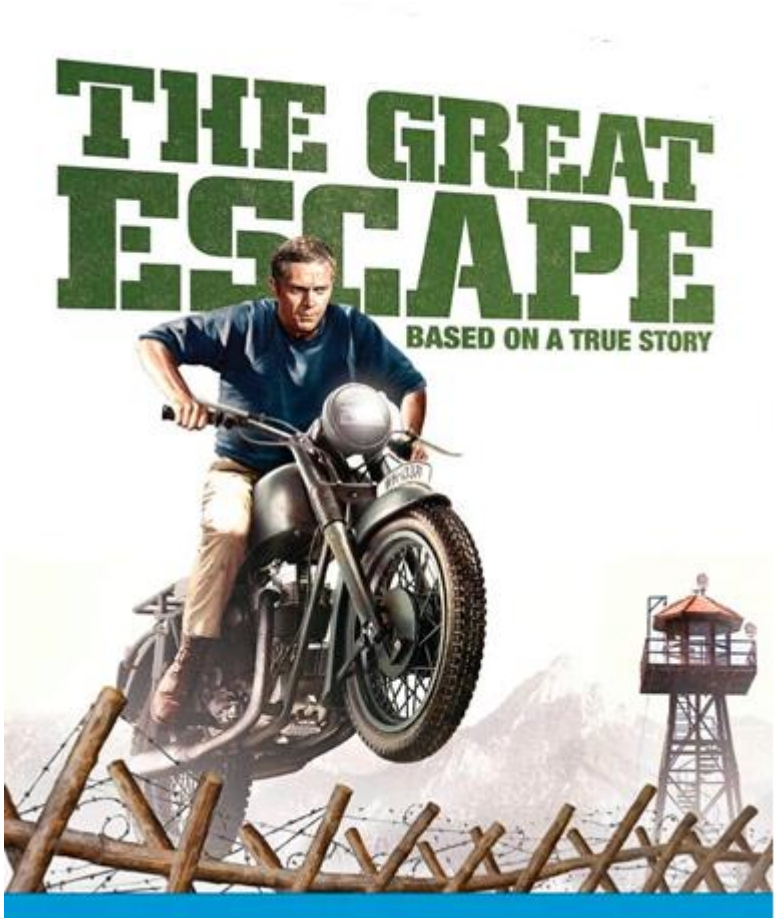
Difference and Innovation



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Abstract

The process of innovation is a complex task to study. It is argued that the innovation literature has dealt with the innovation process through learning and knowledge creation. Following this tradition, Nonaka and colleagues' knowledge creation theory has been taken as the starting point in this thesis. It is a theory that has received almost paradigmatic status, but it has started being criticized. Two issues have been identified, confirmed, and explored. The first issue is that Nonaka's theory has neglected the individual aspect of knowledge creation. The second issue is that Nonaka has misunderstood the terms tacit and explicit knowledge, which serve as the basis of the knowledge creation theory. Instead of tacit knowledge becoming explicit it is suggested by Tsoukas that knowledge creation is about finding new ways of talking, fresh forms of interacting, and novel ways of distinguishing and connecting. To investigate these issues a theoretical approach has been taken. To deal with the individual dimension on knowledge creation, literature on creativity has been explored and discussed. Three paradigms in the creativity literature have been identified; a pragmatic, a social-personal, and a cognitive paradigm. Three important aspects have been extracted; Motivation, movement, and mental structures. The second issue has been dealt with by looking into epistemology, more specifically the two works 'Zen and the Art of Motorcycle Maintenance' and 'Lila' by the philosophical novelist Robert Pirsig. Deleuze's 'Difference and Repetition' has played a supporting role. Four aspects on the creation of new forms have been found. These are; dynamic forms, things have multiple meanings, more creative play, and bodily knowledge. It is found that movement, dynamic forms, and more creative play, can complement Nonaka's theory.

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Introduction

In this introductory part of the thesis I will first elaborate on my personal motivation behind this thesis. I will then continue with an introduction followed by my problem statement with its respective research questions. Finally I will clarify the thesis structure, my choice of theory, and how I have approached the thesis.

Motivation

I 2009 I finished my bachelor on CBS. The final year had been awful; it was a time with stress, anxiety, and lack of meaning. On top of that, I was confronted with more philosophical issues such as Bertrand Russell's skeptical hypothesis that the world started to exist five minutes ago with all human memory and signs. And who can deny that statement? So I decided to do something else with my rationally trained mind. I started a company called Cityview with another lost soul, which turned out unsuccessfully, no wonder why. In the end of the day it was all about showing the world what we were capable of. Somehow the following year I ended up as a teacher but it was still not it. During that year however I rediscovered my passion for creativity - for creating things. In parallel I started digging into philosophy, which challenged my way of thinking. In 2011 I signed up for Cand.merc.MIB to explore the world of innovation and creativity further. In contrast to my bachelor HA.Almen, decision-making was now uncertain and the rational mind less useful. Emphasis was now on more irrational, explorative behavior, rather than rational repetitious exploitation. It was a time where I rediscovered my feelings, something that had been gone for many years. Feelings were no longer unethical but had a place alongside mind. It was also a time where I decided to open up and put judgment aside. At first I became more vulnerable, but soon I realized how much more I learned this way and saw how unpredictable life can be. Putting my identity aside it was now possible to go places I would not normally go. Inspiring as it was, the literature remained on a more superficial level, so I started digging deeper into philosophy. This thesis has always had a twofold purpose; first to become a better inventor, and second to carry creativity out into practice, thus aiming at creating something new in the thesis. I believe I have succeeded the former and failed the latter.

Introduction to problem statement

Understanding the innovation process seems to be beyond human capabilities. One of the most fundamental issues is explained by (Freeman & Soete, 1997). "Generalizations need to be heavily qualified. One reason for this is that the universe of inventions and innovations is not yet known and therefore no strictly random sample can be drawn." In other words, the only thing we can do from a scientific perspective is to study past innovations. However because innovation is about the new itself, we cannot assume that future innovations follow the same patterns as previous ones. In a sense therefore, we can never get a hold on innovation. Whenever it is reduced to a theory it becomes fragile. It becomes a static structure – a ghost and a prison – a point of escape. A related issue to that of (Freeman & Soete, 1997) is the difficultness that lies with distinguishing the rare novel idea that will prove successful from the numerous novel ideas that will be unsuccessful (March, 2010). Van Gogh's paintings were not acknowledged as being brilliant until after his death. So even though we get a lot of ideas, which should we pursue and which should we abandon? What makes this situation even more complex is the fact that we cannot examine any idea in a vacuum. We have to take into account 'the adjacent possible'. Any idea or invention unlocks new doors, which in turn may unlock new doors and so on infinitely (Johnson, 2011). Therefore even though an idea turns out unsuccessfully, it may lead to new opportunities with very high value. A study on the process of innovation that merely focuses on a single moment in time and space therefore seems inadequate. I assert that the innovation literature has been focusing on learning rather than on the innovation process in order to deal with these critical issues. It is assumed that an organization that is capable of learning can survive a dynamic environment. From this perspective learning is about adaption and innovation is about serving changing customer needs. A theory that belongs to this tradition is Nonaka and colleagues knowledge creation theory (from now on Nonaka's theory). It is a theory that has received almost paradigmatic status (Gourlay, 2003), and sheds light on organizational creativity, learning, innovation, and change (Nonaka & Krogh, 2009). Recently however it has started receiving criticism by scholars such as (Gourlay, 2003), (Lindkvist & Bengtsson, 2009), (Hong, 2010), and (Tsoukas, 2011). According to (Aragote, 2013) we still know little about knowledge creation and the relationship between knowledge creation through organizational learning and creativity. Criticism aside, Nonaka's theory, with its widespread success, is the place to start if one wants to inquire into the innovation process.

Problem statement and research questions

From my own personal perspective there has only ever been one problem, namely how to become a better inventor. By inventor I mean a person who is curious about the world, but not skeptical. It is a person who challenges the status quo and actively makes an effort to create new ideas, knowledge, inventions etc. Being an inventor is a lifestyle that values exploration higher than exploitation. It is therefore not about defending certain worldviews, or the exploitation of cash cows. Rather it is about listening and letting go. By acknowledging one knows only a little, one may start listening and learn something new. By letting go, our past cannot dominate the future, and we may overcome ourselves. Time and freedom are essential resources. These resources are not acquired by 'working harder', but by letting go of social chains such as the pursuit for status. Even though innovation is a social phenomenon, the life of the inventor may be lonely with many ups and downs.

Becoming a better inventor is however not an academic problem as such. This thesis has its foundation on Nonaka knowledge creation theory, which has received almost paradigmatic status (Gourlay, 2003). Two major issues in the theory have however been identified. First, In Nonaka's theory knowledge is the outcome of social interactions. According to (Lindkvist & Bengtsson, 2009) the individual aspect on knowledge creation has therefore been neglected. Further examination shows that this issue is not only related to Nonaka's theory but to the whole field of innovation. To complement Nonaka's theory, the literature on creativity with its individual focus should therefore be explored further. Second it is claimed that Nonaka has misunderstood Polanyi's two terms tacit and explicit knowledge (Tsoukas, 2011). Having investigated this issue further I can concede with Tsoukas' criticism. The issue is that Nonaka has applied an epistemology to a social setting. Within the tradition of epistemology, any knowledge of the world starts with the 'I am' (the cogito). Therefore within epistemology the world is seen from 'my' perspective. Tacit knowledge is therefore not something 'out there'. From a phenomenological perspective there is my own focal awareness with an unknown tacit background. Epistemology is therefore always personal and cannot be applied to a social setting. For Tsoukas therefore, knowledge creation is about finding new ways of talking, fresh forms of interacting, and novel ways of distinguishing and connecting. To investigate this issue further, an inquiry into philosophy and epistemology must be

undertaken. We may therefore formulate the problem statement with its respective research questions the following way:

Nonaka's influential knowledge creation theory has started receiving criticism. One issue is that the individual aspect on knowledge creation has been left out. Another issue is that Nonaka has simply misunderstood the terms tacit and explicit knowledge. Further investigation shows that both critiques are valid. To deal with the shortcomings of Nonaka's theory, we may therefore put following two research questions forward:

- *How can the creativity literature complement Nonaka's theory and its lack of the individual aspect on knowledge creation?*
- *How can epistemology complement Nonaka's theory by helping us find new ways of talking, fresh forms of interacting, and novel ways of distinguishing and connecting?*

Thesis structure and choice of theory

The thesis is structured in five different parts. In part one I have attempted to create an innovation overview, by presenting the innovation field from three perspectives; Technomics, Organizational learning, and Open innovation. A table of influential innovation studies created by (Fagerberg & Verspagen, 2009) has been helpful constructing the first two perspectives. The most cited work in the innovation field is that of (Freeman & Soete, 1997), first edition published in 1974. I have therefore used (Freeman & Soete, 1997) to present the technomics perspective (Schumpeter was also a valid candidate). Organizational learning, the second perspective, is based on (Argyris & Schön, 1996) who were the first to propose models that facilitate organizational learning. Argyris and Schön may be seen as the grandfathers of organizational learning (Easterby-Smith & Lyles, 2011). Finally Open innovation is a term that has been on everyone's lip for a decade now. In the MIB curriculum and the MIB course description 'Open innovation' plays a pivotal role. It is a perspective that explains today's business regime that has changed drastically with the rise of the Internet.

