prevailing conception of science was based on the disjunction of subjectivity and objectivity that sought to eliminate from science personal human appraisals.

In sum, despite that one fundamental factor behind the achievements of humankind was the ability to preserve, pass and communicate “explicit knowledge”, such knowledge could not work on its own. Polanyi did not discuss only scientific knowledge, but the nature of knowledge in general, for humans found and used all the time knowledge that did not depend on rational reasoning.

Polanyi (1969) argued that knowing was always an act of a particular individual. Whenever we express what we know we can only do so by “sending” messages of some form. Such messages, however, carry for the most part information, which

only a knowing mind can assimilate, understand and incorporate into its own knowledge structures (Wilson 2002). Therefore Polanyi maintained that although there existed reality independent of mind, knowledge of it was dependent on the knower's mind.

When we know something, we engage in what we know and cannot be neutral or indifferent in relation to it; we have no means to abstract the knowledge from our life and experiences by the means of which we understand that knowledge. Following from that, knowledge is represented in the mind of the knower and it is thus necessarily dependent on the processes and personal properties that take part in the forming of that representation. They direct us, but we are not aware of them in a normal way.

2.1.3 Two Kinds of Awareness

The most central feature of Polanyi's theory of knowledge is a distinction between two kinds of awareness that are involved in all conscious acts. The things that we are attending to and that we are consciously aware of (e.g. propositional belief, mental image, external object, read sentence etc.) belong to focal awareness. However, all focal awareness is dependent on subsidiary awareness that consists of variety of clues, elements and processes (unconscious processes, emotional processes, past experiences, motor responses etc.) that enable focal awareness giving rise to the personal meaning of its contents. This is the structure of all acts of knowing (Polanyi 1969). Hence, the focal object is always identifiable and in this sense explicit, whereas subsidiary content is unidentifiable, tacit. Therefore, argues Polanyi, we base our knowledge of the things we are focally attending to something more fundamental.

To Polanyi the two kinds of awareness are mutually exclusive. This means that we cannot attend to focal and subsidiary elements at the same time. In fact, we cannot attend to what is functioning subsidiarily at all, because the moment we try to shift our focal attention to the subsidiary elements, it becomes focal losing the subsidiary meaning, and having its own subsidiary basis. Polanyi (1966, p. 31) describes this in a following way:

“... Anything serving as a subsidiary ceases to do so when focal attention is directed on it. It turns to a different kind of thing, deprived of the meaning it had.”

In this sense, a mind holding a focal purpose or aim is capable of recognizing relevant elements to accomplish the goal. This associative meaning cannot be turned to explicit language because it is integration of a mind trying to realize its goal; it is not a concrete thing held in the working memory independently of its purpose. Therefore, the meaning of tacit knowledge cannot be seized on by definition. Subsidiary, or tacit, knowledge is not known in itself, but in terms of something focally known; analysis may bring tacit knowledge into focus and formulate it as a maxim but such specification is not exhaustive (Polanyi 1962). For this reason, argued Polanyi, tacit knowledge is ineffable.

Also Frege (1993), among others, has introduced similar lines of thought about the unreachability of the meaning of language based on the structure of sematic meaning he presented⁷. Hence, the problem of unreachability of the contents of the mind that Polanyi discusses is familiar also in the philosophy of language.

2.1.4 Bodily Roots of Knowing

Polanyi (1969) explained that all the major skills of human mind are based on a meaningful integration performed by the body and of the sensations felt by the body. Hence, knowing subjects use their body in virtually all transactions with the world; all human behavior is expressed in and through the body (Gill 2000). As Polanyi (1969, p. 147) puts it,

“The way body participates in the act of perception can be generalized further to include the bodily roots of all knowledge and thought. Our body is the only assembly of things known almost exclusively by relying on our awareness of them for attending to something else.”

In this sense body is not a mere passive physical object in the world but serves as an interface by which one comes to know the world through interaction; man has various ways to manipulate the environment using the body, but the environment also constantly regulates man. Consequently, all knowledge has bodily roots because external objects are attended by being subsidiarily aware of things happening within the body.

Polanyi’s approach differs from the traditional analysis of knowledge notably because he sees bodily participation more fundamental than the conceptual outcome

⁷ This was pointed out to me by Haaparanta (2012).

of the process of knowing; the integration of tacit knowledge in the subsidiary awareness raises the meaning connecting it to the focal representation. Moreover, Polanyi (1969) claims that we observe external things by being subsidiarily aware of the impacts they make on our body and of the responses our body makes to them. On the basis of this one can interpret that some kind of representation of the body state is a fundamental form of tacit knowledge—as well as the ability to register changes in this basic body state and represent them.

2.1.5 The Resulting Epistemology

In general, post-modern theories of knowledge criticized modern theories of knowledge of the way that they de-emphasized the subjective aspect of human experience. Post-modern theories of knowledge suggested instead that exploration of meaning was free and a question of interpretation. The problem of these theories in general is that if any interpretation of a given statement is as valid as any other, these statements lose all their meaning and particularly, so does this claim itself (Gill 2000).

In a similar way, the subjective feature of Polanyi's theory has been a point vulnerable to criticism. Some notable figures of philosophy of science, such as Imre Lakatos and Karl Popper, have claimed Polanyi's epistemology subjectivist. Lakatos denied Polanyi's conception of tacit knowing because he thought that it dragged psychological and sociological elements to epistemological considerations (Gill 2000). Similarly, Popper (1959) argued that the logical content of scientific problems, theories and arguments formed a world of objective knowledge. Thus, knowledge in this objective sense was independent of anybody's claim to know. As Popper (1972, p. 109) puts it,

“Knowledge in the objective sense is knowledge without a knower; it is knowledge without a knowing subject.”

However, the subjective dimension does not make Polanyi's theory subjectivist, but rather broadens the scope of theories of knowledge based on positivist thinking (e.g. Jha 2002, Gill 2000, Prosch 1986, Mitchell 2006). This is essentially because in an ontological sense Polanyi is a realist (see e.g. Mitchell 2006, Scott 1985, Jha 2002). Polanyi (1962, p. vii) argued that knowing was a responsible act claiming universal validity in the sense that the knower's intention was to relate himself to external reality that others could also relate themselves to. Hence, the personal participation

of the knower does not make knowing subjective because knowledge strives for objectivity having always also an objective dimension in this sense. Polanyi does not make a clear objective-subjective dichotomy but accepts both of them as different dimensions of knowledge. As regards the theory of truth, Polanyi's theory seems to manifest fallibilist thinking; according to fallibilist theory of truth empirical statements are predictive, and our developing understanding of the matter may lead us to revise or reject them (Jha 2002).

Polanyi rejected the objectivist ideal of knowledge and instead defined knowledge as a process performed by active knower. The endpoint of the act of knowing is the formed representation that the knower is focally aware of and is able to communicate. But because of the subsidiary, or tacit, roots of the formed representation, knowledge can never be wholly explicit or objective; we tacitly integrate sensations, emotions, motor responses etc. to the focal object with which we operate, which connects the meaning of tacit knowledge and the focal object. So, we know what has sunk into our minds as a result of past integrations (that is, experiences) and the general principles we have taken from them (Prosch 1986). Since we cannot articulate these factors exhaustively, knowledge cannot be justified exhaustively; explicit knowing is based on tacit knowing and thus cannot be fully justified by argumentation. Instead, knowledge becomes assessed by its functionality and acceptance. For example, according to Polanyi's view new knowledge becomes justified by the authority of scientific peers, tradition and the premises of science (Jha 2002). Hence, despite the tacit dimension present in all acts of knowing, knowledge statements can be subjected to testing and the statement may be claimed as "true" based on the evidence.

To end this sub-chapter concerning Polanyi's philosophy, I finally discuss briefly to which philosophical traditions Polanyi's theory is related, and how it can be linked to cognitive science.

2.1.6 Links to Other Traditions of Philosophy

As mentioned earlier, Polanyi's theory has a close connection to phenomenological tradition. Polanyi's conception of knowledge intersects phenomenology particularly at three points: at the emphasis on intentionality, at the concept of indwelling, and at the idea of embodiment. Intentionality refers to the feature of mind to be about, or to represent things, properties and states of affairs (Pierre 2010). Intentionality stresses the importance of the relationship between mental acts and external world

as the main characteristic of mental phenomena. The idea of intentionality derives from Brentano's philosophy of mind (see e.g. Brentano 1995) from the end of the 19th century although the idea of "aboutness" of mind as such is older (Pierre 2010). Polanyi (1968) refers to Brentano, agreeing that consciousness necessarily attends to an object, but adding that it also has roots from which it attends. Hence, Polanyi broadened the conception of intentionality by explaining that the intentional directedness is based upon tacit awareness of the subsidiaries (Zhenhua 2008).

The second point of intersection between Polanyi and phenomenology concerns the similarity of Polanyi's concept of indwelling and Heidegger's notion of being-in-the-world (see e.g. Heidegger 1962). Polanyi (1964) argues that all understanding is based on dwelling in the particulars of the object that we comprehend, and such indwelling means our participation in the existence of that object. He (Polanyi 1964, p. x) continues: "It is Heidegger's being-in-the-world." As I understand it, both of these conceptions seek to overcome the distinction between subject and object, stressing that consciousness is always consciousness of something—in this sense indwelling and intentionality illustrate almost the same idea.

In Polanyi's view, the subsidiary awareness of one's own body represents the highest form of indwelling (Zhenhua 2008). Indeed, the idea of embodiment is an important aspect of Polanyi's philosophy. On the other hand, Merleau-Ponty's phenomenology is considered the most systematic and persistent argument seeking to prove the primacy of body in human experience and meaning (Shusterman 2005). Various researchers interested in Polanyi's philosophy (e.g. Mullins 2000, Grene 1995, Zhenhua 2008) have discussed Merleau-Ponty's influence on Polanyi in this subject.

Despite these evident links to phenomenology, Polanyi cannot be considered as a phenomenologist (Gelwick, 1996, Prosch 1986). He thought that reality was not a human construction; instead, nature offered us clues on which we based our conceptions (Jha 2002). Polanyi therefore assumed the existence of external reality and argued that discovery uncovered its nature (Prosch 1986). He believed that discoveries and mistakes must be assessed in relation to reality, which was the only way to measure them. Since phenomenology in general emphasizes reality as a subjective phenomenon that is experienced in our minds, it is evident that Polanyi's view differs from phenomenological tradition in this sense. In addition, Polanyi's conception of truth is considered fallibilist (see e.g. Mitchell 2006, Jha 2002) that in an ontological sense refers rather to critical realism according to which external reality is assumed but at the same time it is acknowledged that it cannot be understood entirely (nevertheless, it can be understood to a reasonable degree).

Regarding to epistemological orientations, Polanyi's philosophy is related to social epistemology and naturalized epistemology. Social epistemology stresses that social influences considerably affect knowledge production (Goldman 2010). It identifies and evaluates social processes by which epistemic subjects interact with other agents who exert causal influence on their beliefs. On the other hand, Polanyi considers cognitive processes prior to conscious belief, which contextualizes his theory also to naturalized epistemology. According to naturalized epistemology the epistemic status of belief state is dependent on cognitive processes that generate and sustain it (Goldman 1986). As such, these processes cannot be ignored in epistemology. Particularly, the starting point of both social and naturalized epistemology is that the scope of traditional epistemology that stresses the objective justifiability of knowledge is too narrow and one-sided.

2.1.7 Links to Cognitive Science

I end this section concerning Polanyi's philosophy by relating Polanyi's theory to the research of cognitive science. At this point I only situate Polanyi's theory to the research line called 'embodied cognitive science' (or 'embodied cognition'), and the justification of this approach is discussed more in detail in chapter 4.

Embodied cognitive science is a branch inside cognitive science that stresses that the aspects of body beyond the brain of cognitive agent play significant role in the cognitive processing (Wilson & Foglia 2011). Originally dominant views in cognitive science (such as computational theories of mind) considered body as peripheral to understanding the nature of cognition, and thus conceptualized cognition in abstraction from bodily mechanisms of sensory processing and motor control (see e.g. Pecher & Zwaan 2005). Instead, embodied cognitive science aims to understand cognition in a broader sense, that is, the full range of perceptual, cognitive and motor capacities we possess as capacities that are dependent upon features of the physical body. The starting point of embodied cognition is that without the involvement of body in human action thoughts would be empty (Wilson & Foglia 2011).