In part two I will present Nonaka's theory. I have based this review on the two core books (Nonaka & Takeuchi, 1995), and (Krogh, Ichijo, & Nonaka, 2000), and recent

articles. In the end of part two I will present (Tsoukas, 2011) criticism, that Nonaka has misunderstood the terms tacit and explicit knowledge. Finally I will then confirm my two research questions.

In part three I will dig into the creativity literature to explore the individual dimension of knowledge creation, thus dealing with the first research question. I will present the creativity literature from three perspectives; a Pragmatic, a Social-personal, and a Cognitive perspective. I have based these three perspectives on (Sternberg, 1999) and (Hennessey & Amabile, 2009). In 'The Handbook of Creativity' seven paradigms on creativity are identified; a mystic, pragmatic, psychoanalytic, psychometric, social-personal, cognitive, and a confluence paradigm (Sternberg, 1999). The mystic paradigm is abandoned for scientific reasons. The psychoanalytic paradigm refers to Freud's early studies on creativity, but only little material exists. The psychometric paradigm emerged in the early 70's with the 'Torrance Test' that made more systematical studies on creativity possible. It is however not before the 80's that theories on creativity really start to appear. The confluence paradigm is the contemporary desire for an integration of all creative paradigms into one, but not much has been seen. This has left me with a Pragmatic, a Social-personal, and a Cognitive perspective on creativity. I have based the Pragmatic perspective on (deBono, 1996) who is a pioneer within this paradigm (Sternberg, 1999). To present the Personal-social perspective I have been drawing on (Amabile, 1996), (West & Sacramento, 2006), and (Csikszentmihalyi, 2006). Later I have decided to reduce this section to Csikszentmihalyi. Lastly I have used the work of (Ward, Finke, & Smith, 1995) to present the Cognitive perspective. A complementary view on affect by (George & Zhou, 2007) has been discarded. Part three will be finished with a discussing on creativity in relation to Nonaka's theory.

In part four I will deal with the second research question, thus looking into philosophy and epistemology. My main philosophical works are 'Zen and the Art of Motorcycle Maintenance' by (Pirsig, 1974) and 'Lila' (Pirsig, 1992). Pirsig's writing on creativity and technology makes him a relevant choice. To assist Pirsig I draw a little on 'Difference and Repetition' by (Deleuze, 2004). Pirsig is then discussed in relations to Tsoukas statement that we should generate new forms to extract hidden gem from our practices. Finally in the end of part four I return to Nonaka by applying Polanyi's framework from an epistemological perspective.

In part five I will initiate a final discussion in relation to the problem statement and the respective research questions. I will then follow up with a brief conclusion and a few final words. As for the literature, this thesis is mainly based on primary literature created by influential scholars. Robert Pirsig (in part four) may be more influential as a novelist rather than a philosopher as such. He has been a great starting point for my personal inquiry into philosophy and difference.

Delimitation

Nonaka's theory is the foundation of this thesis. In accordance with Nonaka's theory I approach the innovation process with knowledge creation. In part two it is argued that Nonaka's definition of knowledge also includes that of ideas. Hence knowledge creation is about generating knowledge and ideas. In accordance with Nonaka's theory macro and political perspectives on innovation are also not taken into account. We have seen that Nonaka's strong focus on the social dimension has neglected individual aspects on knowledge creation. I believe that the best way to approach this dimension is through philosophy and psychology. My primary focus in this thesis has been on studying philosophy from Plato to Deleuze.

Studying thinking is truly confused. When we examine our own thinking it becomes an act of thinking in its own right. Even if we could monitor our own thinking, the output must still be analyzed with our own minds. In a sense it therefore seems that any epistemology is flawed because it thinks thinking. Since we cannot escape our own thinking the choice is between a confused something (epistemology) or nothing. I have taken the path of confusion.

As for the subject 'Difference and Innovation', difference refers to the philosophical dimension of this thesis. Difference is a term that has interested most philosophers and is therefore an essential part of philosophy. For an invention to become an innovation it must be different from existing things. Since I deal with the innovation process through knowledge creation, 'Difference and Innovation' then refers to the generation of new and different knowledge and ideas.

Approaching the thesis

Projects on CBS are primary concerned with case studies. From my personal experience, the conclusion was always known from the very beginning of the project. Working with a case study feels limiting because the direction is given beforehand. In the innovation literature a popular distinction is made between exploration and exploitation. Exploration includes things captured by terms such as search, variation, risk taking, experimentation, play, flexibility, discovery, and innovation. Exploitation includes such things as refinement, choice, production, efficiency, selection, implementation, and execution. (March, 1991). Knowing the conclusion from the beginning of a project can be characterized as exploitation. I decided to approach my thesis differently. First, instead of having a case study I decided to be purely theoretical. Second, it has been a purpose to be 'innovative'. I wanted to carry the innovation literature out into practice. For this reason I have taken a more explorative approach. I feel that the essence of exploration is the initiation of a task without having full information. As more information is acquired, new directions should be considered. My interest of becoming a better inventor has been consistent throughout the project, however the problem has taken many forms. It was not before the deadline that I knew the exact conclusion. It has been a cyclical process of reading, reflecting and writing.

My personal philosophical journey started three years ago when I first read 'Zen and the Art of Motorcycle Maintenance' by (Pirsig, 1974). Since then I have been philosophizing on a daily level. I have officially been working with this master thesis for 14 months. During the first half of the thesis I was living in Berlin where I have attended to philosophical lectures on Humboldt University of Berlin. In the final half I have been living in Copenhagen. Working with this project I have realized the difficulties that lie with creating something new in science, or philosophy for that matter.

Part one: Innovation

Innovation is multidisciplinary. Hence to get a comprehensive overview, it is necessary to combine insights from several disciplines. An important distinction is made between invention and innovation. Invention is the first occurrence of an idea for a new product or process. Innovation is the first commercialization of the idea. In many cased there can

be a considerable time lag between the two (Fagerberg, 2006). Another popular distinction is made between radical and incremental innovation. Radical innovations in products and processes have increasingly originated in professional R&D laboratories in universities, industry and government. Incremental improvement of products and processes associated with increasing scale of investment and learning from experience of production and use (Freeman & Soete, 1997). In attempting to understand the survival of novelty in the face of adaptive mechanisms, theories of novelty have been developed along two main tracks. According to the first, new elements are produced from combinations of established old ones. Schumpeter belongs to this track. The other track explains novelty in terms of adaptive inefficiency (March, 2010).

In this part I will present an overview on innovation. I will do this by presenting three different perspectives; a Technomics, an Organizational learning, and an Open innovation perspective. Early studies on innovation, including Schumpeter, have primarily been focusing on technology from an historical and economic perspective. Even though the idea of the knowledge economy goes back to the 60's (Powell & Snellman, 2004), it was not before the 90's that organizational learning and knowledge management became popular. Finally Open innovation explains today's business regime, with the increased tendency towards a more global networked economy focusing on core processes and technological platforms.

Technomics

The technomics paradigm focuses on technological dynamics and its various phases. The primary perspective is economical, even though a social or institutional framework also may provide important insights into the dynamics of technology. To clarify this perspective I draw on (Freeman & Soete, 1997)**.** I will follow the authors by first making a brief historical account presented by five successive industrial revolutions. I will then provide a micro Technomics view by presenting six different strategies. The authors' macro perspective on Technomics will not be reviewed here. It should be noted that technological innovation is not the total universe of innovation. According to Schumpeter for example, innovation consists of one of the five phenomena; introduction of a new good, introduction of a new method of production, opening of a new market, conquest of a new source of supply of raw materials or half-manufactured goods, or

implementation of a new form of organization (Godin, 2008). In relation to Schumpeter, marketing and organizational innovations are therefore not covered (Freeman & Soete, 1997). It should also be noted that the authors are focusing solely on innovation arising from the professional R&D system.

A brief historical background

Appendix A shows five suggested waves; the Industrial revolution, the age of steam and railways, the age of electronics and steel, the age of mass production of automobiles and synthetic materials, and the age of micro electronics. These are described as 'successive industrial revolutions'[1]. Schumpeter was one of the first to suggest that these long waves were due to the introduction of major new technologies into the economic system.

Until the 20th century 'single inventor entrepreneurs' mainly drove innovation. However professional R&D slowly became the standard, and firms, rather than single-inventors, started to dominate the introduction of new inventions. During the three first revolutions (and a part of the fourth) innovation was understood as a linear process. Schumpeter saw the innovation process as discovery, followed by commercialization, and then adaption and diffusion (Braunerhjelm & Svensson, 2009). Technical innovation has however shown to be more complex and non-linear. Technological change is shaped by society, and society is shaped by technological change (Giddens). Modern R&D is characterized by its scale, its scientific content, and the extent of its professional specialization. The evolution of the professional R&D seems to indicate that innovation is systematical process.

A micro view on Technomics

According to the authors it is no longer satisfactory to explain firm behavior exclusively in terms of response to price signals and adjustment toward equilibrium. Any satisfactory theory should take account of the variety of behavior in different industrial sectors and different historical periods. Also such a theory must assume a bounded rationality, imperfect information, and market and technology uncertainty.

[1] According to the authors, Schumpeter only analyzed the first three of these waves. Also in contrast to Schumpeter, the authors have focused on the large-scale diffusion of technology systems, rather than on their first introduction.

Market and technology uncertainty arises because every innovation project is particular and thus not calculable. Technical uncertainty can be reduced in experimental development and trial production stages, but the outcome of the stages cannot be known. Given the nature of uncertainty it is argued that most firms have little incentive for radical innovation. Instead they concentrate on defensive R&D, imitative innovation, product differentiation, and process innovation. Given this uncertainty, the authors suggest that the social context of project estimation is a process of political advocacy and clash of interest groups rather than a sober assessment of measureable probabilities.

Innovation is a coupling activity. On one hand it is the recognition of a need (market demand). An innovative firm should therefore be in close touch with the requirements of its customers to recognize potential markets. On the other hand it requires new technological knowledge (technology push). It must therefore be capable of monitoring the advancing frontier of scientific research to be the first to realize a new possibility. In order to link together the technical and market possibilities, successful entrepreneurship and management is needed.

Technology cycles

Appendix B illustrates the dynamics of process innovation in industry. An early radical product innovation leads to many new entrants and to several competing designs. Process innovations and scaling up of production then lead to emergence of a dominant robust design, the erosion of profit margins and a process of mergers and bankruptcies, ending with an oligopolistic structure of a few firms. What becomes the standard is not always the most optimal design. A lock-in may occur due to the establishment of supporting externalities, a user-base that may face switching costs, or the increased platform value of a critical mass of users (Schilling, 2010).