An important motivation for the development of embodied cognition science has been the assumption made by computational theories of mind that the meaning of a concept consists of the links between the abstract symbol representing that concept and the abstract symbols for other concepts (and their semantic features) (see e.g. Glenberg et al 2005, Wilson & Foglia 2011). However, this view does not explain how perceptual experiences are translated to arbitrary symbols that represent

concepts, nor how the symbols are mapped back onto real world. For example, the classical sematic network memory theories assume that the meaning of a symbol is captured in its relation to other symbols. Such symbols, however, are close to meaningless without any reference to outside world (Pecher & Zwaan 2005).

The stressing of the significance of the body in cognitive processing is obviously clear point of converge between embodied cognitive science and Polanyi's philosophy, but embodied cognition offers also other significant points from the perspective of Polanyi's theory. For example, the concepts we use are shown to contain both perceptual and motor representations (for neuroimaging based evidence, see e.g. Simmons et al. 2007, Martin & Chao 2001, Simmons & Barsalou 2003; for behavioral evidence see e.g. Pecher et al 2003, Spivey et al. 2002). In other words, when we use concepts, we (unintentionally) simulate situations where those concepts apply. This means that conceptual knowledge is richer of its contents than can be expressed in words. Moreover, it gives more perspective to the relation between language and understanding by suggesting that language is grounded outside the linguistic system (see e.g. Glenberg et al. 2005). This means that language processing and understanding (for example, in communication) involves simulation of related situations, motor action, perceptions, emotions etc. To my understanding, these are the kind of subsidiary events that remain beyond the reach of articulation that Polanyi sought to capture with the term 'tacit knowing'.

2.2 Tacit Knowledge in the Knowledge Management Literature

According to Hong and Ståhle (2005) KM can be approached from four different perspectives:

1. The philosophical and psychological perspective (focus on e.g. epistemological exploration, knowledge types and their interactions, people's will and motivation).
2. The organizational and sociological perspective (focus on e.g. organizational learning, new forms of organization, networks and communities).
3. The economic and business perspective (focus on e.g. competitive advantage, measurement of knowledge and skills, KM as focus strategy).
4. The technological perspective (focus on e.g. information technology, knowledge tools and systems and enterprise portal).

As will be explained, the subject area of this research touches primarily philosophical and psychological, and the economic and business perspectives of KM.

It was already suggested in the early 1980's in the literature of strategic management that organizations should be considered in terms of their resources instead of the products they made, and that this view would set a new focus on the strategic planning (e.g. Wermerfelt 1984). The idea of this resource-based view was that organizations should identify the types of resources that could lead to high profits. Following from that, an organization should create a situation where its own resource position, either directly or indirectly, made it more difficult for others to catch up (Wermerfelt 1984). The resource-based view of the organizations in general seeks to explain how organizations can achieve sustainable competitive advantages by differentiating themselves from their competitors (Barney 1991). According to this view organizations' resources consists both tangible and intangible assets related to it, and the attention is paid particularly to the resources that can be considered unique. Therefore the resources that are uncommon, poorly imitable or nonsubstitutable are particularly valuable for organizations as they seek competitive advantages (Barney 1991).

From this perspective, knowledge as intangible, firm-specific and developed over time was seized as a strategic asset with a significant potential to be a source of sustainable competitive advantage for an organization. In the early 1990's there already was a general agreement that knowledge management will represent the most important competitive advantage factor for organizations (Toffler 1990, Quinn 1992, Drucker 1993). Indeed, knowledge was recognized as the third important factor of production alongside with labor and capital in leading economies, and become thus considered a "new" crucial resource of economy (Romer 1990). Knowledge was soon seen even as the most important factor of production and economic resource. As Drucker (1993, p. 8) remarked in 1993,

"the basic economic resource—the means of production—is no longer capital, nor natural resources, nor labor. It is and will be knowledge."

In the organizational context this meant that knowledge assets and intellectual capital became more important for companies than physical or financial assets; the implication of this shift in thinking was that to prosper in "the new economy" and to exploit the vital knowledge assets, new management techniques, new technologies, and new strategies were needed (Stewart 2001). Moreover, learning and creation of new knowledge were concluded to be of prime importance (Nonaka 1991).

2.2.1 Why Tacit Knowledge?

In the beginning of the 1990's Japanese theorist Nonaka (Nonaka 1991, Nonaka & Takeuchi 1995) presented the theory of knowledge creation. The starting point of Nonaka's theory was the idea that organizations should create new knowledge in order to innovate and recreate their environment instead of processing information in order to merely adapt to changing environment. As Nonaka and Takeuchi (1995, p. viii) put it:

“By organisational knowledge creation we mean the capability of a company as a whole to create new knowledge, disseminate it throughout the organisation, and embody it in products, services and systems...”

One crucial point that differentiated Nonaka and Takeuchi's theory from the management ideology of the time was the idea that only individuals created knowledge, and the organization should support creative individuals by providing them contexts to create knowledge (Nonaka and Takeuchi 1995). Hence, knowledge was recognized as tied to human element because humans in the organization identified, interpreted and used that knowledge. However, Nonaka and Takeuchi emphatically remarked that although knowledge creation started from the minds of the individuals, personal knowledge was generally of little value to an enterprise unless it was shared in the organization. This reflected the positivist roots upon which business and management studies were traditionally based (Hislop 2005). As Myers (1996, p. 2) put it,

“For knowledge to provide a company with sustainable competitive advantage, such knowledge must be independent of any given individual. For this reason we can identify - and then manage - organizational knowledge only to the extent it has been captured by an organization's systems, processes, products, rules, and culture.”

Hence, on this idea is based the conception that is today predominant in the KM literature: one of the most critical KM-processes of the organization is to convert subjective beliefs and conceptions of the individuals to objective organizational knowledge capital.

From the epistemological perspective this setting is interesting as the aim is to objectify subjective “knowledge”. Theoretically the objective is challenging because it presupposes bridging subjective and objective theories of knowledge. The focus was no longer on knowledge understood as objectively reliable entity but as a

resource of production despite its respectability in the scientific sense. Consequently, despite of being novel, the idea of knowledge creation signified that knowledge understood traditionally as justified true belief was not alone sufficient to explain the processes of organizational knowledge. Knowledge management theory needed a broader theory of knowledge (Maasdorp 2007a, Schreinemakers and Essers 1997). According to my understanding, it was essentially this problem that Polanyi's theory, and particularly the concept of tacit knowledge, was seen to provide the answer.

Nelson and Winter (1982) introduced the concept of tacit knowledge to organization theory in their dynamic capabilities approach to organizations (Teece 1998, Maasdorp 2007a). Dynamic capabilities refer to an organisation's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments and explain innovations in organisations (Teece et al 1997). Nelson and Winter (1982, p. 76) saw that Polanyi's theory "provides a useful perspective on other realms of knowledge". Nonaka's and his colleagues (Nonaka 1991, Nonaka & Takeuchi 1995, Nonaka & Konno 1998) work was an example of such an approach and it is generally considered to be the first KM application of Polanyi's theory (Maasdorp 2007a).

2.2.2 Nonaka and Takeuchi's Theory of Organizational Knowledge Creation

The main idea behind Nonaka and Takeuchi's theory of knowledge creation is that organisations have to constantly create new knowledge in order to be competitive. They (Nonaka & Takeuchi, 1995 p. iv) define organisational knowledge creation as

"capability of a company as a whole to create new knowledge, disseminate it throughout the organisation, and embody it in products, services and systems..."

Nonaka and Takeuchi (1995) argue that tacit knowledge has been overlooked in organizational context, but in Japan tacit knowledge is an important source of companies' competitiveness. Hence, they state the epistemological presuppositions upon which their theory is based in the following way:

"...we classify human knowledge into two kinds. One is explicit knowledge, which can be articulated in formal language including grammatical statements, mathematical expressions, specifications, manuals, and so forth. This kind of knowledge can be thus can be transmitted across individuals formally and

easily. This has been dominant mode of knowledge in the Western philosophical tradition. However, we shall argue, a more important kind of knowledge is tacit knowledge, which is hard to articulate with formal language. It is personal knowledge embedded in individual experience and involves intangible factors such as personal belief, perspective, and the value system.” (Nonaka & Takeuchi, 1995 p. viii)

Nonaka and Takeuchi (1995, p. 58) further remark:

“In our theory of organizational knowledge creation, we adopt the traditional definition of knowledge as ”justified true belief.” It should be noted, however, that while traditional Western epistemology has focused on ”truthfulness” as the essential attribute of knowledge, we highlight the nature of knowledge as ‘justified belief.’ ”

Nonaka and Takeuchi (1995) further sub-divide tacit knowledge into two types: first, the technical dimension, which encompasses the kind of informal and hard-to-pin-down skills or crafts captured in the term ‘knowhow’; second, the cognitive dimension that consists of schemata, mental models, beliefs and perceptions that reflect individuals’ vision of reality and are so ingrained that they are taken for granted.

Nonaka and Takeuchi (1995) argue that the dynamic model of knowledge creation is anchored to an assumption that human knowledge is created and expanded through social interaction between tacit knowledge and explicit knowledge that they call ‘knowledge conversion’. Knowledge conversion consists of four processes or modes that together form so called SECI-model. The four modes are socialization (conversion from tacit knowledge to tacit knowledge), externalization (conversion from tacit to explicit knowledge), combination (conversion from explicit to explicit knowledge), and internalization (conversion from explicit to tacit knowledge).

Nonaka and Takeuchi (1995) explain that socialization means social interaction that enables tacit to tacit knowledge transfer through shared experiences; since tacit knowledge is difficult to formalize, it can be acquired by spending time together. In externalization tacit knowledge is made transferable to others, for example by using figurative language, metaphors or suitable analogies. In combination mode explicit knowledge is collected from inside or outside the organization and then combined, edited or processed into new refined knowledge. Internalization is essentially about learning by doing; explicit knowledge becomes part of an individual's knowledge base and will be asset for the organization. Internalization results also as an ability to

see connections and the capacity to make sense between fields, ideas, and concepts. Nonaka and Takeuchi stress that in the process presented by SECI-model knowledge is continuously converted and created as users practice, learn and share. Thus, the process should be seen as a continuous, dynamic spiral of knowledge.

These modes are the engine of the knowledge-creating process (Nonaka & Takeuchi 1995). While all the four modes are necessary for the process of knowledge creation, Nonaka and Takeuchi argue that externalization is the most important because it creates new, explicit concepts from tacit knowledge. Hence, the key to knowledge creation lies in the mobilization and conversion of tacit knowledge to explicit knowledge. Externalization refers to the articulation of one's own tacit knowledge (ideas, beliefs, intuitions etc.) in words, and on the other hand, eliciting, deducing and translating tacit knowledge of others into an understandable form (Nonaka & Takeuchi 1995, Nonaka & Konno 1998). It should be noted that externalization is not the only way to share tacit knowledge in Nonaka and Takeuchi's theory, because also socialization means sharing of tacit knowledge through shared experiences. Externalization is however more relevant in the context of this research because it presumes conscious processing of tacit knowledge and interaction between objectivity and subjectivity, which calls for more complex epistemology.

Nonaka and Takeuchi mention metaphors, analogies and figurative dialogue as suitable methods for the process of externalization. The idea is that something previously inexpressible can be expressed by using a "non-analytical" method. Drawing on Donnellon et al (1986) they claim that metaphors create novel interpretation of experience by presenting something in terms of something else, and by that they can function to reconcile discrepancies in meaning. Analogies, in turn, reduce the unknown by highlighting the commonness of different things (Nonaka & Takeuchi 1995). Importantly, externalization is a social process among individuals within a group; Nonaka et al (2001) argue that the modes of knowledge creation cannot take place without a specific context that is a shared place for cognition and action.