In appendix C, the importance of production in the various phases is shown. The importance of management skills, scientific and engineering know-how, and external economies are very high in the early phase and the growth phase. Unskilled labor and capital on the other hand is of less importance in the early stage but becomes very important in the mature phase.

Strategies

Since profit and growth maximization is seldom possible with uncertainty, strategies can instead be examined when a firm is confronted with a new technical change. Appendix D illustrates six such strategies. These strategies are of course not pure forms but shade into each other. Also firms may change strategies over time, or have different strategies in different industries.

The offensive strategy is designed to achieve technical and market leadership. The R&D department therefore has a key role. The firm itself must generate scientific and technical knowledge not available, and must take the proposed innovation to the point at which normal production can be launched. It will usually attach considerable importance to patent protection since it is aiming to be first and must hold a very long-term view with high risks. In order to increase its absorptive capacity, and to gain access to knowledge in external economies, fundamental research (knowledge pursued without any regard to the possible applications) may be conducted. Due to its leading position the firm must have a strong problem-solving capacity in designing, building and testing prototypes and pilot plants. Production planning, tooling, market research, advertising and marketing must also be efficiently performed by the innovating firm, and it must be able to educate both its customers and personnel in the early stages of new technologies. To pursue an offensive strategy a firm must be highly education intensive.

The defensive strategy may be just as research intensive as an offensive policy. The difference lies in the nature and timing of innovations. The defensive innovators do not wish to be the first in the world, but neither do they wish to be left behind by the tide of technical change. They must therefore be capable of moving rapidly once they decide the time is ripe. The defensive innovator must be capable of catching up with the game, if not of leap-frogging. It must therefore be at least as good as the early innovators and preferably incorporating some technical advances, which differentiate their products, but at a lower cost. Patents too are important in order to not be excluded from a market. The defensive innovator is knowledge intensive and must devote resources to training and education. R&D will be geared more towards efficiency in development and design work rather than research.

The imitative strategy does not aspire to 'leap-frogging' or even to keeping up with the game, but is content to follow way behind established leaders. If the lag is long it may be unnecessary to take a license. Imitators must enjoy certain advantages to enter the market in competition with established innovating firms. These may be advantages in the captive market or in costs. Early innovators will try to maintain a sufficient flow of improvements and new generations of equipment, so as to lose the imitators, but if the technology settles down, and the industry becomes mature, they are vulnerable to imitators. Production engineering and design are two technical functions in which the imitators must be strong in order to create a manufacturing advantage. They will need to be well informed about changes in production techniques and in the market.

The dependent strategy involves the acceptance of an essentially satellite or subordinate role in relation to other stronger firms. The dependent firm is often a subcontractor or sub-subcontractor. It does not attempt to initiate or imitate technical changes in its product. It will usually rely on its customers to supply the technical specification for the new product, and technical advice in introducing it. Small firms in capital-intensive industries are often in this category.

In traditional firms such as handicrafts, restaurants and decorators, the product changes little because the market and competition is stable. The technology is often based on craft skills and scientific input is therefore minimal. Demand on the products of such firms may be strong, but because of their incapability to initiate technical innovation they may be vulnerable to exogenous technical change.

Finally with the opportunist strategy, there is the possibility that entrepreneurs will simply identify a new opportunity in the rapidly changing market, which may not require any in-house R&D, or complex design.

Firm size and innovation

Small firms may have some competitive advantage in the earlier stages of inventive work, characterized with less expensive but more radical innovation. Larger firms on the other hand have an advantage in later stages, characterized by improvement and the scaling up of early breakthroughs. The greatest advantage of small firms probably lies in the flexibility, the concentration and internal communication. Capital intensive

industries and industries that require a lot of technological components are generally dominated by larger firms. Large firms also have a comparative advantage when there are several alternative routes to success with uncertainty attached to all of them, or when a large numbers of specialists are needed.

Organizational learning

The term Organizational learning (OL) goes back to the 60's, but it is not until the early 90's that it started to take off. If one picks up a handbook on Organizational learning such as (Easterby-Smith & Lyles, 2011), one will stumble upon three related terms; Learning organization (LO), Organizational knowledge (OK), and Knowledge management (KM). Two dichotomies have been proposed by (Easterby-Smith & Lyles, 2011) to clarify the scope of these four mentioned bodies. In the first dichotomy a distinction is made between theory and practice. This distinction follows the concerns of academics against those of practitioners. The second dichotomy is the distinction between process and content. Learning is the process and knowledge is the content or product of the learning process. OL and LO therefore refer to the study of the learning processes of and within organizations, where the former is more theoretical and the latter more practical. Similarly, OK and KM are more focused on knowledge itself. OK is being more theoretical and KM more practical. These four bodies are so to speak concerned with the 'engine' of innovation. The focus in this thesis is on the academic bodies (OL, OK). This section of organizational learning I will present through the works of (Argyris & Schön, 1996).

Inquiry and learning

When it comes to understanding learning, the authors refer to Deweyan inquiry. According to John Dewey, inquiry begins with an indeterminate, problematic situation. The inherent conflict of this situation blocks action. In other words, there is an error, which is a mismatch between outcomes to expectation, which then results in a surprise experience. The inquirer then tries to make the situation determinate in order to restore the flow of activity. This can be done with further inquiry into the underlying mistake that causes the error. The Deweyan inquirer is therefore an actor, because he participates in constructing the situation to which he also responds. The transaction between the inquirer and situation is continuing and inherently open-ended. When the

inquiry results in a learning outcome, it also institutes new environing conditions that occasion new problems. Hence it is a kind of dialectics. It's important to note that Dewey sees inquiry as a social process. People tend not only to think and act together in a social setting, but the very process of inquiry, individual or collective, is conditioned by membership in a social system that establishes inquiry taken-for-granted assumptions.

Defining organizational learning

Having clarified the connection between inquiry and learning we can now proceed to organizational learning. An organization can be said to learn when its members learn for it, carrying out on its behalf a process of inquiry that results in a learning product. The learning product is information that may take the form of change in thinking and acting. In other words, learning causes a change in individual behavior. The learning product is said to be organizational when it is embedded in the organizational environment (files, maps, individual minds and artifacts) and embedded in its routines and practices. We can therefore say that organizational learning occurs via individual members and collectives who inquire on behalf of the organization.

In an organization we may talk of different ladders of aggregation that proceeds from individuals to small groups, to departments made up of small groups, to divisions that are clusters of departments, to the organization as a whole, and to the larger field in which the organization interacts with other organizations. Each of these ladders has their own theory of action. A theory of action may take two different forms; the espoused theory and the theory-in-use. Espoused theory is a theory of action, which is advanced to explain or justify a given pattern of activity. Theory-in-use is a theory of action, which is implicit in the performance of that pattern of activity. A theory-in-use is constituted of certain strategies of action with corresponding assumptions, and of deeper underlying values. The difference between the espoused theory and the theory-in-use is therefore, how people say they act, and how people actually act. According to the authors it is very often the case that the espoused theory does not match the theory-in-use.

Single-loop, and double-loop learning

The authors make a distinction between two types of learning - single-loop learning and double-loop learning. As previously mentioned, a theory-in-use is constituted of certain strategies of action with corresponding assumptions, and of deeper underlying values. Single-loop learning refers to a learning product that results in a change in the strategies of action with the respective assumptions, but not in the underlying values themselves. With double-loop learning on the other hand, there is a change in the deeper values, which will then lead to a change in strategies of action and the respective assumptions. Both actions and values are therefore changed with double-loop learning.

An example on single-loop learning is marketing managers who have observed that monthly sales have fallen below expectations. To bring the sales curve back on target, they inquire into the shortfall seeking an interpretation they can use to devise new marketing strategies. In the case of double loop learning, rather than pulling the usual strings, the marketing managers may instead inquire into the bigger picture. By doing so they may find out that the problem they are facing is not occurring because of external circumstances, but because there are internal conflicting differences of value within the company. If proponents within the company choose to fight over their respective values the outcome will at its best be single-loop learning. If the actors on the other hand initiate an open dialogue, they may come to a solution that is better for the company as a whole. Such a dialogue would result in a change in the underlying values and in a change in the strategies of action. The idea of double-loop learning is therefore similar to that of 'systems thinking' in (Senge, 2006). It should be noted that organizational learning does not necessarily have to affect the whole organization. Sometimes a change in a division's theory-in-use will affect no other. At other times it may have repercussions throughout the whole organization, which then require others to examine their theory-in-use. A big part of organizational learning is therefore that of 'unlearning'. All theories will eventually become obsolete and new once must be deployed.

Deutero learning and the organizational learning system

Different 'ladders of aggregation' may not just inquire into their own theory-in-use. Actors may inquire into the very inquiry process itself. This is called deutero learning. Deutero learning changes the way actors approach problems in in the future. According

to the authors, the process of inquiry is embedded in what they call the 'organizational learning system'. This system is made up of structures that channel organizational inquiry, and of the behavioral world of the organization that is draped over these structures. Organizational structures are forums, information systems, spatial environments and so on. The behavioral world constitutes the qualities, meanings, and feelings that habitually condition patterns of interactions among individuals within the organization in such a way as to affect organizational inquiry. The behavioral world therefore determines what will be discussed, which individual perceptions of organizational experience that will be scattered or concerted, which organizational maps that will be constructed, shared and tested, and whether and in what way conditions of error will be reduced so that inconsistencies and incongruities in organizational theory-in-use may be discovered. Appendix E shows the three different types of learning.

Enabling double loop learning

The aim of the authors is to make organizations capable of making continuous double-loop learning. To do so a threshold must be surpassed. If the organization manages to surpass this threshold it will start experiencing virtuous feedback cycles rather than vicious feedback cycles. An intervention model is therefore proposed. In order to enable continuous double loop learning, the organizational learning system must be improved, which in turn requires a shift in the theory-in-use of the respective employees. More specifically a shift from a model-I theory-in-use towards a model-II theory-in-use is required. For cultural reasons most employees hold a model-I theory-in-use. With this theory-in-use the employee has a defensive behavior and protects his own interests within the organization. With the model-II theory-in-use an employee is open for dialogue and works in the interest of the organization as a whole. In Appendix F the learning feedback cycle is illustrated. In appendix G and H, the model-I and model-II theories are described more in detail [2].

[2] It should be noted that a theory-in-use can also be changed through deterioration, memory loss, or random variation, but this is not within the definition of organizational learning. Also learning might lead to effects that are negative overall, such as in the case with competence traps, where previous success causes patterns that subsist even when they are obsolete.

Open innovation

In this section I draw on (Chesbrough, 2011), who coined the term 'Open innovation'. Open innovation explains the recent tendencies towards a more networked economy. Knowledge has been widely distributed with the Internet, communication has become easier, and users are now willing to innovate. There has been an increased specialization and a lowering of transaction costs.

According to Chesbrough the current economic situation in the western world is a commodity trap. Important product development tools are now well understood and available around the world. Furthermore because knowledge and skills are distributed in both emerging and developed economies, companies have started to produce their products in places with cheap labor. Finally the product lifecycles are getting shorter and shorter, which means that products now have smaller lifetimes to cover R&D spending's and to generate an economic profit.