2.2.3 The Establishment of the Concept of Tacit Knowledge in the KM Literature

Despite the fact that Nonaka and Takeuchi's theory has been criticized in the secondary literature (e.g. Cook & Brown 1999, Tsoukas 2003; this criticism will be

discussed below), the epistemological foundation, namely the classification of knowledge into tacit and explicit, has gained a dominant role as the basis for epistemology in the KM theory (Maasdorp 2007a, Stacey 2001). In fact, the epistemological distinction between tacit and explicit knowledge has been so influential that even the whole field of KM has been defined based on it. For example, according to different authors KM means

- "...systemic and organizationally specified process for acquiring, organizing, and communicating both tacit and explicit knowledge..." (Alavi & Leidner 1999, p. 6);
- "The identification, optimization, and active management of intellectual assets, either in the form of explicit knowledge held in artefacts or as tacit knowledge possessed by individuals or communities." (Snowden 2002, p. 63);
- "...the formalized, integrated approach of managing an enterprise's articulated and tacit knowledge assets." (Capeda-Carrión 2006, p. 34).

Nonaka and Takeuchi's theory was novel in the sense that it suggested that the creation of new knowledge was more important than processing the old one. However, SECI model did not become popular only as model of process of innovation but it has been generally adopted as a model of externalization or codification of tacit knowledge in the KM literature. Maasdorp (2007b) argues that probably since the focus in the field of KM is on management of knowledge (instead of creation), converting tacit knowledge into explicit has been over-stressed. Indeed, let us consider the following claims:

- "One of the major tasks of Information Era organizations that seek to be successful is to create conditions whereby everyone can verbalize their tacit knowledge." (Kikoski & Kikoski 2005, p. 67);
- "The primary task of managers is the conversion of tacit, human capital into explicit, structural capital." (Irick 2007, p. 1);
- "Tacit knowledge needs to become explicit; what's unspoken must be said aloud. Otherwise it cannot be examined, improved or shared." (Stewart 1997, p. 74).

Such claims are relatively exaggerated interpretations of Nonaka and Takeuchi's thinking considering that externalization is only a part, albeit important, of their theory.

In sum, from the perspective of this study Nonaka and Takeuchi's theory had two significant implications for the development of KM theory. First, the bulk of

KM authors differentiate between two types of knowledge, tacit and explicit, which is the "default" basis of theory of knowledge in contemporary KM literature. Second, in order to manage tacit knowledge, 'capturing', 'externalizing', 'codifying' and 'explicating' such knowledge is often emphasized as a central procedure of KM in organizations.

It should be taken into account that Nonaka's theory of knowledge creation has gone through a series of moderate revisions (e.g. Nonaka et al 2000, Nonaka et al 2001, Nonaka & Toyama 2003, Nonaka & Toyama 2005, Nonaka & Konno 1998, Nonaka & Peltokorpi 2007, Nonaka & von Krogh 2009) in which Nonaka and his colleagues have developed and clarified their view.

Nonaka and Konno (1998) introduced the concept of 'ba' defining it as a space for emerging relationships. The idea of ba is that it serves a context for knowledge creation; it can be physical (e.g. office), virtual (e.g. teleconference), mental (e.g. shared experience) or any kind of combination of them (Nonaka and Konno 1998). Nonaka et al (2001) argue that knowledge creation cannot take place without a specific shared context for cognition and action. Hence, ba is a place where participants create new meanings through interactions (Nonaka & Konno 1998). The innermost idea of ba is to positively influence the outcomes of the knowledge creation (Nonaka & von Krogh 2009). Nonaka et al (2006) have also discussed other enabling conditions for knowledge creation, such as trust, team atmosphere, care and courage.

Probably more significant revisions that Nonaka and his colleagues have made are related to their epistemological view. These correctives have partly derived from the critique that the theory of knowledge creation has received. Indeed, in the relatively short history of knowledge management, Nonaka and Takeuchi's theory has been extremely significant and influential—yet also controversial. As Gourlay (2006) suggests, Nonaka's attempt to provide a straightforward usable theory of knowledge creation is highly ambitious, and it is no surprise that some of its elements have been questioned by various authors. I will next discuss briefly the critique presented concerning the theory of knowledge creation, Nonaka and his colleagues' response to it, and also some clarifications they have presented concerning the theory of knowledge creation.

2.2.4 The Critique towards the Theory of Knowledge Creation

Alvesson and Kärreman (2001) have questioned the whole idea of management of knowledge and knowledge creation. They argue that the conception of knowledge in the KM literature is incoherent and vague; the concept of knowledge simply means too much, and as a result, it informs us less and less. According to them, 'knowledge' has various meanings, and when it is combined with the idea of management, the result is contradictory. The authors thus seem to present a question, how are we supposed to manage knowledge if we do not know much about knowledge itself? They claim that management part of the concept is often seen too self-evident; for example Nonaka and Takeuchi (1995) link managerial practices and knowledge creation without serious attempts to theorize what management is about. As a conclusion Alvesson and Kärreman argue that KM is more about managing people or information than practice attuned towards facilitating knowledge creation.

Gourlay (2006) argues that Nonaka and his colleagues' proposition that knowledge is created through the interaction of tacit and explicit knowledge is flawed. He particularly pays attention to the justification of created knowledge, that is, the process of determining whether the created concepts (tacit knowledge transformed to explicit) are worthwhile in the organization. He argues that this clearly involves the evaluation by managers of the new ideas against pre-defined criteria, which refers more to decision making than to knowledge creation. Nonaka's definition of knowledge as 'justified belief' thus seems to mean managers beliefs whose justification is related to prior strategic decisions and forecasts. A realistic model of knowledge creation should account for the production of scientific type of knowledge that, according to Gourlay, is the foundation of the ability to manage organizational processes. Since Nonaka and Takeuchi's theory fails to do that, it adopts a radically subjective definition of knowledge (Gourlay 2006, Essers & Schreinemakers 1997).

Nonaka and Peltokorpi (2007) suggest that the most well-articulated and quoted critique towards Nonaka and Takeuchi's theory comes from Tsoukas (1996, 2003), Cook and Brown (1999), and Brown and Duguid (2001). Tsoukas (2003) questions the nature of tacit knowledge presented in the theory of knowledge creation as set of if-then rules that are articulable after a learning process. Tsoukas argues that focusing ones attention to action, one is no longer involved in that action, but thinking that activity, which is a different thing. Also, the division of knowledge into tacit and explicit types has been criticized (e.g Tsoukas 2003, Cook & Brown 1999, Brown & Duguid 2001). The core of this critique draws from Polanyi's objection of

purely objective knowledge and the inherently inseparable nature of tacit and explicit knowledge that follows from it. Tsoukas (2003) illustrates his interpretation of Polanyi's theory metaphorically by presenting that tacit and explicit knowledge are two sides of the same coin. For these reasons these authors question the ontological and epistemological basis of the theory of knowledge creation.

2.2.5 Nonaka and His Colleagues Reply

Nonaka and his colleagues have answered the received critique in various publications (e.g. Nonaka & Peltokorpi 2006, Nonaka & Peltokorpi 2007, Nonaka & von Krogh 2009). As I understand it, Nonaka's main arguments against the received criticism are following.

First, Nonaka and Peltokorpi (2007) argue that whereas the theory of knowledge creation draws from various philosophical schools, the critique towards it is given by scholars faithful to original writings of Polanyi who base their views on interpretative philosophies (phenomenology and pragmatism). Hence, Nonaka and Peltokorpi do not see it surprising that the theory of knowledge creation becomes criticized from this kind of anti-positivistic view that reacts negatively to linear models based on "if-then" rationale. Nonaka and Peltokorpi (2006) argue instead that these contrasting philosophies should be combined to create dynamic accounts of knowledge and its creation. The core of this idea is that instead of being purely subjective or objective, both of these dimensions are included in knowledge because people validate tacit knowledge through social interaction. Tacit knowledge is this way objectified and becomes thus a socially justified true belief. In addition, they (Nonaka & Peltokorpi 2007) remark that although SECI model might create an image of linear knowledge conversion, all models in social science present real-world complexity in a crude and simplified manner.

Second, Nonaka and Peltokorpi (2007) note that Nonaka has not argued in any publication that all tacit knowledge can be converted as such to explicit knowledge. Instead, while indwelling enables people to acquire tacit knowledge, everything that is experienced cannot be internalized and all that is internalized cannot be shared. In this sense, they claim, the conversion of tacit knowledge to explicit knowledge has been misunderstood by the critics; it is rare for tacit knowledge to be completely transformed into codified form without losing some of its characteristics. However, they still maintain that some tacit knowledge can be shared even not in its original form.

Third, Nonaka and Peltokorpi (2007) remark that straightforward separation between the types of tacit and explicit knowledge has been questioned. They admit that it would have been more adequate to refer to two distinct but interrelated dimensions of knowledge. They remind that Nonaka (1994) has used the iceberg metaphor in order to illustrate that tacit and explicit knowledge exist in a continuum, and are seen complementary and mutually enabling in the theory of knowledge creation. Although they agree that purely objective knowledge does not exist, they still maintain that the different natures of tacit and explicit knowledge make knowledge conversions, and thus also knowledge creation, possible.

The knowledge continuum view is further explained by Nonaka and von Krogh (2009). They stress that Nonaka's epistemological view, and its conception of truth separates itself from correspondence doctrine prevalent in organization theory; according to correspondence doctrine truth is assessed according to its correspondence to supposedly objective reality. Instead, in the theory of knowledge creation beliefs are true to the extent that they can be justified by an individual at the certain moment (Nonaka & von Krogh 2009). Hence, drawing from pragmatism, Nonaka and von Krogh seem to argue that beliefs become true judged by their usefulness. They claim that the status of truth is important because it enables a broader definition of knowledge and justifies the knowledge as a continuum view.

I will finally discuss briefly Nonaka and his colleagues' response to the critique; this discussion may also be considered as an introduction to my research problem.

2.2.6 Discussion on Nonaka and His Colleagues' Reply

It seems somewhat contradictory that Nonaka and Peltokorpi (2006, 2007) stress the difference between paradigmatic⁸ views as a significant reason for the arisen critic, but they hardly discuss about the problems of Nonaka's own view that seeks to combine these same opposing views. Since different paradigms often represent a different worldview, their "internal conceptual worlds" may be so different that they simply cannot be combined (see e.g. Denzin & Lincoln 1994). This is why it seems that any supposedly neutral basis of combining paradigmatic views is actually necessarily paradigmatic (Burrell & Morgan 1979). As Lincoln and Guba (2000) remark, this still does not prevent one from blending elements of different

⁸ By *paradigm* I refer to different views of how research should be done based on adopted nature of reality (e.g. positivism and interpretativism here). According to Guba (1990) paradigms can be characterized through their ontology, epistemology and methodology; these characteristics create a holistic view of the nature of knowledge and how it can be gained.

paradigms. However, the blending demands that the blended elements are similar enough or at least resonate strongly (Lincoln & Guba 2000). We can now critically ask, how strong is the resonance between interpretativist and positivist views (in Nonaka and Peltokorpi's terms), the synthesis of which Nonaka and Takeuchi originally sought? The question is significant, because if there is not enough common ground to unite these views, the key concepts of the resulting theory might remain vague and loose somewhere between the different paradigms.

Nonaka and Peltokorpi (2007) correct Nonaka's view that some kinds of tacit knowledge cannot be converted to explicit while other kinds can. They further explain that tacit and explicit knowledge are seen interrelated and complementary rather than separate types of knowledge. However, neither of these points seems to change the fact that the engine of the knowledge creation still is the conversions between tacit and explicit knowledge. The conversion from one to another seems to necessitate two categories, classes or types *by definition*. Moreover, the distinction in the domain of tacit knowledge only complicates matters further (Maasdorp 2007b). Indeed, the distinction raises more questions concerning the nature of tacit knowledge than it solves, if the nature of the kinds that can be converted and the kinds that cannot be converted is not explained more profoundly. The distinction they make in fact seems to augment the need to characterize tacit knowledge more accurately, but this is left undone.