To get out of the commodity trap four concepts are proposed; think of your business as a services business, co create with customers, use open innovation, and transform your business model with open services Innovation. In the following I will go through each of these four concepts.

Think of your business as a services business

Today services comprise roughly 80 percent of economic activities in the US and it is growing. Especially more knowledge-intensive services are becoming the engine of growth in the entire developed world. The future prosperity will come from learning how to manage this shift from a product-based economy to a largely services-based economy, driven by innovation in the services sector of the economy, and transforming the product sector of the economy in the process. In a product exchange, the job is done when the exchange has taken place. In a service exchange, the service-provider's job is not finished until the customer's need is fulfilled. Companies must think about the lifetime value of their customers. According to Chesbrough this shift to services is a shift away from the classical era of the product-driven value chain by Porter, where the product is the unit of differentiation and service is understood as a cost center that's sole function is to support the product. In the new era services become a profit center

and the unit of differentiation. See appendix I for Porter's value-chain and appendix J for Chesbrough's model. According to Peter Drucker, customers want the holes the drill can make, not the drill itself. Customers do not buy products, but utility.

As an example, GE aviation is a company that has had great success defining itself as a services business. Rather than making a one-time sale on their engines they now provide a lifetime service on their engines. For GE aviation this now means that their market has grown and they generate more knowledge on their engines, which in turn can improve the quality further. For the customers it is easier to manage and they can now focus on their primary activities.

Co create with customers

In order to be a successful services business, co creation with the customers is needed. Referring to Nonaka, Chesbrough reminds us of the tacitness of new knowledge that due to its nature inhibits communication. Chesbrough mentions two ways to co-create with customers and to overcome the nature of tacit knowledge; the first is to observe the customers in their "native habitat" and extract unmet needs. One way to do this is with the use of data mining. Data mining is the gathering of customer information through observed behavior using semantic search on the Web. The second idea is to embed the customers in the value chain of the company by providing them with certain tools. Lego has been successful co creating with users who have contributed with brand new designs. Amazon has been successful with customers providing product feedback for other customers and in the music business a company called Popcuts recruits, motivates and rewards trendsetters who can market and distribute new songs to the rest of the crowd (user-distribution).

Use open innovation

Open innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as they look to advance their business. In the closed innovation paradigm, the company conducts its own R&D with its technology at hand in order to implement new products and services on the market. With open innovation the company opens up for participation with third parties in order to gain access to a broader range of technologies and knowledge. These

transactions are usually coordinated and governed in M&A's, licensing and different collaborations. Furthermore having access to more technology and knowledge means that new market opportunities arise that can be tapped into with technology spin-outs and licensing to companies in analogy markets. In appendix K and L the closed and open innovation models are illustrated.

At first sight it seems, that with the open innovation paradigm, only a few identical corporations will serve the market. This is however not the case according to Chesbrough. The open innovation paradigm is an entire eco system where companies specialize themselves. It is a system where both big and smaller players can thrive as long as they manage to capitalize on their core processes. Therefore instead of being specialized in specific products within certain industries, companies must specialize in specific activities on a global level.

Companies can earn profits either through scale or scope. Economies of scale refer to the reduction of cost per item with increased volume. The first way one can reach economies scale is through a better utilization of fixed assets. The second way comes from gains in knowledge through more transactions or uses. Amazon's system of recommending books serves as an example of the second type of economies of scale. Economies of scope refer to the efficiencies that result from offering multiple items from a single source. Similar to economies of scale there are two ways to obtain economies of scope. The first is the flexibility of an asset. If an asset can be used in more activities it can be utilized more. The second is the reduction in customer costs beyond the actual purchase price of an item, such as search costs to locate and select items, purchasing costs, receiving costs etc. By providing a one-stop shopping these additional costs are eliminated.

According to Chesbrough, a company can pursue both economies of scale and scope by using open innovation. When using a platform business model there are two complementary kinds of openness; 'outside-in' and 'inside-out'. With outside-in a company makes greater use of external ideas and technologies in its own business. In a services context, outside-in knowledge allows a company to provide additional elements to a service offer beyond the company's own knowledge and experience. Such additional elements extend the offer and provide more value and one-stop shopping for customers.

Apps on I-phones is an example of outside-in openness, where external firms can develop and offer apps to Apples customers base. Inside-out is the idea that companies can sell their core processes to other companies. By doing so the company can reach economies of scale because it increases the volume of activity that passes through those processes.

Transform your business model with Open Services Innovation

Chesbrough defines the business model the following way:

1. Articulating the value proposition
2. Identifying the market segment
3. Defining the structure of the value chain that the firm requires to create and distribute the offering, and determine the complementary assets needed to support its position in this chain
4. Specifying the revenue generation mechanisms and costs structure
5. Describing the position of the firm within the value network
6. Formulating the competitive strategy

These six items are all variables that the company may change in order to design its own unique business model. The company can for example change the way it charges for its products (4) or choose to serve completely new customers (2) with existing products and services or new once (1).

According to Chesbrough there are some business models that are more powerful than others. The ultimate goal for a business is to become a platform for other businesses to build on. This however requires opening up the organization's business model to harness the energy and investments of third parties in the business. At the bottom of Chesbrough's business model hierarchy is the commodity business model. At the top of the hierarchy is the platform business model. The platform business model requires extensive investments and development but provides tremendous differentiation and long-term value for the firm. A successful platform can be thought of as a two-sided market between suppliers and customers. On one side of the market is a wealth of suppliers providing numerous choices for customers to choose from. On the other side

are lots of customers looking for items to choose. In a platform business model, key suppliers and customers become business partners, entering into relationships in which both technical and business risks are shared. The business models of suppliers are now integrated into the planning processes of the company. The company in turn has integrated its business model into the business model of its key customers. And these customers share their future plans with the company, a critical part of their own business model. This allows the company to create its business model as a platform to lead its industry including suppliers and customers. This broadening of the business model must go still further. In addition to key suppliers and customers, many third parties that offer complementary products and services need to be encouraged to participate in the company's future business plans. One important device that enables this integration of business models throughout an ecosystem of suppliers, customers, partners, and collaborators is the ability of the company to establish its technologies as the basis for a platform of innovation for that ecosystem. In this way, the company can attract other companies into its business by sharing the tools, standards, intellectual property, and know-how needed for these supporting players to implement the platform successfully. This platform not only coordinates internal R&D with external R&D toward desired business objectives, it now shapes the future direction for that coordination.

Companies that have developed growing services business models have adopted a front-end and back-end approach to put more focus on services in their business while maintaining economic efficiencies. In the front-end the interaction with the customers takes place. These interactions takes place in different experience points. The front-end must be able to meet the unique combinations of needs of the customers (one element of scope). This however makes it more difficult to manage the back-end, where the supporting processes that are not transparent to the customers belong. In order to reach economies of scale the backend must be standardized in the most efficient way. Having a more open platform makes it possible both to obtain scale and scope, simply focusing on managing the platform, while having third parties to provide the back-end processes.

Wrapping up on innovation

Schumpeter was one of the first scholars to use the term innovation, but it was not until the 60's that innovation became a widely discussed phenomenon. The early focus was on the history of technological advance. One of the main foci was therefore on

technology- product- and industry lifecycles. In relation to the firm (theory of the firm), the literature on Technomics has had a more strategic focus, facilitating top management. At this time the emergence of new products was still a black box. I believe that the organizational learning literature has evolved, as it became evident that the entire organization should be facilitated and not just top management. With (Argyris & Schön, 1996) the single individual now comes in focus. The organizational member must inquire into the bigger picture of the organization, on his own. He must think for himself. The organizational learning literature gets a better hold on how knowledge is created and transferred, which may then result in new products. Nonaka also belongs to this tradition. However with the rise of the Internet, technological opportunities have changed, and there has been a renewed interest in technological management. Focus has therefore switched back to the strategic level, concerned with the actual business regime.

While technomics and Open innovation are important, they remain strategic and the process of innovation is therefore black boxed. Organizational learning is the only field that approaches the innovation process as such, in dealing with the learning process in organizations. Hence Nonaka becomes a good starting point for further investigation.

Part two: Knowledge creation

In this part I will go in depth with the knowledge creation theory developed by Nonaka and colleagues. According to (Easterby-Smith & Lyles, 2011) it is a theory that belongs to the field of organizational knowledge (OK). It is a theory that been cited by authors in a widening set of disciplines, and has evidently achieved something like a paradigmatic status (Gourlay, 2003). The aim of this part is first to present Nonaka's theory. I will then present Tsoukas' criticism on Nonaka, which claims that Nonaka has misunderstood the terms tacit and explicit knowledge. Finally I will confirm my two research questions.

Nonaka's knowledge creation theory

In their evolutionary theory of economic and technological change, it was Nelson and Winter 1982 who started viewing the firm as a repository for knowledge (Nonaka &

Takeuchi, 1995). Nelson and Winter may therefore be seen as the founders of the OK field. Nonaka's theory was first introduced in an article in 1994, followed by the famous book, 'The Knowledge Creating Company' in 1995. Nonaka has been advocating his theory ever since, by implementing continuous incremental improvements such as the implementation of 'ba', knowledge assets, and the idea of the company as a dialectical being. In this part I will present the knowledge creation theory based on the two main books (Nonaka & Takeuchi, 1995) and (Krogh, Ichijo, & Nonaka, 2000) and articles that have been published later on.

According to Nonaka and colleagues, organizational knowledge theory aims at developing a comprehensive view of knowledge that sheds light on organizational creativity, learning, innovation, and change. It is a view that complements the knowledge-based view of the firm and the theory of dynamic capabilities (Teece, Gary, & Amy, 1997), by explaining the dynamic process of organizational knowledge creation (Nonaka & Krogh, 2009). In the knowledge-based view the company is seen as a production function where both the inputs and outputs are knowledge. The firm is situated in a market where it can sell and buy knowledge. In the long run, a firm may continue to exist, when it can produce knowledge more efficiently than the market. The most important knowledge assets are the capability to continuously create new knowledge out of existing specific capabilities, rather than the stock of knowledge such as particular technology that a firm possesses at one point in time (Nonaka & Toyama, 2002). For the knowledge to be a sustainable competitive advantage it must be valuable, rare, in-imitable, and non-substitutable (Barney, 1991), (Nonaka, Toyama, & Konno, 2000). High-quality tacit knowledge is the source of sustainable competitive advantage since it takes time to be accumulated and is not easily replicated. (Nonaka & Toyama, 2002).

Traditional organizational learning theory

The Cartesian split of mind and matter is based on the assumption that the essence of a human being lies in the rational thinking self. The thinking self therefore seeks knowledge independently of the world and of other human beings. According to (Nonaka & Takeuchi, 1995) this view is still very dominant in the western world, even though many contemporary philosophers have challenged it. The dominance of the Cartesian

split in traditional organizational learning theory has lead to a view of an organization as an information-processing machine. In this view the organization processes information from the environment in order to solve problems and adapt to the environment based on a given goal. In this tradition bounded rationality of human beings is assumed, which means that the organization must deal with a complex reality. Reality is cut into pieces of information that are small and simple enough for one person to process. The information is then processed and reassembled by the organizational members so that the organization as a whole deals with the complex reality in the end. This passive view fails to capture the dynamic process through which the organization interacts with its members and the environment. Instead of merely solving problems, organizations create and define problems, develop and apply knowledge to solve the problems, and then further develop new knowledge thought the action of problem solving. The organization and individuals grow through this process (Nonaka & Toyama, 2003).