Nonaka and Peltokorpi's (2006, 2007) comment on contradictions that have arisen based on different scholarly views is understandable, yet rather trivial; it is obvious that certain phenomena appear different if observed through different "paradigmatic lenses". In fact, it seems that discussion about the nature of the tacit knowledge and its relation to concept of knowledge in general has developed relatively little during the past twenty years it has been discussed in the KM literature. Indeed, despite the figurative appeal of the competing metaphors related to different paradigms that have been presented (e.g. the iceberg metaphor by Nonaka 1994; the coin metaphor by Tsoukas 2003; the theatre stage metaphor by Brohm 2007), they are of little comfort in clarifying the concept of knowledge because unfortunately such metaphors do not have much in common with human cognition that is after all the basis of knowing.

In this research I have chosen another kind of approach. Knowledge and consciousness have been central themes in cognitive science for several decades. Hence, knowledge and knowing can be approached from a more naturalistic basis, freer from strict aprioristic assumptions (this argument will be discussed later). Although there are brief references to the interest of relevance of cognitive

psychology to the KM issues (see e.g. Nonaka and von Krogh 2009), to my knowledge this kind of research approach has not been systematically applied in the KM literature.

3 Research Problem

The application of the concept of tacit knowledge in the KM literature is foreshadowed by conceptual vagueness. Although Polanyi is widely referred as the source author of the concept, his philosophy seems to be all but well-known in the field (see e.g. Tsoukas 2003, Maasdorp 2007a, Grant 2007). In this sense the concept has been disengaged from its original epistemological context. For this reason the concept has remained loose because it is not tied to any particular theoretical background in the KM literature.

The problem originates from the classification of knowledge into tacit and explicit forms and the juxtaposition of the two forms that is a natural consequence of the classification. Tacit knowledge is widely recognized as a multidimensional phenomenon difficult to define as such. Instead, the less challenging form of knowledge, explicit knowledge, is generally defined in the literature as codified knowledge. By the definition of explicit knowledge the remaining part of knowledge, namely tacit knowledge, becomes defined non-codified-knowledge, which in the logical sense seems correct if knowledge is classified in these two forms. Consequently, the “default” definition of tacit knowledge in the KM literature seems to be ambiguous “knowledge difficult to articulate” (e.g. Hansen et al 1999, Baumard 1999, Fleck 1997).

As a result, different authors refer to different mental phenomena that all can be interpreted to be included into the realm of the definition of tacit knowledge. For example, ‘tacit knowledge’⁹ is used to refer to intuitive knowledge (e.g. Kikoski and Kikoski 2004), assumptions (e.g. McAdam et al 2007), values (e.g. Seidler-de Alwis & Hartmann 2008), unconscious knowledge (Easterby-Smith & Lyles 2003), expertise (e.g. Johannessen et al 2001), mental models (Nonaka & Konno 1998, Nonaka & Takeuchi 1995), beliefs (e.g. von Krogh et al 2000), intentionally concealed knowledge (e.g. Szulanski 1996, Leonard & Sensiper 1998), knowledge not understood (e.g. Lambertson 1997), unspoken collective knowledge (e.g.

⁹ In this research ‘tacit knowledge’ refers to tacit knowledge possessed by individuals. In the KM literature also ‘collective tacit knowledge’ has been discussed (see e.g. Collins 2010, Ambrosini 2003, Spender 1996). This theme will be briefly discussed in chapter 8.

Baumard 1999), personal internal knowledge (Irick 2007), context-specific knowledge (Nonaka & Takeuchi 1995, Gourlay 2002) etc.

Hence, 'tacit knowledge' seems to be a label for residual instances of knowing that somehow differentiate from explicit knowledge. Moreover, as Hedesstrom and Whitley (2000) have remarked KM authors have taken advantage of the nebulosity of the concept by stretching it in ways that are advantageous to them in applying the concept to their particular area of research. Yet at the time the concept of tacit knowledge is supposed to be one of the most significant foundational concepts of KM. The problem is significant for various reasons.

First, every concept has an intension and usually (but not necessarily) at least one extension (Bunge 1998). The intension of a concept is the set of properties that define the objects that represent the concept. In other words, intension is related to the contents and the meaning of that concept. The extension of a concept is the set of objects to which the concept can apply. Consequently, the more properties the intension of a concept has the more accurate the definition of the concept is and refers thus to a smaller set of objects because less objects will share wider set of properties (Bunge 1998). Inversely, adding new objects to the extension of a concept might reduce the intension of the concept in so that the intension corresponds the wider extension. As the intension of the concept refers to a wider set of objects, the intensional meaning of the concept might begin to blur. In other words, if tacit knowledge refers to virtually any cognitive or social phenomenon "difficult to articulate" it becomes meaningless, at least in the scientific context.

Second, a scientific theory or a model is fundamentally an explanation of a set of facts constructed to explain and predict phenomena of certain part of reality (Bunge 1974). Theories and models are conceptual structures explaining the phenomena under observation by defining the concepts and the relations between them. A theory or a model should have specific implications for observable events in the reality. Accordingly, theories predict some observational consequences deduced from the theory so that the correctness of the theory can be assessed. However, a theory suffering from conceptual vagueness is liable to result in various, even contradictory predictions that the theory makes because of different interpretations of the same concept (Rakover and Kaplan 1990). Moreover, given that one of most important functions of scientific theories is to make predictions, it is obvious that theories including poorly defined concepts make wider amount of predictions—up to a point in which the made predictions are anything but accurate, reliable or even very clear. Therefore, in the case of tacit knowledge it is somewhat simple to report positive results for instance concerning explication or externalization of tacit

knowledge because some assumptions, beliefs, insights or previously unspoken “knowledge” can always be “externalized” out of the subjects regardless of the used method. For example, various research papers (e.g. Jabar et al 2010, Fergus et al 2003, Mulder & Whiteley 2007) introduce a system or an application that is shown to successfully capture or codify tacit knowledge, which is not surprising if tacit knowledge is defined as “knowledge rooted within the minds of individuals” (in Fergus et al 2003).

Third, indefinite ideas cause wider problems for the research of KM by directing research to wrong lines. For example, Grant and Qureshi (2006) remark that many KM projects have stated as their aim the conversion of tacit to explicit knowledge, and storing and sharing it by developing proper ICT-systems for the purpose. These projects, however, often have very limited success (Grant & Qureshi 2006). As Grant (2007) suggests, this might have very negative effects on organizations. Importantly, when organizations take this approach, they tend to focus on the knowledge that can be captured, rather than what should be captured (Grant & Qureshi 2006). As Chimezie and Osigweh (1989, p. 580) put it,

“If any of the concepts that form a proposition are ill-defined, an ambiguous research proposition or an ill-conceived emphasis on certain aspects of an organizational phenomenon may result.”

Fourth, the use of a concept of tacit knowledge in a confusing way gives a somewhat indefinite image of the scientific study of the field of KM; KM is a multidisciplinary field, which means that it should communicate with other relevant fields of science. This naturally becomes difficult if central concepts adopted outside the field are redefined. However, theoretical statements from different disciplines should refer to the same set of phenomena (Bunge 1974). It has been also remarked that imprecise concepts make it difficult to produce cumulative knowledge (e.g. Achinstein 1968).

Fifth, if the meaning of a scientific concept begins to blur, the risk of a misuse of the original theory (from which the concept is adopted) grows. From the perspective of the scientific plausibility it is significant fault if the application of a theory does not follow the logic and the implications of the original theory. Chimezie and Osigweh (1989) note that in some cases it is possible to accept certain amount of conceptual flexibility. This means that the meaning of a concept may be applied slightly in order to give meaning to it in a different context. But still, the modified concept should not be imprecise.

In Polanyi’s theory tacit knowledge cannot be articulated because the knower is not directly aware of it (Polanyi 1966). Yet the articulation of tacit knowledge has

become an important theme in the contemporary KM literature. In sum, there is clearly a need to the better theoretical understanding and accuracy concerning the nature and forms of knowledge in the field of KM. Based on the issues described above I state the main problem of this research as follows:

How well the implications and logic of Polanyi's theory of knowledge are present in Nonaka and Takeuchi's conception of knowledge?

Whereas Nonaka and Takeuchi's theory is the most systematic and in-depth presentation of the subject, many authors have discussed the application of tacit knowledge in a more loose way referring only to Nonaka and Takeuchi, and bypassing Polanyi's philosophy (see e.g. Maasdorp 2007a). In this sense the analysis of Nonaka and his colleagues' theory logically includes theories following their thinking and adopting their conception of knowledge.

As the title of this thesis ('How tacit is tacit knowledge?') already hints, I am specifically interested in the perspective, how plausible the idea of externalization of tacit knowledge is. The question is important in the sense that if externalization was shown to be impossible, the usefulness of the concept of tacit knowledge in the KM theories emphasizing or aiming at practice would become questionable; tacit knowledge would not be the operationalizable component, and the concept's power to explain knowledge creation in a practical level would diminish significantly.

Answering this problem requires a comparison between the polanyian conception of knowledge and the conception of knowledge assumed by the theories stressing the importance of externalization of tacit knowledge. Either of the conceptions mentioned above are pre-given. Given that Polanyi's theory dates back to 1950's, it is important to analyze its credibility from the cognitive perspective; Polanyi himself drew from research of psychology of his time, and by the recent significant development of psychology/cognitive science there is a good reason to re-evaluate Polanyi's basing assumptions concerning human cognition. Moreover, it is possible to clarify Polanyi's thinking by making the founding concepts of his theory more concrete by relating them to empirically studied cognitive phenomena. This theme forms the first sub-problem, and it can be expressed specifically as follows:

Can the bodily basis and the tacit dimension of knowing stressed by Polanyi be explained in the light of contemporary understanding of cognition?

The discussion of the first sub-problem aims particularly at clarifying the concept of tacit knowledge in a polanyian sense. The second sub-problem concerns the conception of externalization of tacit knowledge present in KM literature:

What kind of theoretical assumptions, namely epistemology and theory of cognition, underlie the conception of externalization of tacit knowledge?

The analysis of the epistemological and ontological assumptions that underlie the conception of externalization of tacit knowledge is necessary in order to compare those to Polanyi's founding assumptions in an attempt to evaluate the usage of tacit knowledge in the KM literature.

In the next chapter I discuss my philosophical starting points and methodological choices in an attempt to answer the research questions stated above.

4 Methodology

In this chapter I first discuss the nature of the research in general, and then elaborate the nature of the research questions and explain my methodological choices to address them. As will be explained, I will approach the subject from a naturalistic perspective, in particular from the perspective of cognitive science. This approach and its justification are also discussed more in detail in this chapter.

This research is a theoretical basic research. The purpose of theoretical basic research is to deal with fundamentals of a certain theoretical environment in order to increase the understanding of the phenomenon under observation (Uusitalo 1991, Kallio 2006). Theoretical basic research aims at explaining and making more visible the phenomenon by asking “what is”-questions and explaining them by answering to causal “why is”-type of questions (Sutton & Staw 1995, Kallio 2006). Theoretical basic research may also problematize prevailing theories and conceptions—in this case the approach can be specified to be critical basic research (Kallio 2006). Problematization, however, necessitates that it is presented, at least implicitly, how things should be. Importantly, basic research does not mean the abandonment of empirical knowledge, but quite vice versa; existing empirical knowledge may serve as basis for theoretical basic research (Kallio 2006).

The objects of analysis of this research are scientific theories. Scientific theories can be approached from the perspective of the idea of multi-level theory building (e.g. Tsoukas & Knudsen 2005, Kallio 2006). The idea is that different types of theories can be broadly speaking classified hierarchically according to the nature of questions that they try to answer. A modification of Tsoukas and Knudsen’s idea of the subject is illustrated in the figure 1.

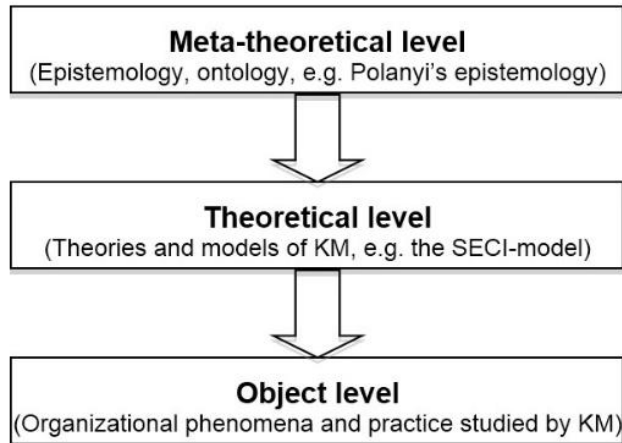


Figure 1. The idea of meta-theoretical reflection in the context of this research. The three levels are adopted from Tsoukas and Knudsen's (2005, p. 6) model.

Meta-theoretical level can be considered consisting of the theories of the nature of reality and knowledge (Tsoukas & Knudsen 2005). Meta-theoretical level thus provides the vision of the nature of reality that can be applied in the lower levels. Theoretical level refers to the basic theories of different scientific disciplines that are based on the conceptions regarding the features and problems of the subject area (see Kallio 2006). The object level is the most practical level on which scientific theories are tested, applied in practice and modified further to “everyday theories” (for example in training and consulting). As Kallio (2006) explains, the upper levels determine normatively lower levels, but also lower levels affect upper levels; for example, it is possible to show by empirical testing (e.g. on the object level) that basic theories are erroneous.

Although a theory belongs primarily to a certain level, at the same time it may be embodied in other levels. The idea is that theories themselves can be considered consisting of different levels, which aims at providing more holistic understanding of the theory. For example, Nonaka and Takeuchi's theory of knowledge creation belongs to the theoretical level as it is a disciplinary basic theory. It however carries some meta-theoretical assumptions (either explicitly stated or implicit) concerning the nature of reality that it assumes. On the other hand, it defines what kind of applications based on it can be used in the object level. Polanyi's theory, in turn, belongs to the meta-theoretical level by definition, because it discusses the nature of knowledge.

Theoretical research can be applied in all the three levels, whereas empirical research is restricted to the theoretical and to the object level. This is because the truthfulness of the theories on the meta-level is impossible to verify (see Kallio 2006). The focus in the context of this research is situated particularly to the meta-theoretical–theoretical axis, which justifies the theoretical approach.

The methodology of theoretical research is in general difficult to express because it is essentially based on researcher's intuition, thinking and insights (Neilimo & Näsi 1980). Naturally, there are no guidelines for such creative processes (Bunge 1974). On the other hand, it is difficult to differentiate the methods of theoretical research because they are mutually complementary; any theoretical research includes almost necessarily more than one theoretical method (Kallio 2006).

The primary scientific methods used in this research are analysis, synthesis and argumentation. Ritchey (1991) defines analysis as the procedure by which an intellectual or substantial whole is broken down into parts or components in order to determine its essential features and their relations. Analysis aims at better understanding of the governing principles of certain scientific system by displaying its logical structure (Beaney 2012). I use analysis particularly as I assess the meta-theoretical assumptions of the idea of externalization of tacit knowledge and the theory of knowledge creation in general. Also Polanyi's theory has to be broken down to in order to analyze it from the cognitive perspective.

Synthesis, in turn, is defined as the opposite procedure to analysis: it refers to combination of separate elements or components in order to form a coherent whole. Synthesis compile information together, for example, in order to propose alternative solutions. My attempt to clarify Polanyi's conception of tacit knowledge necessarily includes synthesis as I apply the understanding of contemporary cognitive science to Polanyi's thinking. This aims at broadening the scope of Polanyi's theory. Analysis and synthesis go methodologically hand in hand in the sense that every synthesis is built upon the results of a preceding analysis, and every analysis requires a subsequent synthesis in order to verify and correct its results (Ritchey 1991).

Argumentation in general refers to an act of presenting justifications in an attempt to show that one view is better than some other view. More formally, an argument consists of an act of concluding, one or more acts of premising (which assert propositions in favor of the conclusion), and a stated or implicit inference word that indicates that the conclusion follows from the premises (Hitchcock 2006). It should be pointed out that this account of argument allows premises and conclusions to be any speech acts which assert the truth of a proposition (including acts like suggesting, hypothesizing and deducing) (Groarke 2013). Since in theoretical

research the rationale is not based on first-hand empirical evidence, the role of argumentation becomes particularly important; the credibility of the research is deeply dependent of researcher’s ability to affect the reader by means of argumentation that is effortless to follow (see e.g. Kallio 2006)

4.1 The Nature of the Research Problems and the Structure of the Research

The structure of the research process is explained in figure 2. Polanyi’s theory of knowledge is first analyzed from the perspective of cognitive science. Next, in accordance with the research problem, Nonaka and Takeuchi’s conception of externalization has to be constructed into the meta-theoretical level in order to be able to compare it with Polanyi’s theory that itself is meta-theoretical. In particular, it is important to analyze what kind of relationship tacit and explicit knowledge have in both theoretical environments. The above mentioned procedures finally enable the comparison between the two theoretical entities. This comparative analysis is the key to answer the research problem.

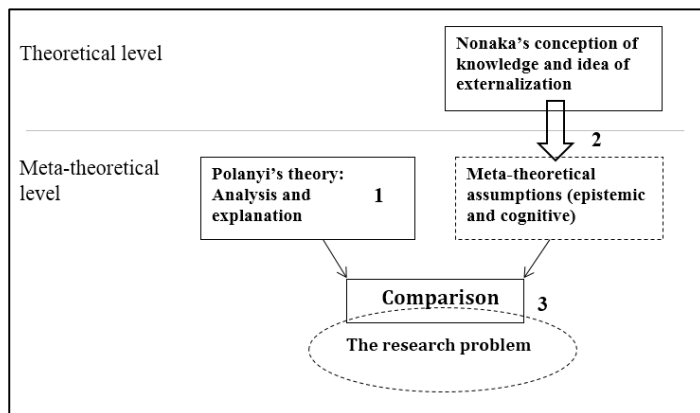


Figure 2. The structure of the research process. 1) The analysis of Polanyi’s theory, particularly from the cognitive perspective. 2) The extraction of epistemological and cognitive assumptions of the conception of externalization of tacit knowledge. 3) The comparison of the meta-theoretical assumptions of the two theories, which is the key to the research problem.

Next I discuss briefly the two sub-problems, my approach to them, and the rationale behind my approach.

4.2 The First Sub-problem – Analysis of Polanyi’s Theory

I approach Polanyi’s theory from the perspective of the findings of contemporary cognitive science. In general, psychology has come to dispute the territory of epistemology by offering persuasive arguments for absorbing the whole of epistemology (Bunge 1974). Specifically, since perceiving, representing and inferring are functions of the central nervous system, the study of knowledge falls within the realm of psychology and neuropsychology (Bunge 1974). This development refers to naturalization of epistemology, an idea inspired by Quine (e.g. in Quine 1969) and Kuhn (e.g. in Kuhn 1970). According to the main thesis of naturalized epistemology, epistemology is a multidisciplinary affair and understanding the mind-brain architecture is necessary for it (Goldman 1986). In other words,

"Questions about how we actually arrive at our beliefs are [...] relevant to questions about how we ought to arrive at our beliefs. Descriptive questions about belief acquisition have an important bearing on normative questions about belief acquisition." (Kornblith 1994, p. 2)

Moreover, whereas the starting point of the classical definition of knowledge is the belief, whose truthfulness and justifiability are then analyzed, Polanyi particularly stresses the importance of elements that form the focal belief. Such elements include neural processes. As Polanyi (1966, p. x) writes, “tacit knowing is the way in which we are aware of neural processes in terms of perceived objects”. Polanyi made it clear that knowledge of the brain (tacit knowledge) and knowledge of the mind (focal knowledge) are not identical, even though the operations and existence of the mind depend necessarily on the brain. Hence, Polanyi himself suggested that knowledge is not a matter that belongs exclusively to the realm of philosophy. Polanyi’s theory redefined innovatively epistemology by incorporating insights of psychology (Jha 2002). Hence, it is justified to continue the tradition in the light of findings of post-polanyian cognitive science.

Although the naturalization of epistemology is a significant line of research in philosophy, the suitability of naturalistic approach is not always self-evident to all contexts. For example, tacit knowing as a research subject includes certain inter-paradigmatic tensions because, on the one hand, Polanyi’s theory criticizes objectivist philosophy of science, and Polanyi’s own view takes into account personal and phenomenal elements of human cognition. In particular, Polanyi draws, among others, from phenomenological literature. Phenomenology, in turn, can be considered as opposing view to naturalism.

On the other hand, knowledge management literature that applies Polanyi's thinking recognizes itself as positivist (see e.g. Nonaka & Takeuchi 1995, Hislop 2005) discipline with often managerial perspective. The commensurability between different paradigmatic views is thus a significant theme in this research. For this reason it seems necessary to discuss briefly the suitability of my cognitive approach to Polanyi's theory. To be more precise, one might critically ask whether cognitive science is a justified approach to analyze Polanyi's epistemology.

The first question to consider is whether cognitive science is strictly related to some line of philosophy of science? As argued above, in the literature of management research positivism is often mentioned as a basing philosophic view. To be precise, although positivism plays a significant part in the history of philosophy, it had been mostly bypassed as a philosophical view before cognitive science even was born. Hence, although positivism as a term is still used in special sciences (with relatively loose and varying meanings, though), it is hardly noted as a philosophical view in cognitive science.

Given that cognitive science means an interdisciplinary study of mind applying a diversity of methods, it is difficult to label it belonging to certain philosophical paradigm. As I understand it, the richness of cognitive science is its view that combines philosophical, theoretical and experimental results in order to draw conclusions about the nature of mind. Hence, naturalistic philosophy is probably the most closely related philosophical view to cognitive science, whose basing idea is that psychological and computational results have significant implications to traditional philosophical problems in epistemology and metaphysics. The starting point of naturalism is that scientific method can, and should, be used to investigate different areas of reality (Kim 2003). In other words, naturalism in its original form stated that there was no credible position outside of science from which ontological questions could be answered. At this point the original question about the suitability of cognitive science to analyze Polanyi's theory becomes relevant, because originally phenomenology, from which Polanyi drew, has been essentially an anti-naturalistic view.

First of all, Polanyi indeed drew also from the phenomenological literature, but his own view, as I interpret it, cannot be subsumed strictly under phenomenology, nor any other modern philosophical school (see e.g. Gelwick 1996). Polanyi's ontological view, namely the assumption of existence of external reality whose nature knowledge and discovery uncovered, is relatively clear detachment from phenomenology. In this sense Polanyi's philosophy certainly can be approached from outside phenomenology.

There has recently been in general an increasing dialogue between phenomenology and cognitive science due to the acknowledgement that the interaction between the two can be mutually enlightening (Gallagher & Zahavi 2008). On the one hand, consciousness was raised as a scientific question in the late 1980s (e.g. Chalmers 1995, Searle 1992, Dennett 1991) in cognitive science, and in this context phenomenology as a philosophical approach was thought to be of possible importance (Gallagher & Zahavi 2008). On the other hand, the embodied approaches to cognition motivated the reconsideration of phenomenology in cognitive science (e.g. Varela et al. 1991, Damasio 1994, Clark 1997). This view objected strongly the body-mind dualism prevailing in cognitive science at that time, and in fact, a significant inspiration for this view were the insights of phenomenologist Merleau-Ponty (Gallagher & Zahavi 2008).

In summary, despite the early tensions between phenomenologist and naturalist approaches, they have found each other, particularly in the methodology of cognitive science. Moreover, this is not only an alternative view, but a notably strong research orientation in present cognitive science (e.g. Dreyfus 1996, Gärdenfors 1999, Wheeler 2005, Damasio 2010, Gallagher & Zahavi 2008, Schmicking & Gallagher 2010).