Defining knowledge

The authors adapt a traditional definition of knowledge as 'justified true belief'. Their focus is however on 'justified' rather than on the 'true' aspect of belief. This stands in contrast to the traditional Western epistemology, which focuses on 'truthfulness' (Nonaka, Toyama, & Konno, 2000). Traditional Western epistemology, with its heavy laden on skepticism, can be seen as a search for the method to establish the ultimate truth of knowledge beyond all doubts, on which all other knowledge can be grounded (Nonaka & Takeuchi, 1995). To clarify his understanding of knowledge, Nonaka refers to the epistemology of pragmatism developed by philosophers such as John Dewey and to social constructionism by (Berger & Luckmann, 1967). From the pragmatist point of view, beliefs become true if they can be justified and are useful to the individual or group and enable this individual to act, the group to coordinate individual action, and shape reality. The view of social constructionism constitutes the more social dimension, where knowledge over time becomes institutionalized and creates reality (Nonaka & Krogh, 2009). Knowledge is therefore dynamic since it is constantly created in social interactions amongst individuals and organizations. Also knowledge is context-specific, as it depends on a particular time and space. Without being put into a context, it is just information. Information becomes knowledge when it is interpreted by individuals and

given a context and anchored in the beliefs and commitments of individuals. (Nonaka, Toyama, & Konno, 2000).

SECI

Organizations cannot themselves create knowledge, only its members. The role of the organization is therefore to facilitate knowledge creation. The authors assume that knowledge is created in the interaction between tacit and explicit knowledge (Nonaka & Takeuchi, 1995). The interaction between the two types of knowledge is called knowledge conversion. There are four modes of knowledge conversion; from tacit to tacit (socialization), from tacit to explicit (externalization), from explicit to explicit (combination) and explicit to tacit (internalization). Knowledge created through each of the four modes of knowledge conversion interacts in a spiral movement of knowledge creation. It is a spiral, not a circle, because the interaction between tacit and explicit knowledge is amplified through the four modes of knowledge conversion. The spiral becomes larger in scale as it moves up through the ontological levels (individual, group, etc.). Knowledge created through the SECI process can trigger a new spiral of knowledge creation, expanding horizontally and vertically across organizations. This interactive spiral process takes place both intra- and inter-organizationally. Knowledge creation is a self-transcending process, in which one reaches out beyond the boundaries of one's own existence. In knowledge creation, one transcends the boundary between self and other, inside and outside, past and present (Nonaka, Toyama, & Konno, 2000). In the following the four modes of knowledge conversion are explained further (Nonaka, Toyama, & Konno, 2000) (also see appendix M):

Socialization is the process of converting new tacit knowledge through shared experience. Since tacit knowledge is often time- and space-specific and hard to articulate, it can best be acquired through shared experience. Socialization typically occurs in apprenticeship or in informal meetings outside the workplace or beyond organizational boundaries. Firm often acquire and take advantage of the tacit knowledge embedded in the customers or suppliers by interacting with them.

Externalization is the process of articulating tacit knowledge into explicit knowledge. When tacit knowledge is made explicit it can be shared, and become the basis for new

knowledge for others. An example is concept creation in new product development. However knowledge can also be created for non-product purposes. The success of making knowledge explicit depends of the use of metaphors, analogies and models.

Combination is the process of converting explicit knowledge into more complex and systematic sets of explicit knowledge. Explicit knowledge can be gained both from the inside and outside of the organization. The new explicit knowledge can then be shared among the members in the organization with the use of computerized communication networks etc. This mode can also include "breakdown" of concepts. Breaking down a concept such as a corporate vision into operationalized business or product concepts also creates systemic, explicit knowledge.

Internalization is the process of embodying explicit knowledge into tacit knowledge. Internalization is closely related to 'learning by doing'. Explicit knowledge, such as product concepts or the manufacturing procedures, has to be actualized through action and practice. Training programs can help trainees understand the organization and themselves. By reflection the trainees can internalize the explicit knowledge written in documents etc. When the knowledge is internalized it becomes part of the individuals tacit knowledge in the form of shared mental models or technical knowhow.

According to Nonaka socialization is connected with theories of group processes and organizational culture. Combination has its roots in information processing, and internalization is closely related to organizational learning. The mode of externalization has however been neglected in the literature (Nonaka & Takeuchi, 1995).

Knowledge outcome

A five-phase model is proposed to explain the outcome of the knowledge conversion process. The five phases are; sharing tacit knowledge, creating new concepts, justifying concepts, building an archetype, and cross-leveling knowledge. Sharing of tacit knowledge belongs to the socialization phase. In the externalization phase new concepts are created and justified. Then in the combination phase, the concepts are carried out in an archetype. Finally the archetype may become internalized by other organizational

units (Nonaka & Takeuchi, 1995). Another outcome may also be a new social practice (Nonaka & Krogh, 2009).

As an example of the knowledge conversion process I turn to the famous home bakery machine case (the first automated bread-making machine), which was developed and successfully introduced on the Japanese market in 1987 (Nonaka & Takeuchi, 1995). In this specific case there were three knowledge cycles. The first cycle ended with the assemblage of a prototype, which, however was not up to the design team's standards. This triggered the second cycle, which started with Tanaka (employee), who took an apprenticeship with a master baker. Her purpose was to knead bread dough properly in order to later 'convert' this know-how into particular design features of the bread-making machine under development. Following this, the third cycle came into operation whereby the commercialization team, consisting of people drawn from the manufacturing and marketing department, further improved the prototype that came out of the second cycle, and made it a commerciality viable product.

Ba

Ba is a concept that was first introduced in (Krogh, Ichijo, & Nonaka, 2000). This section on ba is based on (Nonaka, Toyama, & Konno, 2000).

Knowledge needs a context to be shared, created and utilized. This is contrary to the Cartesian view of knowledge that treats mind and matter separately. This context the authors call 'Ba'. It is in Ba that information is interpreted in order to become knowledge. Ba is a specific time and space, but not necessarily a physical space. It is a concept that unifies a physical space such as an office space, and a virtual space such as e-mailing, and a mental space such as sharing of ideas. The key concept of understanding ba is interaction. Knowledge is created through interactions among individuals or between individuals and their environments. Ba works as the platform of knowledge creation by collecting the applied knowledge of the area into a certain time and space and integrating it. Ba exists at many ontological levels and these levels may be connected to form a greater ba. Individuals form the ba of teams, which in turn form the ba of organization, and the market environment becomes the ba for the organization. Ba transcends the boundary between micro and macro. The coherence amongst ba is

achieved through organic interactions amongst ba based on the knowledge vision, rather than through a mechanistic concentration in which a center dominates. Hence, neither micro nor macro dominates, but they both interact with each other to evolve into a higher self. The interfaces amongst ba also evolve along with ba themselves. There are four types of ba, which are defined by two dimensions of interactions. Along the first dimension the interaction can take place individually or collectively. Along the other dimension the interaction can take place face-to-face or in virtual space (books, manuals, teleconferences etc.). See appendix M.

Originating ba is defined by individual and face-to-face interactions. This is a place where individuals share experiences, feelings, emotions and mental models. It is a place that transcends the boundaries between self and others, by sympathizing or empathizing with others. Originating ba mainly offers a context for socialization.

Dialoguing ba is defined by collective and face-to-face interactions. It is a place where individuals' mental models and skills are shared, converted into common terms, and articulated as concepts. Shared articulated knowledge is further brought back to each individual and then further articulation occurs through self-reflection. Dialoguing ba is more consciously constructed than originating ba, and mainly offers a context for externalization.

Systemizing ba is defined by collective and virtual interactions. It mainly offers a context for combination of existing explicit knowledge, as it can be easily transmitted to a large number of people.

Lastly exercising ba is defined as individual and virtual interactions, and mainly offers a context for externalization. Here people embody explicit knowledge. Exercising ba synthesizes the transcendence and reflection though action, while dialoging ba achieves this through thought.

Knowledge assets

Knowledge assets are inputs, outputs, and moderating factors of the knowledge-creating process. Due to their dynamic nature they are difficult to value and manage effectively.

Nonaka and colleagues define four knowledge assets; experiential knowledge assets, conceptual knowledge assets, systemic knowledge assets and routine knowledge assets. (Nonaka, Toyama, & Konno, 2000). See appendix O.
Experiential knowledge assets consist of the shared tacit knowledge that is built through shared hands-on experience amongst the members of the organization, and between members of the organization and its customers, suppliers and affiliated firms. Skills and know-how that are acquired at work are examples of experiential knowledge assets. Other examples are emotional knowledge, physical knowledge and rhythmic knowledge. These assets are difficult to grasp, trade and evaluate due to their tacit nature.

Conceptual knowledge assets have tangible forms and consist of explicit knowledge articulated through images, symbols and language. They are based on the concepts held by customers and members of the organization. Brand equity, concepts and designs are examples of conceptual knowledge assets.

Systemic knowledge assets consist of systematized and packaged explicit knowledge, such as explicitly stated technologies, product specifications, manuals, and documented and packaged information about customers and suppliers. A characteristic of systemic knowledge assets is that they can be easily transferred. This is the primary focus of knowledge management literature.

Routine knowledge assets consist of the tacit knowledge that is routinized and embedded in the actions and practices of the organization. Know-how, organizational culture and organizational routines for carrying out day-to-day business are examples. A characteristic of routine knowledge assets is that they are practical.

Managing SECI

In order to lead the SECI process the company must articulate a knowledge vision, develop and redefine knowledge assets, build connect and energize ba, and lead the SECI (Nonaka, Toyama, & Konno, 2000). See appendix P.

The authors suggest a middle-up-down management style. With this style middle managers have a pivotal role in the organization. Middle managers are at the

intersection of the vertical and horizontal flows of information in the company, and actively interact with others to create knowledge by participating in and leading ba. Middle managers should build ba by providing physical spaces as well as facilitate interactions between various ba. They should energize ba by supplying necessary conditions, such as autonomy, creative chaos, redundancy, requisite variety, and love, care, trust and commitment. Autonomy can be nurtured by allowing for self-organizing teams. The idea of a creative chaos is to create breakdowns, which will become opportunities for learning. Redundancy is the intentional overlapping of information about business activities, management responsibilities, and the company as a whole, which promotes the sharing of tacit knowledge and helps members to understand their own role in the organization. A requisite variety (or internal diversity) is needed in order to match the complexity in the environment. Love, care, trust and commitment are preconditions for sharing of knowledge. Middle managers should not just facilitate the SECI process but must also manage the diffusion of outcomes to other ontological levels[3].