If we now reconsider the problem of approaching Polanyi's theory from the perspective of cognitive sciences, we can notice that the paradigmatic gap is not at all that deep that it might seem at first. However, let us still consider inter-paradigmatic commensurability in general. Lincoln and Guba (2000) remind that the boundaries between paradigms keep shifting as they are our own constructions. In addition, although researchers have their paradigmatic preferences, they seldom are, or should be, adhering strictly to one paradigm, but should be inspired by and sympathetic towards other paradigms (Tsoukas & Knudsen 2002). Quite the contrary, strict "paradigm mentality" proliferates and polarizes perspectives inhibiting discourse across paradigms (Lewis & Grimes 1999).

According to Gioia and Pitre (1990) multi-paradigmatic approach aid exploration of scientific research, particularly in the case of complex phenomena, by helping researchers employ disparate theoretical perspectives (Lewis & Grimes 1999). In the case of this research the subject area indeed deals with complex phenomena marked with debates and contradictory findings. Finally, I do not want to label this research (or myself as a researcher) strictly under a certain paradigm. As the objective of this research is to provide holistic understanding of polanyian conception of tacit knowing as a cognitive phenomenon, I feel that it cannot be analysed from one prescribed starting point.

4.3 The Second Sub-problem – Analysis of the Conception of Externalization of Tacit Knowledge

The point of this sub-problem is to extract the epistemological and cognitive assumptions that the conception of externalization of tacit knowledge seems to imply. After that it is possible to evaluate the mutual compatibility of these assumptions, but also their compatibility with Polanyi's assumptions. The evaluation of the mutual compatibility is important, because the validity of the basic theories of non-exact sciences (such as KM) must be assessed primarily by focusing on their internal consistency and their capability to solve the problems that they addresses (Heiskala 2000). This is because the validity of basic theories of non-exact sciences cannot be easily evaluated by empirical testing because the knowledge in these fields is not universal but many times dependent on the circumstances (Kallio 2006).

The internal consistency of Nonaka and Takeuchi's conception of knowledge, and particularly the idea of externalization of tacit knowledge, is assessed by deriving the meta-theoretical assumptions of their theory using the method of analysis. This makes it possible to study the coherence of its theoretical building-blocks on a deeper level. According to my understanding, particularly the method of analysis crosses the line beyond theory and opens the door for meta-theoretical considerations. Analysis, however, implies also dialogue with synthesis that refers to assembling approach in order to present a better-grounded view of the analysed system, or (as in this case) to reassess the internal coherence of the system.

5 The Original Research Papers

In this chapter I briefly present the main ideas, methodologies and contributions of the original publications in the order that they appear in this thesis.

Publication I: Representation of the Body as a Basis of Personal Knowledge.

In this publication I suggest that there are important similarities between Polanyi's conception of the subsidiary awareness of body and Damasio's (in Damasio 1999) theory of consciousness that, on the one hand, represents the most recent neuropsychological understanding of formation of human consciousness, and on the other hand, builds on the argument that conscious acts (such as knowing) are based on subject's property to represent the body state and changes in it. The main purpose of this publication is to assess the justifiability of Polanyi's concept of embodiment of knowledge. It is concluded that both Polanyi and Damasio consider representation of one's bodily states as the most fundamental form of knowledge. The publication contributes to understanding of Polanyi's theory by clarifying the idea of embodiment in a more concrete way by applying the results of recent findings in cognitive sciences. In a sense Polanyi's argument concerning the crucial role of embodiment is even strengthened because, as Damasio suggests, consciousness itself is dependent on the representation of body. Hence, the publication not only shows that Polanyi's theory is still relevant in the realm of cognitive sciences, but also suggests that from the cognitive perspective Polanyi's philosophy was rather progressive by nature at his time.

Publication II: Towards Better Understanding of the Concept of Tacit Knowledge – a Cognitive Approach.

This publication aims at clarifying and broadening the scope of Polanyi's theory, by explaining acts of tacit knowing from the perspective of cognitive sciences. In this article I pounce on the concrete examples of tacit knowing that Polanyi used most in his writings in order to analyze what they are about from the cognitive perspective. It should be noted, that the classification of the instances of tacit knowing presented

by Polanyi to relevant class of psychological phenomenon (for example, the classification of skillful use of tools to the class of motor skills) are based on my interpretation. The purpose of this publication is to trace the possible mechanisms that would explain the tacitness of tacit knowledge, and based on the results of the analysis, to assess what kind of epistemic contents, if any, tacit knowing bears. This publication contributes to clarification of Polanyi's theory by broadening it by explaining the cognitive mechanisms of the examples he presented. Polanyi's theory is also situated in the context of naturalist epistemology. In addition, it is suggested that Polanyi's epistemology includes the processes of focal belief-formation, which are not considered in the classical definition of knowledge.

Publication III: The Problem of Tacit Knowledge – Is It Possible to Externalize Tacit Knowledge?

This publication serves as an introduction to the problems related to the idea of externalization of tacit knowledge. While this problematization is not new, but discussed by various authors, this publication shows the relevance of this issue in another area, namely in the information system science. It is also suggested that mutual understanding is not only dependent on successful externalization of tacit knowledge, but requires also the understanding of the other parties. This is an aspect that has caught much less attention in the literature. Hence, this publication contributes to KM discussion by sketching the idea that while externalization of tacit knowledge seems impossible, more attention should be paid on understandable communication of, in Polanyi's terms, the contents of the focal awareness.

Publication IV: Epistemological Problems Concerning Explication of Tacit Knowledge.

This article aims at exploring the meta-theoretical assumptions of the conception of externalization of tacit knowledge by transferring it from theoretical level to meta-theoretical level by means of analysis. This allows the assessment of the internal consistency of the conception of externalization. This publication contributes to the discussion concerning the nature of knowledge in the area of KM by extracting the epistemological premises of the conception of externalization of tacit knowledge and showing, by argumentation and examples, that its epistemological basis is internally self-contradictory.

Publication V: Externalization of Tacit Knowledge Implies a Simplified Theory of Cognition.

Whereas previous publication (publication IV) discussed the epistemological basis of the conception of externalization of tacit knowledge, this publication addresses the problems of the theory of cognition that becomes assumed by it. It is shown that particularly the introspective nature of the process of externalization and the language dominance view of mind, both assumed by the conception of externalization, are problematic. These issues have not been discussed profoundly in the KM literature. Also, the unreachability of tacit knowledge leads to conclusion that the emphasis should be shifted to the pursuit of (shared) understanding instead of externalization of tacit knowledge. Finally, I argue that despite the significance of tacit dimension to human knowing, tacit knowledge might be a concept of minor importance in the KM discipline in the sense that it is impossible to manage.

Publication VI: In Search for a Theoretically Firmer Epistemological Foundation for the Relationship between Tacit and Explicit Knowledge.

In this publication I critically analyze the two prevailing epistemological views in the mainstream KM literature (that is, ‘knowledge as category’ and ‘knowledge as continuum’) addressing their weaknesses. I present a simple epistemological view that is based on Polanyi’s conception of knowledge. Polanyi’s epistemology is also compared to classical definition of knowledge, and as a result of this analysis I discuss the conception of internal justification of knowledge. Also, the idea that the emphasis should be on making focal forms of knowledge more comprehensible is elaborated along the publication.

Table 1 summarizes the theoretical and methodological approaches *primarily* applied in each of these publications. Also the sub-problem that the publication in question principally addresses is mentioned in the table.

Publication	Type of theoretical research	General purpose	Methods	Addressed sub-problem
I	Synthetic basic research	Expansion of a theory	Analysis, synthesis	1
II	Synthetic basic research	Expansion of a theory	Analysis, synthesis	1
III	Analytical basic research	Comparison between theories	Analysis	2
IV	Analytical basic research	Analysis of a theory	Analysis	2
V	Critical basic research	Problematization of a theory	Analysis	2
VI	Critical basic research	Problematization of a theory	Analysis, synthesis	1,2

Table 1. A summary of the theoretical and methodological approaches primarily used in the publications. Note that argumentation is the basic method of all the publications and hence not explicitly mentioned in the table.

6 Results

In this chapter I discuss the most important findings of the original research papers in relation to the presented research problems.

6.1 Sub-problem 1: Polanyian Tacit Knowledge – The Cognitive Perspective

Polanyi's philosophical arguments concerning the structure of knowing are in line with findings that contemporary sciences of mind (psychology, neuroscience and cognitive science) have recently provided. The assessment of Polanyi's epistemology from the perspective of cognitive science shows that tacit knowing is not only a real mental phenomenon but also the fundamental basis of all knowledge as Polanyi (1962, 1966) claimed. Hence, the claim that the basis of human knowing is beyond the knowing subject's capability to focally trace the roots of his knowledge seems justified.

According to Polanyi's epistemology the fundamental idea behind the subjective dimension of the knowing is the bodily roots of all conscious acts. Indeed, based on Damasio's (1999) view, the representation of body state is an essential condition for conscious acts. Representations of reality must be directed to organism itself (to the body state and changes in it) to be able to be conscious of them. In this sense consciousness implies subjectivity, that is, a sense of having a self that is separate from the world. Directing an external representation to self enriches the meaning of the representation by adding experience-based predictive features (such as emotional and motor information) to it. The personal perspective of knowing is constructed principally by this mechanism.

The analysis of the instances of tacit knowing presented in Polanyi's examples shows that from the perspective of knowing the processes that Polanyi calls tacit are mostly unconscious, which is the primer reason for the difficulty to describe them; these tacit processes occur in the brain regions that are not directly connected to the working memory, which means that the knowing subject cannot monitor them in any way. Tacit processes function automatically, which means that the knowing

subject becomes aware mainly of the conscious results of tacit processes (as the results become represented in the working memory), but not of the tacit processes *per se*. It seems that the acquirement of tacit knowledge is not dependent on the knower's awareness of what is being learned, and does not need to be manipulated by "higher" brain areas but is internalized automatically. It is important to note that these processes to which tacit knowing is related are not typical only to humans, but also appear in other species. From the viewpoint of evolution, the function of these processes is, before anything, adaptation to environment. Hence, the evolutionary roots of these processes go much further back in time compared to higher processes of consciousness, such as the use natural language typical only to humans. Human intelligent behavior thus should be viewed as being organized in a hierarchical way out of older neural modules, each of which had evolved programs for particular functions. From this perspective subsidiary processes represent the epistemic foundations on which emerging explicit operations are based. Although tacit knowledge is inductive by its nature, it still embodies epistemic content that gives the knowing subject better possibility to control its environment. Tacit knowledge has a personal justification based on experiences that have produced neural changes that affect behavior in a purposeful way.

Tacit knowledge and the processes related to it in are essentially about the formation of focal belief. Whereas the traditional analysis of knowledge only starts from the belief and is primarily concerned with questions related to the truthfulness and justification of the beliefs, Polanyi's theory of knowledge stresses first and foremost how humans arrive at their conscious beliefs or representations. This idea is illustrated in the figure 3.

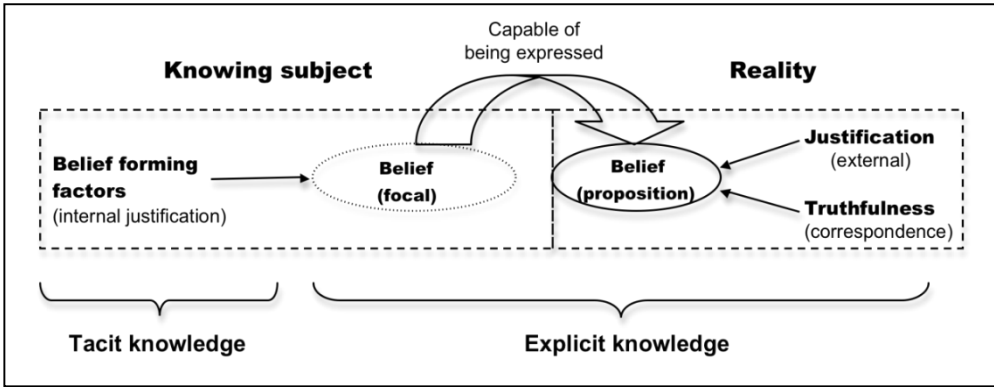


Figure 3. The relation between traditional definition of knowledge ('Reality') and Polanyi's theory of knowledge ('Knowing subject'). In Polanyi's theory both the focal belief in the knower's mind and articulate belief represent "explicit knowledge". Tacit knowledge refers to belief forming factors that cannot be fully traced. In this sense tacit knowledge can be understood as an internal justification for the focal belief. Instead, the traditional approach to knowledge studies justification and truthfulness of propositional beliefs.

6.2 Sub-problem 2: Tacit Knowledge in the Conception of Externalization of Tacit Knowledge

The externalization of tacit knowledge enabling epistemology assumes two kinds of knowledge, tacit and explicit. The conception of tacit knowledge is claimed to be adopted from Polanyi's epistemology, whereas the conception of explicit knowledge corresponds the traditional, or objectivist, definition of knowledge. The aim of externalization is to convert tacit knowledge to explicit knowledge by the means of introspective methods. Introspection refers to examination of one's own conscious thoughts or perceptual experiences. In Polanyi's terms it would mean examination of the contents of focal awareness.

These two epistemological views that are assumed are, however, mutually incompatible based principally on the stance they take on the questions concerning the justification of knowledge and the role of the knower. Hence, the theory of knowledge that the idea of externalization of tacit knowledge assumes is internally contradictory.

Furthermore, the conception of explication of tacit knowledge implies a somewhat simplified theory of cognition. According to the contemporary research of cognitive science, the presumed direct access to the contents of our mind is only

a fragment of our imagination and our mental capacity (e.g. Ledoux 2002, Damasio, 1999, Paivio 2007). We simply cannot see or describe what is going on in our brains when we are learning, remembering, solving a problem or using our expertise. Indeed, the validity of “externalized tacit knowledge” attained by introspective methods is questionable because awareness of private representations comes as a result of drawing inferences from later observations of those representations.

Moreover, the conception of externalization assumes some kind of language dominance-view of mind that in cognitive sciences has been rejected as insufficient conception. The symbolic representations do not appear from nothing before them. Our thoughts and concepts, and all other aspects of cognition, are based on the perceptual system, past interactions with our environment and our understanding of the world that is included into the body and the brain.

6.3 The Application of Polanyi’s Theory in KM Literature Based on Nonaka and Takeuchi’s Conception of Knowledge

The analysis of Polanyi’s theory shows that externalization of the content of subsidiary awareness is not theoretically possible. In other words, the idea of externalization of tacit knowledge does not follow the logic and implications of Polanyi’s theory. Actions strongly guided by tacit knowing can many times be described afterwards (e.g. intuitively made decision or skilful motor performance) but such retrospective reflection does not make tacit knowledge in the polanyian sense accessible.

The predominant epistemology basing on Nonaka and Takeuchi’s conception of knowledge that distinguishes tacit and explicit knowledge as different types of knowledge is based on misinterpretation, either intentional or unintentional, of Polanyi’s theory. To be sure, focal (explicit) and subsidiary (tacit) knowledge are central concepts in Polanyi’s epistemology. However, Polanyi does not make such a dichotomy, but describes the structure of knowledge that concerns in general all acts of knowing. The most fundamental difference between the interpretation of Polanyi’s theory presented here and the typical interpretation presented by the bulk of KM scholars is related to the question, how Polanyi’s theory is understood in general; it is widely adopted idea in the KM literature that Polanyi’s theory is a theory of the existence of two types of knowledge. However, I argue that Polanyi’s theory is rather a theory of knowledge that has two-levelled structure.

Based on Polanyi's and KM authors' ideas of tacit knowledge three different levels of content of mind can be distinguished from the perspective of accessibility.

1. Conscious linguistic representations, or representations that are easily made linguistic (e.g. declarative information, propositional thoughts, texts etc.);
2. Conscious representations that are difficult to articulate because of, for example, limitations of vocabulary (e.g. an unusual color), richness or modality of the representation (e.g. a vision or a multimodal experience) or not-yet analyzed nature of representation (an incomplete idea or assumption not yet submitted to full verification). In other words, compared to the representations of level 1, the representations of this level are more phenomenological in nature;
3. Unreachable content impossible of becoming a conscious representation.

Based on the characterizations of tacit knowledge made by KM authors applying Polanyi's theory for externalization, it is evident that they refer with 'tacit knowledge' to larger set of mental phenomena than Polanyi. This means that the extension of the concept of tacit knowledge in the KM literature is larger than in Polanyi's theory. The addition of objects (or phenomena) to the extension of the concept of tacit knowledge has reduced its intension, which in turn has caused the blurring of the concept of tacit knowledge in the KM literature. To Polanyi tacit knowledge is a phenomenon of the level 3, whereas tacit knowledge in the KM literature refers to both level 2 and 3. However, the focus seems to be on the level 2. The difference between the views is illustrated in figure 4.

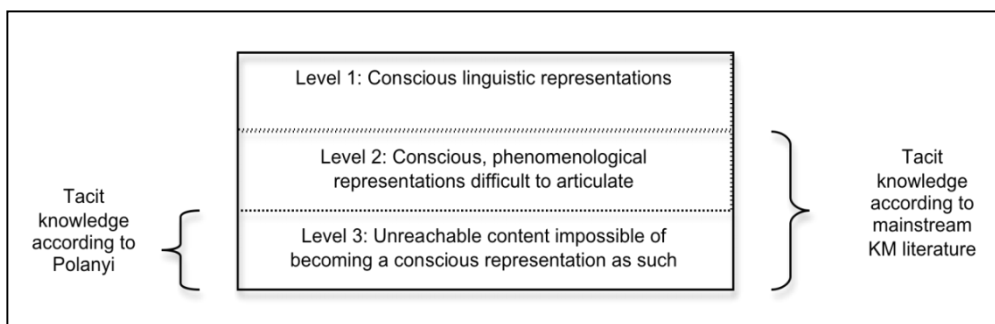


Figure 4. Tacit knowledge according to different sources.

Hence, Polanyi's theory has been extended in the idea of externalization of tacit knowledge in a way that distorts the original meaning of the concept.

Given that knowing occurs within a human knower, all knowledge has necessarily a tacit dimension that refers to subconscious or otherwise subsidiary elements that reflect the experiences of that particular knowing subject. As a result of the tacit factors the knower forms a focal conception of the matter, which represents the explicit dimension of knowledge. Hence, all instances of knowledge have tacit and explicit dimensions. When this basic structure of knowledge is taken into account, knowledge can be further divided into categories in a suitable way. Importantly, all categories in the model should manifest this structure. The basic structure and further classification of knowledge is described in figure 5.

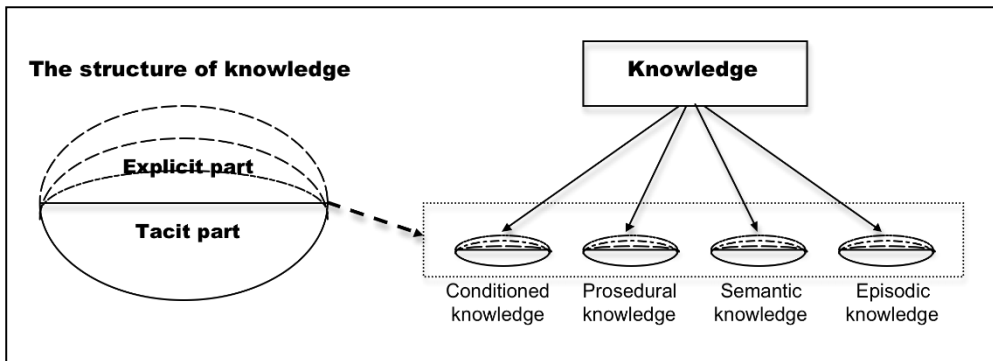


Figure 5. The structure of knowledge. Knowledge has a tacit part upon which the possible explicit part is founded. All instances of knowledge manifest this structure, even if knowledge is further categorized in a suitable way depending on the context. In this figure is presented an example of categorization adopted from the psychological memory research (e.g. Schacter et al 2000).

7 Contribution

Despite the growing number of publications in KM, theoretical (epistemological and cognitive) perspectives of knowledge have been even overtly ignored in the mainstream KM (Sthyre 2003, Jakubik 2011). KM lacks in general a solid theoretical foundation and especially a complementary understanding of the nature of knowledge (Alvesson & Kärreman 2001). Since KM itself is based on disciplines (such as philosophy, economics, information system science, psychology, social psychology and organization theory) that have well-established theories (see e.g. Jakubik 2011) it is not only possible to build such a theoretical bedrock for KM, but in fact necessary in the name of credibility of KM as an independent scholarly discipline. In a broad sense this research answers to the evident need of further research and more profound discussion of epistemological issues in the KM literature.

The main contribution of this research comes from the clarification of Polanyi's theory of knowledge, and particularly the concept of tacit knowledge in the context of KM. Although Polanyi's theory has been discussed in the KM literature, to my knowledge there has not been particularly profound attempts to clarify his thinking by broadening his theory from the perspective of cognitive science. On the other hand, in the area of philosophy Polanyi has been criticized for his failure to explain cognitive processes involved in tacit knowing despite the psychological influences of his theory (see e.g. Webb 1988, Gulick 2004). This approach provides better understanding of Polanyi's theory by relating his philosophical concepts to studied cognitive phenomena. This also expands Polanyi's theory by providing complementary elements and insights that support his philosophical claims. Also, situating Polanyi's theory in the context of current cognitive sciences shows that his ideas are still relevant, over sixty years later.

The research participates in the development of theoretical foundation of KM by pointing out problems and controversies in the existent literature, particularly in the conception of knowledge that originates from Nonaka and Takeuchi's (1995) theory, and has been widely adopted. This idea is not at all new, but discussed by various authors before, as explained above. This critique has been at least partly explained to be caused by the different philosophical position that the critical views represent

compared to Nonaka and his colleagues view (e.g. in Nonaka & Peltokorpi 2006). In this sense the perspective of cognitive science applied in this research augments this discussion by pointing out the problematic features of Nonaka and his colleagues thinking from the perspective of contemporary understanding of cognition. The idea here is to take the discussion forward without getting stuck to paradigmatic differences with which the different views have been explained. Furthermore, I have aspired to broaden the discussion by profound epistemological analysis that clarifies the theoretical controversies built in the conception of externalization of tacit knowledge.

I have suggested in this research how knowledge could be classified in a way that is supported by Polanyi's structure of knowing. In more general sense this research contributes by encouraging to adaptation of wider conception of knowledge. Conception of knowledge in different fields is typically based on the knowledge that is open to study, either direct (through perception) or indirect (through reasoning). For example, in computer science it is often assumed that there exists two types of knowledge; first, some kind of direct and observable knowledge that can be inputted and stored into information systems, and second, knowledge that the system can automatically deduce based on given rules and the inputted knowledge (Colburn 2000). Nevertheless, let us consider programming as an example: an experienced programmer is able to see the underlying commonalities, differences, strengths and weaknesses of different data structures, possible approaches and solutions of programming tasks. This is knowledge that is essential in programming, but also knowledge that goes significantly beyond the syntax and semantics that can be expressed explicitly (Soloway and Ehrlich 1984). Although this kind of knowledge is challenging to study, its existence cannot be denied and it should not be bypassed for example in the teaching of computer science.

Finally, this research shows the relevance of cognitive science to KM in general, and particularly to knowledge related issues. For instance, the starting point of knowledge creation is individuals' personal understanding, not always directly open to study. Since traditional contemporary epistemology seeks principally criteria for justification (see e.g. Bunge 1974, Colburn 2000, Polloc & Cruz 1999) its normative nature explains rather rigidly knowing in practical context. Indeed, in organizational context knowing is often closely related to decision making, problem solving and reasoning in general. Knowledge that is built in such processes might be difficult to explain with normative basis. This, in fact, is a well-known problem in the fields of computer science and artificial intelligence; many basic and effortless everyday tasks of humans are extremely difficult and computationally hard to execute by means of

rules and logic. Hence, more naturalized approach gives more perspective and conceptual tools on explaining these processes, which in turn hopefully gives more perspective also on their management.