The role of top management is to redefine the organization on the basis of the knowledge it owns. Top management must instill a knowledge vision by clarifying what knowledge the company should create and communicate this direction to the middle managers. It should read the situation in terms of what knowledge is available and what is lacking according to the knowledge vision. Another task of top management is to create the value system that evaluates, justifies and determines the quality of the knowledge the company creates (together with norms, skills, and routines).

The firm as a dialectical being

One of Nonaka's latest ideas is 'the firm as a dialectical being'. According to (Nonaka & Toyama, 2002) it is firms who can manage contradictory forces, such as competition and corporation, integration and disintegration, and creativity and efficiency, who are the ones that will survive and prosper. This view is different from traditional organization theories that instead try to smoothen out contradictions through the design of an

[3] This selfless and altruistic behavior of the employees may however be questioned in western companies. According to (Davenport & Prusak, 2000) the majority of employees in western companies seek reputation, and it is therefore suggested that the organization is seen as an intra organizational market for knowledge.

organizational structure, incentive systems, routines, or an organizational culture. To synthesize these contradictions the authors refer to the SECI model. However in addition to the SECI model the authors also refer to Giddens and the dualistic nature between the agents and structures (Nonaka & Toyama, 2003). Knowledge is therefore not solely created between social actors, but also between social actors and their environment.

Tsoukas' critique on the SECI-model

The four modes of the SECI-model build on Polanyi's two concepts, tacit and explicit knowledge. According to (Tsoukas, 2011), Polanyi's philosophy largely follows a Heideggerian philosophical perspective. From this perspective, knowledge involves skillful action and the knower necessarily participates in all acts of understanding. According to Polanyi, all theoretical knowledge necessarily contains a 'personal coefficient'. In other words, tacit knowledge is a precondition for explicit knowledge. A map cannot read itself, but requires the personal judgment of a human agent in applying abstract representations, such as the map, to the world. Personal judgment cannot be prescribed by rules but relies essentially on the use of our senses. It is a skillful performance, involving both the mind and the body that establishes a correspondence between explicit formulations of our formal representations and the actual experiences of our senses.

The personal coefficient in all acts of knowing is manifested in a skillful performance carried out by the knower. The aim of a skillful performance is achieved by the observance of a set of rules, which are not known as such to the person following them. Rules are assimilated and stored in the unconscious mind. Skills retain an element of opacity and unspecificity. They cannot be fully accounted for in terms of their particulars, since their practitioners do not ordinarily know what those particulars are, and even when they do know them they do not know how to integrate them. This becomes clearer when we understand the two concepts, focal awareness and subsidiary awareness. Since all knowing involves skillful action, one can only know something when this something is carried out - one can only know how to drive down a nail when one is actually driving down the nail. When driving down a nail one has a subsidiary awareness of the feelings in the hand, which is merged into the focal awareness of

driving down the nail. If the focus were turned to the bodily particulars that are subsidiary known, the corresponding action of driving down the nail would suddenly become clumsy. Thus we must rely subsidiary on particulars for attending to something else, hence our knowledge of them becomes tacit and irreversible. In the context of carrying out a specific task, we come to know a set of particulars without being able to identify them, thus 'we can know more than we can tell'.

The internalizing of subsidiary particulars when focusing on the focal target is called indwelling. A skillful driver is someone who continuously has interiorized elements and dwelled in them. 'In fact' when we dwell on the tools we use, we make them extensions of our own body. This indwelling of subsidiary particulars has an unconscious trial and error effect, by incorporating available elements of the situations, which are helpful for the purpose.

The structure of tacit knowing has three aspects; a functional, a phenomenal, and a semantic. The functional aspect consists in the from-to-relation of particulars to the focal target. The phenomenal aspect involves the transformation of subsidiary experience into a new sensory experience. All the manifold, unconscious, sensory experiences are converted into one sensory experience - one feeling of driving the car. Therefore, an indwelling of more and more particulars enables us to acquire new experiences. Finally the semantic aspect is the meaning of the subsidiaries, which is the focal target on which they bear.

From a phenomenological perspective, knowledge has a recursive form. It is context-specific and black boxed in the sense that we assimilate, interiorize, and instrumentalize certain things in order to focus on others. When we try to examine what is black boxed, what was subsidiary now becomes the focal target, and the whole situation is completely different. Hence tacit knowledge is irreversible and therefore not transferable or convertible into explicit knowledge.

Focusing on the bread-kneading case from earlier, even though the concept of 'twisting stretch' emerged when the employee spent time with the skillful baker, this did not occur due to tacit knowledge becoming explicit. When a task is carried out, it may be brought to awareness when propped in the context of a temporary breakdown. This

forces us to look at the patterns we tacitly know, by making them focal targets each with their own tacit background. By dialogue we may see new connections and give prominence to distinctions, which our ordinary forms of language easily could overlook. Therefore although skilled performance is ultimately ineffable, it nonetheless can be talked about through dialogically reminding ourselves of it. We may notice certain important features, which had hitherto escaped our attention. We are led to relate to our circumstances in new ways and see new ways forward. Therefore for Tsoukas there is no conversion from tacit to explicit knowledge, but rather it is when we find new ways of talking, fresh forms of interacting, and novel ways of distinguishing and connecting, that we can 'extract hidden gems' in our practices.

As a response to this critique, Nonaka argues that tacit and explicit knowledge is on a continuum. It is by no means all tacit knowledge that can become explicit, however that knowledge along the explicit end of the continuum can be explicated. According to Nonaka, knowledge conversion is then about expanding the previous boundaries of the knowledge of the individuals and teams by constantly mixing different practices. The concept of 'twisting stretch' emerged because Tanaka (the employee) temporarily left her social practice of engineering and product development and joined the social practice of bread baking. Entering this new practice required her to reflect on the rules of performance (Nonaka & Krogh, 2009).

Discussion on knowledge and ideas

As we have seen, knowledge is generally understood as justified true belief. However with the emergence of social theories such as (Berger & Luckmann, 1967) and (Kuhn, 1996), the idea of an absolute truth has been challenged. This has caused a change in the nature of knowledge with less emphasis on truth and more emphasis on justification and pragmatic action. Knowledge is utility which enables us to do things in the world such as innovation. From this perspective on knowledge we may then say that the purpose of science is innovation. This transformation of knowledge also means that the distinction between 'ideas' and 'knowledge' has become more vague. For Kant, an idea is problematic because it cannot be borrowed directly from the senses and surpasses the understanding (Somers-Hall, 2013). According to Kant, an alien is therefore an idea. However from a 'pragmatic and social constructionist perspective' an alien can be

argued as being knowledge. Here the dimension of 'belief' does not refer to the actual existence of an alien but rather it is a 'belief that the alien can be useful for/in action'. Hence I argue that knowledge creation also includes the creation of ideas. This can be confirmed if we examine the cases of knowledge creation in (Nonaka & Takeuchi, 1995). For example in the Honda case, ideas such as 'man-maximum & machine-minimum' and 'tall boy' are the outcomes of the knowledge conversion process (Nonaka calls them concepts). Externalization is in general about the creation and justification of new concepts. (Nonaka & Takeuchi, 1995).

Confirming the research questions

Two shortcomings were identified in Nonaka's knowledge creation theory. The first was proposed by (Lindkvist & Bengtsson, 2009), who claim that the theory fails to explain processes of individual knowledge creation. Having dealt with Nonaka I can now confirm this issue. This criticism however is not limited to Nonaka and colleagues, but can account for the innovation literature as a whole. An explanation for this could be that innovation as such has been regarded as a leadership problem, and that the literature therefore has been concerned with 'organizing'. It therefore seems reasonable to pursue my first research question, which I will initiate in part three by looking into the creativity literature.

The second issue was stated by (Tsoukas, 2011) with his criticism of the SECI-model. More specifically it is claimed that Nonaka has misunderstood the two concepts tacit and explicit knowledge. This is a criticism I can now concede. The underlying problem is that Nonaka has applied an epistemology to a social setting. This may become clearer if we turn to Stankiewicz who commits the same mistake. Stankiewicz distinguishes four different technological regimes; the craft regime, the engineering regime, the architectural regime, and the research regime (Stankiewicz, 2000). According to Stankiewicz, tacit knowledge is more dominant in the craft regime with face-to-face interaction, in contrast to the research regime, which is more dominated by explicit knowledge. The problem however is that tacit knowledge is not something 'out there'. Within epistemology, what is out there is taken to be 'my representation'. In other words, if I spend time with a baker, the baker and his actions are merely appearances in my representation, which I make sense of. Therefore from a phenomenological

perspective there is my own focal awareness with an unknown tacit background. I believe Nonaka has missed this point because of his cultural background, which is as social one of oneness (Nonaka & Takeuchi, 1995).
From a social point of view (putting tacit and explicit knowledge aside), according to Nonaka, knowledge conversion is about expanding the previous boundaries of the knowledge of the individuals and teams by constantly mixing different practices. This may still be the case, but it does not account for the origin of ideas, which emerge in the mind of the individual. If we return to the baking case with Tanaka and examines the case from her point of view, rather than socially, the emergence of the concept 'twisting stretch' can be explained the following way: Tanaka approaches the baking process by using normal scientific method. In order to understand how the bread actually comes about she imitates the baker by means of trial and error. This is undertaken by internalizing one explicit element at the time, testing one hypothesis after another. Eventually the idea of the kneading process emerges, which turns out to be the critical element in making the good bread.

I therefore agree with Tsoukas that there is no conversion from tacit to explicit knowledge. According to Tsoukas, we can extract hidden gems in our practices by finding new ways of talking, fresh forms of interacting, and novel ways of distinguishing and connecting. The question is then, how do these new forms come about? A next logical step is therefore to inquire further into epistemology, which I will initiate in part four.

Part three: Creativity

We have seen that the individual creative aspect has been left out in the innovation literature. The purpose of this part is therefore to explore this dimension further. Based on (Hennessey & Amabile, 2009) and (Sternberg, 1999) I have identified three perspectives on creativity; a Pragmatic, a Social-personal and a Cognitive paradigm. After a brief introduction on creativity I will clarify each of these three perspectives. I will finish this part by discussing the creativity literature in relation to Nonaka's theory.

A brief introduction on creativity

The earliest conceptions of creativity drew on mystical interpretations. Plato argued that a poet is able to create only that which the muse dictates (Sternberg, 1999). A consequence of this conception was that creativity was considered beyond measurement and comprehension. As with innovation, it was not until the late 20th century that creativity as a scientific field has emerged. Graham Wallas proposed one of the first creativity models in 1926. Ever since the role of creativity in problem solving has been acknowledged. According to Wallas, humans go through four different stages when trying to solve a problem; preparation, incubation, illumination, and verification (Hélie & Sun, 2010). In 1953 Osborn invented the famous brainstorming technique, which is a technique that was mainly developed for groups, and was designed to deal with what he described as 'driving with the brakes on.' The four guidelines were; criticism is ruled out, freewheeling is welcomed, quantity over quality, and further combination and improvement (Isaksen, 1998). In 1967 Gilford proposed a model, 'the structure of intellect' (Barlow, 2000), which in 1974 became the foundation of one of the first creativity tests; the Torrance test (Sternberg, 1999). With the Torrance test the field of creativity could finally start to prosper.

Innovation begins with the generation of new ideas. The ability to generate new and useful ideas is termed creativity (Schilling, 2010). According to (Amabile, 1996) creativity is the production and generation of novel and useful ideas in any domain, whereas innovation is the successful implementation of creative ideas within an organization. It seems that business uses the term innovation and tends to look at the organizational level, whereas psychology uses the term creativity and looks at the individual level (Sternberg, 1999). According to (Boden, 1991) creativity is the ability to produce work that is useful and novel, but the novel work must be different from work that has been previously produced and surprising in that it is not simply the next logical step in a series of known solutions.

Pragmatic creativity

The aim of the pragmatic view is to provide the reader with tools to become more creative. The techniques however have not been scientifically validated (Sternberg, 1999). To clarify this view I draw on the work 'Serious creativity' by (deBono, 1996). De

Bono makes a distinction between concepts and ideas. A concept is a general method or way of doing something. An idea on the other hand is a specific and concrete way of putting a concept to work, thus concerned with action. One may hold the concept 'too long waiting time', which may carried out into action with the idea 'fast-food'. Furthermore the idea 'fast-food' may be turned into a concept, which allows for new ideas on how to carry out the 'fast-food' concept. From this perspective we may perceive of ideas as solutions in relation to a concept.

According to De Bono, the tradition of western thinking is based on analysis and argument. Through analysis we break down complex and unknown situations into smaller chunks with which we can cope. The emphasis on analysis is related to the search for the truth and is concerned with 'what is'. In order for any analysis to take place we need concepts. Without concepts we can't break something down into smaller chunks. The opposite pole to analysis is called design, which is concerned with the synthesis of chunks in new ways. The output of this new synthesis may again be analyzed. Analysis and design must therefore be balanced. De Bono claims that our cultural tradition with its focus on problem solving has neglected design. Not all problems can be solved by analysis alone, which becomes evident when standard routines are not enough to solve a problem.

We have developed excellent methods for processing information such as mathematics, statistics, computer modeling, simulations and so on. However for any information processing to take place we need perception, which has received little attention. This is because perception has been understood as a passive system. According to De Bono, perception is something we can influence, thus an active system. Most ordinary thinking takes place in the perceptual phase and most of the mistakes of thinking are inadequacies of perception rather than mistakes of logic. We make judgments too fast instead of broaden our perception on the subject; what De Bono calls a 'logic bubble'. In order to be creative, it is important to realize the fluidity of perception and the possibility of multiple perceptions. The logic of perceptions is not static like the processing logic. It is not logic of truth and of 'what is', but rather logic of 'what can be'. The lateral thinking techniques provide tools for broadening our perception.

Self-organizing systems and creativity

According to de Bono the nerve networks in the brain work as a self-organizing system. In contrast to a passive system, where all activity comes from an external organizer, an active system (a self-organizing system) organizes information itself without any help of an external organizer. When information reaches the brain, the nerve networks of the brain organizes this information into preferred patterns. These preferred patterns are useful because they allow us to recognize 'things', which allow us to deal with the world faster. We do therefore not perceive each unique piece of information but instead we perceive our patterns. De Bono makes an analogy with rain falling onto the landscape. Eventually streams, rivers and valleys will be formed which will affect the flow of future rain. Our patterns have therefore been created and shaped since we were infants, and as we grow older fewer patterns emerge because of the large catchments areas of the established ones.

Judgment is an essential part of perception and plays two main roles. The first role is to find, identify, match or recognize the appropriate pattern. This happens almost automatically. The second role of judgment is to be sure that we do not wander off the track of our patterns. The second aspect thus deals with the rejection of ideas that are wrong or contrary to experience.

The model for creativity is the same as the model for humor. The time sequence of our experience has set up our routine perceptions. We see things and expect things in certain ways. With humor the punch line takes us away from the main-track to the end of a side-track, and we then immediately see the other track we might have taken. Therefore every valuable creative idea, or joke, must be logical in hindsight. We only recognize those ideas that have a logical link back to the main-track. See appendix Q. ideas are relational because we only realize their value and meaning in relation to something else. Without this something else an idea is void.

De Bono claims that creativity occurs when we break with existing ways of organizing things. Lateral thinking is concerned with different ways of escaping our routine patterns. Lateral refers to the moving sideways instead of moving along the main-track as with normal thinking. However De Bono emphasizes that lateral thinking is not the same as divergent thinking, because lateral thinking does contain a few elements of

convergent thinking. Lateral thinking is concerned with the exploring and changing of perceptions and concepts. De Bono also mentions other sources of creativity such as innocence, experience, motivation, tuned judgment, madness, chance, accident and mistake. Lateral thinking may not necessarily be the basis for artistic creativity. Lateral thinking can be used both by individuals and in groups. The primary focus in 'Serious creativity' is on individual creativity.

Creative modes

Walt Disney once told that he was able to switch between three modes; the dreamer, the realist, and the spoiler. The dreamer represents a mode of thinking where everything is possible and there are no constraints. The realist on the other hand is pragmatic and concerned with how ideas work in practice. Finally, the spoiler is looking for reasons for the ideas not to work. De Bono's 'six thinking hats method' is similar to Disney's method. Each color of the hats represents a specific mode of thinking. The green hat is keen to make a creative effort. The red hat has to do with feelings, emotions, intuitions and hunches. The yellow hat is optimistic and looks how something can be done. The blue hat is concerned with thinking itself .The white hat is concentrated with data and information that is available or that must be acquired. Finally the black hat judges all ideas.

Creative thinking methods

De Bono makes a distinction between everyday creativity and specific situation creativity. Everyday creativity is a free setting without any goals or rules. The most important element in everyday creativity is the 'creative pause', which is the willingness to stop up and make a creative effort about something. With specific situation creativity on the other hand, a focus point is present. De Bono is mainly concerned with the latter, which will be clarified in the following section.

Specific situation creativity

Specific situation creativity is divided into three different stages. The first stage is concerned with setting up the focus point. In the second stage, one or more creative

techniques are chosen and used. In the final stage, the creative output from stage two is explored further and formally written down. See appendix R.

Stage one

In the first stage an area specific or purpose specific focus point should be defined. One should experience with alternative ways of phrasing the focus point. The focus point should not be phrased to specific or too general. It is an option to search for existing information, which may change the focus point further. When the focus point is clear it is a final option to break it into sub-focus points, which may get their own specific attention later on.

Stage two

When the focus has been set, one should choose one or more creative techniques in order to generate ideas. De Bono's techniques can be divided into provocations and non-provocations. Provocations have a more divergent nature compared to the more convergent non-provocative once. These will be explained in turn.

Stage two A: using non-provocative techniques

Among the non-provocative techniques are; Challenge, Alternatives, Concept fan, Concepts, and Sensitizing. De Bono treats each of these five techniques independently, but further examination shows that the first four are interlinked. The Sensitizing technique will not be reviewed here.

A way to become more creative is simply to 'challenge' concepts and ideas. We may also challenge our 'thinking shaping factors'. These shaping factors can be dominating concepts, assumptions, boundaries, essential factors, avoidance factors, and either/or polarizations.

The essence of the challenge is to come up with new ideas, or simply 'alternatives'. As explained earlier, ideas can only be generated in relation to something. This is the reason why we must first challenge something within our focus. Alternatives are therefore ideas we generate in relation to a fixed point, namely the concept or idea that we have challenged. In order to generate alternatives we can either block, escape or

even drop the existing way of doing the thing. By blocking the existing way we are simply forced to look for different ways. We can try to escape the way by saying 'if this thing was not even important, what would we do?' De Bono makes a distinction between finding and creating alternatives, and claims that we are better at the former. We do not bother creating alternatives but rather recall those alternatives we already know in order to move on faster. A way to create alternatives is to think of alternative purposes, alternative groups, or alternatives by resemblances.

'The concept fan' is a similar method to generate alternatives. See appendix S. With this method we generate alternative ideas, alternative concepts, and maybe even alternative directions. The chosen focus point from stage one can be seen as the direction of a given thinking session. From this direction one can generate different ideas by asking 'how is this carried out'. If the focused direction is 'healthy fast-food', an idea could be a 'salad buffet'. At some point one may then start exploring those ideas that have been generated by repeating the same question 'how is this carried out'. By doing so we may create ideas of ideas. With the concept fan we therefore move further and further away from the direction. It should be noted that an idea turns into a concept when it has its own respective sub-ideas. Therefore everything between the highest end of the hierarchy (the direction) and the lowest level (ideas) is called concepts. At some point we can also choose to move back towards the direction by taking a concept, and ask the question 'how does it help'. By doing so we may generate alternative ideas from which the chosen concept might have emerged in the first place.

With the 'concepts' technique the focus is solely on concepts. Every business for example has implicit underlying concepts, which shapes the business. By extracting those concepts we can become more aware of our business. We can then choose to strengthen these concepts or even change them

Stage two B: using provocation techniques

As explained earlier, provocations are designed to break with our normal thinking. It is important that provocations are not treated and judged as serious suggestions. As we saw with brainstorming in the introduction, judgment hinders creativity by acting as a brake. According to De Bono both hypotheses and provocations are part of the creative process because they both bring something that is not there. A provocation however

goes beyond a hypothesis. A main-difference between the two is that the hypothesis is concerned with truth whereas the provocation is concerned with getting ideas. See appendix T.

Provocations need to be set up first before they can be used. To set up a provocation one can use the escape method, the stepping stone method or the random input method.

With the escape method, some of the normal things we take for granted within our focus is taken out. In the focus area of restaurants, we take for granted that the restaurants make their own food. A provocation is therefore; Restaurants do not make their own food.

With the stepping-stone method, we look at normal ways something is done, and then form a provocation by reversal, exaggeration, distortion or wishful thinking. A reversal is; the football plays me. An exaggeration is; companies have unlimited resources. A distortion is; I wake up before I sleep, and an example of wishful thinking is; employees work harder for less money.

Lastly with the random input method we simply add a completely randomly word to the focus, which forces a different thinking but still in relation to the focus point.

When the provocation has been set up, 'movement' is needed to generate ideas. Movement is the willingness to go forward without judging – it is green hat thinking. There are five different ways of movement; extract a principle, focus on difference, moment to moment, positive aspects, and circumstances. By 'extracting a principle' we examine the provocation and extract a principle, concept, feature or aspect. By 'focusing on difference' we compare the provocation with the normal way of carrying it out. With 'moment to moment' we visualize the provocation and see what happens. The fourth way of movement is to focus and extract the 'positive aspects' of the provocation. Finally with 'circumstances' we examine under what circumstances the provocation has direct value.

Stage three

When the creative output has been generated, a final effort should be made to extract the underlying concepts from the session. This is can be done by asking the question 'how does it help' (also explained in the concept fan). One should try to rephrase those concepts that have been extracted. When this is done one should then switch to the ideas. Some ideas may require further sharpening, tailoring, strengthening or reinforcing. Furthermore the ideas must be compared to existing ideas and their respective consequences must be considered. The treatment of ideas may require a creative session in its own right with a new specific focus point and so on.