8 Discussion

Nonaka and his colleagues were one of the first KM scholars to explicitly emphasize the role of tacit knowledge in knowledge creation and innovation. Their theory is based on an important idea that organizations should focus on individuals and subjective dimension of knowledge in order to be successful. Nevertheless, the stressing of the importance of codification of tacit knowledge seems to turn the argument upside down; tacit knowledge is seen as a reservoir of secondary knowledge that is of no use unless at least some of it is converted to explicit knowledge. In this sense explicit knowledge seems to have a privileged role in the field compared to tacit knowledge, although the original intention was to stress the importance of tacit knowledge (e.g. in Nonaka & Takeuchi 1995). To be sure, their starting point is management of knowledge, which necessarily calls for more straightforward approaches that they first assume. This controversy between the conception of knowledge and the conception of management (that e.g. Alvesson and Kärreman (2001) have pointed out) forces them to make compromises, which seem to be the foundation of the theoretical problems. The division of knowledge into tacit and explicit, is not based on the realistic theory of knowledge/cognition, but on the needs to manage knowledge.

The critique towards the KM theory presented in this research does not mean that the adoption of Polanyi's theory of the nature of knowledge would be some way a wrong choice in the KM thinking. The adoption of Polanyi's thinking by Nonaka and his colleagues is well justified in the sense that Polanyi was primarily interested in the nature of scientific discovery, which as a process also aims at creation of knowledge; both Polanyi and Nonaka with his colleagues argue that objective knowledge cannot explain innovations that are instead based on our resources of tacit knowing.

Polanyi's theory describes the structure of conscious acts, and its tacit part explains how we arrive at our conscious beliefs. The point is that because of this structure, we cannot get rid of all subjective elements of knowledge, and we cannot trace backwards the premises of our focal representations (whether they be assumptions, beliefs, intuitions, ideas etc.). According to this interpretation, externalization explained by Nonaka and his colleagues' theory occurs, and even

begins, in Polanyi's terms in focal awareness while tacit knowing is a phenomenon situated to subsidiary awareness. In conclusion, while tacit knowledge is a fundamental concept in our understanding of the nature of knowledge in any context (scientific or non-scientific), its role in the context of knowledge creation seems to be different from what has been assumed in Nonaka and Takeuchi's theory. In other words, the concept of tacit knowledge is fundamental addition to the conception of knowledge in justifying the idea of knower-dependent nature of knowledge, but the concept seems to be of limited *practical* utility in the sense that tacit knowledge cannot be operationalized in a way that Nonaka and Takeuchi, and many scholars after them assume. Moreover, if a form of classical definition of knowledge is adopted (as Nonaka and Takeuchi do), tacit knowledge is out of its realm because it hardly is based on belief or is objectively justifiable. In sum, the concept of tacit knowledge fits relatively poorly to the theories of knowledge creation.

The argument stated above suggests that focus of KM should be on the instances of focal awareness that we are able to articulate (these instances cannot always be considered as knowledge), particularly paying attention to means to comprehensive and convincing expression of such instances; the articulation of our thoughts does not mean automatic comprehension of such thoughts by the other parties involved. Indeed, the receiving of a message "externalized" by another person might range from partial recognition of linguistic expressions to considerable understanding of intended meaning, and the difference between the two is significant. On the other hand, the shifting of the focus from externalization to understanding increases the role of the person who seeks to assimilate other person's understanding. The point is that the burden of comprehension is with the learner, who can only be guided to the direction that is assumed right.

From the perspective of Polanyi's theory also the concept of 'collective tacit knowledge' present in the literature (see e.g. Collins 2010, Abrosini 2003, Spender 1996) seems rather incomprehensible. According to Taylor (2007) collective tacit knowledge refers to systemic routines and the relationship between technologies, roles and unwritten formal and informal procedures of group, organization or society. For example, Collins (2010) explains that Polanyi has missed the full complexity of bike-riding because in addition to the tacit knowledge of how to balance the bike we need collective tacit knowledge to ride it in traffic; riding safely is possible only by understanding the context dependent unspoken conventions of traffic. It seems, however, difficult to comprehend what collective focal awareness and collective subsidiary awareness might exactly be in this case. In other words, the idea of collective tacit knowledge implies some kind of collective consciousness,

which to my knowledge has not been theorized about yet, probably because the idea seems unaccountable. In fact, the author of the above mentioned example himself states that *understanding* (supposedly personal) is required to act according to the collective conventions. There certainly are commonly held beliefs and procedures (articulated and unarticulated) that are related particularly to certain groups, but again, we might critically ask: does the labeling of those beliefs 'collective tacit knowledge' clarify our understanding of the nature of knowledge, or perhaps vice versa?

As for the justification of knowledge, Polanyi argued that knowledge was justified firstly by responsible and competent personal judgment, and secondly collectively by the community that is involved in the practice in question (e.g. a scientific community) (see e.g. Gelwick 1996). Polanyi also argued that knowledge will show its value in case it is worth it, which refers to pragmatist view of some degree; knowledge is at least partly valued based on its operability. If polanyian conception of justification is applied to the context of knowledge creation in organizations, it suggests that the temporal scope of knowledge creation is longer and extends outside the organization. Knowledge does not become justified inside organization in relation to prior strategic decisions and forecasts (as Gourlay (2006) criticized Nonaka and his colleagues thinking), but at least partly in the practice, probably in the longer term, in a wider social context and possibly outside the organization; this is because it is very difficult to know beforehand what created "knowledge" turn out to be valuable. This also suggests that knowledge creation is not based on conversions between different types of knowledge but should be viewed as a development and justification of partly indefinite beliefs that represent at best some sort of preliminary form of knowledge.

Polanyi (1962, e.g. p. 277) discusses the creative power to expand beliefs into more concrete or practical form by the support of the conviction that these beliefs had the needed capacity. Therefore, according to his view it seems that knowledge creation is about creation and synthesis of ideas/beliefs and the emergence of their justification. Actually, this idea fits well to Nonaka's understanding of knowledge creation as a social process. From the polanyian perspective individuals' brains create new as they reflect external objects (such as new ideas given by other persons) onto one's existing knowledge-structures and tacit understanding. Individuals, acting by themselves, are relatively tied to their own trains of thought. In this sense illustrative dialogue and open-minded presentation of one's ideas provide new perspectives and insights. The role of tacit knowledge in polanyian sense is to intuitively foreground the ideas of others that "have something in them".

8.1 Future Research

When it comes to the continuation of the research of this particular subject area, I would like to emphasize that despite the conceptual problems of Nonaka and Takeuchi's theory, the issues that it addresses and the objectives that it aims are important. Hence, a possible research line worth of further investigation might be a reformulation of Nonaka and Takeuchi's theory towards a direction that would be conceptually simpler and epistemologically more consistent. To my understanding, this endeavor could draw more on cognitive science, particularly because, as argued above, other forms of cognitive products than knowledge have probably more dominant role at least at the early stages of knowledge creation. For example, in terms of cognitive science externalization could be explained as a process in which the intention is the conversion of internal representation(s) to external representation(s)¹⁰. In fact, this viewpoint might offer a deeper and more versatile perspective to externalization, because some important research work has been done on how we are able to improve our thinking and comprehension by creating external representations and structures (e.g. Kirsh 2010, Paivio 2007, Clark 2008). This approach could be possibly extended also to the rest of the phases of Nonaka and Takeuchi's theory. The entity under development would come closer to knowledge as it justification developed from initial commitment first to internal justification in the organization and possibly further to justification in a wider context. These ideas are however uncompleted and require further research.

In general, cognitive science could be applied more widely in the research of KM. It is methodologically rich discipline, and as showed in this research, it crosses traditional borders between different disciplines, which gives it more conceptual flexibility and explanatory power compared for example to philosophy. Alongside with philosophy it provides a rather diverse view to explain knowledge related issues, especially in the organizational context where acts of knowing are often affected by complexity, uncertainty, and economical and temporal pressures.

¹⁰ *Representation* in general refers to a likeness or simulation of an idea, a concept or an object. While external representations refer to ones that are available in the environment (e.g. writings, utterances, pictures, maps, graphs etc.), internal representations refer to ones held in the subject's mind.

8.2 Limitations of This Research

This research combines in particular three scholarly areas: philosophy, knowledge management and cognitive science. Based to my own scholarly background and to an attempt to provide a new perspective to the subject, in this research cognitive science and philosophy are emphasized at the expense of knowledge management. While I am aware of this clear limitation, the idea behind this choice has been that for the purposes of management we first have to know what we are trying to manage. In this sense, the discussion of knowledge precedes the discussion of its management. In any case, although Nonaka and his colleagues, and Polanyi are widely referred authors in the KM literature, this research is limited to the discussion that is based on their thinking and does not take a stand on what other epistemological views are present in the KM literature. In this sense this research may give deceptively one-sided image of the KM research in general. On the other hand, this leaves the door open to future research as the discussion is relatively easy to expand.

It should be kept in mind that the polanyian conception of knowledge (and of tacit knowledge) presented in this research is based on my interpretation of Polanyi's theory. I have highlighted factors that I have assessed as the most important, but the choices made by me are not the only possible. Hence, my interpretation as a researcher is in this sense one-sided and insufficient to some extent, because every interpretation is disputable and open to other alternatives (Palonen 1988). For this reason I have tried to focus on the internal consistency of this research by making the argumentation as transparent as possible.

Due to the theoretical approach of the research I have not presented any empirical evidence to support my results. The theoretical approach has been a conscious choice since the beginning of this research because the focus is on meta-theoretical questions that cannot be proven by empirical evidence (Kallio 2006). Most importantly, my aim has been to produce conceptual knowledge on which the further research could be based.

In this research I have drawn from recent findings in the area of cognitive science (and psychology). Unfortunately it is impossible to take into account all the limitations that the studies I refer have had. The empirical material I have used refers, however, for the most parts to the basic body of knowledge of cognitive science (and psychology) that is not subject to significant debates.

9 Conclusions

The main point of Polanyi's theory is that the knowledge that we are able to express (propositional knowledge) is based upon various pre-linguistic knowledge capacities that Polanyi called tacit knowledge. For the subsidiary role and the non-linguistic nature of tacit knowledge any knowledge utterances cannot be reduced to their exact origins, and consequently, Polanyi denied the existence of fully explicit knowledge. About four decades later, tacit knowledge became a basic concept of knowledge management theory.

Knowledge management is relatively recent field having only about 15-20 years of history as a distinct scholarly discipline. Nonaka and Takeuchi's theory of knowledge creation is probably the most significant theory of contemporary knowledge management. It challenged the traditional perspective that considered organizations as information processing machines and opened a far-reaching discussion on the nature of knowledge by presenting an epistemological view that highlighted the role of tacit knowledge alongside with explicit knowledge. This discussion, without doubt, has been extremely important in the evolution of the field of KM.

Whereas the attempt of contemporary KM theorists to unite subjective and objective views on knowledge has not been very successful yet, Polanyi's theory already unites subjective aspects of knowing with objective ones, and as such might function well as epistemological basis for KM theories. Polanyi's theory, however, has its practical implications. The most crucial of them from the viewpoint of KM is that tacit knowledge cannot be managed by managers or KM practices, but only by the brain. Hence, while tacit knowledge is fundamental concept in understanding the nature of knowledge, due to its unreachability it is not deployable in the theories of knowledge creation in a way that has been presented by Nonaka and Takeuchi, and the authors following their conception of knowledge. In this sense the position that has been given to tacit knowledge in the field of KM seems overestimated. Given that KM is relatively young discipline, it is not surprising that its concepts, theories and practices are only emerging. Nevertheless, I argue that the kind of meta-theoretical reflections conducted in this research should have been done more accurately before the adoption of the epistemology based on dualism of tacit and

explicit knowledge as a default epistemological view of the field. This might have changed the theoretical assumptions, the emphasis of research and even the results of the field of KM because the basis of applied research is developed in interaction with basic research.

From the epistemological perspective the most problematic feature of KM seems to be the fact that it is situated in the point of clash of scientific thinking, and economic/managerial objectives that call for practical utility. However, if KM wants to avoid alienating itself from scientific principles and hold on its status as a significant area of research, profound meta-theoretical reflections are necessary. This research has sought to contribute the patching up of this need.

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