De Bono emphasizes the importance of sticking to the time, focus, and chosen techniques that have been agreed upon. Also during each session one should take notes of ideas, potential ideas, concepts, new focuses, changes and the general flavor of the session. In the end of the session the output should be more formally written down.

Evaluation

The evaluation procedure is the 'fourth stage' but is analytic rather than creative. It is concerned with assessment, judgment, and decision capacity of an individual or an organization. In this final evaluation the feasibility, benefits, resources and fit must be considered for each of the generated ideas.

Social-personal creativity

One of the most influential models within this perspective is Amabile's componential model. According to (Zhou & Shalley, 2003) another influential model is the interactionist model proposed by (Woodman, Sawyer, & Griffin, 1993). I have chosen to present this perspective with the systems model developed by (Csikszentmihalyi, 2006).

In the systems model, creativity is the process that can be observed at the intersection where individuals, domains and fields interact. See appendix U. For creativity to occur, a set of rules and practices must be transmitted from the domain to the individual. The individual must then produce a novel variation in the content of the domain. For inclusion in the domain, the field however must select this variation. It is therefore gatekeepers within the respective fields that decide which changes should be included in

the domain. Therefore according to the systems model, a new meme is only called creative when it is socially valued. In the following I will first clarify the cultural context to which the domains belong. I will then follow up with the social context, which consists of the fields. Finally I will explain the individual level.

The cultural context

Cultures are systems of interrelated domains. Cultures affect creativity in three ways. First, the better tools there are for storing memes such as technical procedures, kinds of knowledge, styles of art or belief systems, the higher creativity is likely to be prized. If memes can only be transmitted orally, traditions must be strictly observed so as not to lose information. Second the accessibly and availability of information affects creativity. If the memes are protected from people, creativity will unlikely occur. Third the number of domains and the cultural hierarchy between the domains determines the level of creativity.

When a domain is too diffuse and loosely integrated it is almost impossible to tell whether a novelty is or is not an improvement in the status quo. Conversely it may be so tightly organized that no new development seems possible. Therefore creativity is less likely right before a paradigmatic revolution. Those domains that can be changed are more likely to attract creative people. The changeability depends on how autonomous a domain is from the rest of the culture or social system that supports it, and on how the culture values the domain.

The social context

The society is the sum of all fields. Fields are made of individuals who practice a given domain and have the power to change it. Societies that enjoy a material surplus are in a better position to help the creative process. Societies based on commerce, with a strong bourgeois class trying to be accepted by the aristocracy, have been usually favorable to novelty. Also societies located at the confluence of diverse cultural streams can benefit more easily from that synergy of different ideas that is important to the creative process. External threats may also mobilize society to recognize creative ideas. Finally if the society is either too uniform or has too much divisiveness, it is unlikely to generate novelty that will be accepted and preserved.

It is gatekeepers who have the right to add memes to a new domain. Gatekeepers therefore determine whether an input is creative or not. The gatekeepers are designated the fields and some domains may have only a very small field consisting of only a few scholars. The field can influence creativity in different ways. One way is the field's access to economic resources. Without economic resources it can be difficult to do novel work. Also the centrality of the field in terms of societal values will determine how likely it is to attract skilled people. Finally the degree of openness to new members has an impact of creativity. Highly hierarchical organizations generally see novelty as a threat.

The individual

In order to function within a creative system, one must internalize the rules of the domain and the opinions of the field. This also creates a basis for rejecting the 'bad' ideas and keeping the 'good' ones. Some great contributors in science have been rather conservative and unimaginative, but in general as an innovator one should be capable of breaking rules. Thinking skills such as divergent thinking and problem finding is useful. A final aspect comes with the social dimension of creativity. In order to implement something new one should have a strong network and be good at advocating ones work.

Even though it is said that necessity is the mother of invention, it is difficult to become an inventor if one has to think of survival. As it takes time to internalize the rules of the domain and the opinions of the field, there has to be a background environment that allows for some surplus energy. That being said, there is a tendency that creative people grow up in atypical conditions on the margins of community. Csikszentmihalyi mentions four important qualities for individual creativity; talent, intrinsic motivation, cognitive abilities, and appropriate traits[4].

Cognitive creativity

The cognitive perspective started to emerge in the 90's with (Boden, 1991) as one of the pioneers. To explain this perspective I draw on (Ward, Finke, & Smith, 1995)[5].

[4] According to (Amabile, 1996), expertise, creative thinking and task motivation are the essential individual factors.

[5] The reader should be aware that it has been necessary to restructure the content of this book and this review is therefore heavily biased towards my personal interpretation.

Creativity as combinatorial

According to the authors creativity is combinatorial. Language is the hallmark for creativity and the creation of new concepts build on existing ones. The authors argue that the earliest building blocks of our creations came not from something we decided to make, but from objects we discovered in nature that could meet certain needs. When we develop a new idea we tend to recall something we are familiar with and pattern the new idea after that. Truly creative ideas arise when we wisely preserve and extend what is worthwhile from existing knowledge, and reject only the ideas that constrain our thinking. We may therefore say that old knowledge both enables and constrains our creativity.

Knowledge as a double-edged sword

Because knowledge both enables and hinders creativity it is said to be a double-edged sword. That being said, it is still experts with great field insight who carry out most creative breakthroughs. Csikszentmihalyi showed us the necessity of internalizing rules of the domain and opinions of the field, which created a basis for rejecting the 'bad' ideas and keeping the 'good' once. Experts may also know what has failed for others and why it has failed, and avoid inventing something that already exists. In the following I will clarify why knowledge is a double-edged sword, by discussing paradigms and movements, starting points, and fixations.

Paradigms and movements

Movements in art are very similar to paradigms in science. A scientific paradigm differs from another in terms of the goals it tries to achieve, the questions it asks, the method it uses, the phenomena it studies, and even the language and explanation it uses. When a scientist is influenced by a certain paradigm it guides what he thinks and sees. Because the paradigm becomes a way of finding and solving certain problems it is crucial to creativity.

Starting points

When we enter a problem-solving mode, within a given paradigm, we put ourselves under certain concepts and constrains. We can call these concepts starting points (similar to De Bono's focus points). A designer may put herself under the concept 'dress'.

Every conceptual space has certain properties, some more essential than others. The inventor may challenge each of these and should be careful breaking essential properties, thus escaping the concept completely. When writing science fiction, the writer must stick to certain science fiction rules and opinions. Actually the writing process is free, but if the final product is labeled science fiction the reader will expect a science fiction essence. What neither (Ward, Finke, & Smith, 1995) nor (Csikszentmihalyi, 2006) mention is the possibility to create a completely new field or label, which is something that must be considered when we break the essence of a concept. The inventor must know the power of labels. He must know when to abandon a label for another, or when he should invent a new one. By creating a new label it may be possible to convince the audience that his invention truly differs from the rest of the world.

Fixations

On an even smaller scale we can talk of fixations, which refer to blocks that obstruct successful problem solving. The designer, that tries to invent a new 'dress', may fail to carry it out because of obsolete algorithms and heuristics. Fixations are especially common in more creative problem solving regimes where the inventor unconsciously applies innate algorithms and heuristics that block the process.

Creative realism

Creative realism refers to the exploring of those ideas that are both creative and are likely to have a realistic impact on realistic issues and problems. There are two elements of creative realism; structural connectedness and imaginative divergence. Structural connectedness is the element, that new ideas should be meaningfully connected to the structure of previous successful designs and ideas. It is important to try to explore creative possibilities that are tied in at least some ways to existing designs and structures that have proven to be successful in the past. We saw that the science fiction writer should stay connected with existing meanings and rules within the label. Imaginative divergence refers to the capacity for new designs or ideas to excite the imagination and encourage the exploration of new possibilities.

The cognitive landscape

Knowledge is a hierarchy of concepts that are interrelated in certain ways. On a higher level of this hierarchy the authors talk of schemas and mental models rather than of concepts. A mental model can be that of day and night explained by the rotation of the earth and the sun. One may not only have knowledge of external phenomena. Metacognition is the creation of knowledge through the examination of ones existing knowledge and processes. Changing these processes can enable new thoughts, which may lead to new inventions.

There are two cognitive faculties for creativity; concepts and visualization. Both concepts and visualizations are constructed from knowledge that we have already acquired. Concepts and visualization are related because we can visualize a concept with its respective properties.

The authors make a distinction between the creation of ideas with or without a problem at hand. The former is called problem solving and the latter creative play. This distinction is very similar to De Bono's distinction between specific creativity and everyday creativity. However another distinction between generation and exploration is proposed. Generation is the creation of new creative structures whereas exploration is the probing of these structures. With these two sets of distinctions a matrix can be constructed as shown in appendix V. Within the problem solving regime we therefore have the generation of solutions, and the exploration of solutions that have been generated. Similarly, in creative play we can generate preinventive forms. An example is the painter who generates novel forms without knowing what these forms are. Lastly in creative play we can explore the forms of the painter without any certain goal or problem present.

Due to the free nature of creative play little can be said. This was also the case with De Bono and everyday creativity. Following is therefore concerned with problem-solving.

The problem solving regime

According to the authors, creative thinking underlies successful problem-solving in general. Some problems call for creative solutions and some do not. With reproductive problem solving, accepted known solutions can be applied to solving a given problem.

With creative problem solving on the other hand, existing knowledge does not suffice. In order to come up with solutions, the existing knowledge must be transformed in some new way. Truly creative problem solving is the solving of a new type of problem, one for which existing knowledge cannot yet produce a satisfactory solution.

There are well-defined problems and ill-defined problems. With a well-defined problem, a starting state, a goal state, and a set of operations to reach to the goal, are all clearly expressed. Well-defined problems are usually best confronted with reproductive problem solving. In contrast, ill-defined problems, such as determining the optimal temperature for a school, cannot be solved in a straightforward way and requires creative thinking.

There are two useful strategies to reproductive problem solving; algorithms and heuristics. Algorithms are abstract formulas that describe specific relationships between certain elements. Heuristics are similar to algorithms but only rules of thumb. One of the things that characterize experts is that they have insight into algorithms and heuristics within their expert fields.

The authors suggest that problem solving starts with defining the problem followed by generation and then exploration. See appendix X. I will briefly go through each of these phases.

Defining the problem

By first formulating the problem at an abstract level, we can discover exactly what goals we need to accomplish without having to commit ourselves to any of the standard ways of reaching those goals. By then exploring the greatest possible range of means to those ends, we can move beyond the narrow thinking that comes along with considering only the small set of existing solutions. Abstraction also aids in making our assumptions explicit. In defining a problem more abstractly a storeowner may define his business as 'provider of home entertainment' instead of simply 'selling records and tapes'. With this reformulation of the business problem new opportunities can emerge.

Generation

When a problem has been properly defined we can use analogies, or conceptual combinations to generate solutions. With the use of analogies we take concepts from one area and extend them to another. A classical example is that of using the solar system to understand the world of atoms. The difficulty that lies with analogies is to know which features from the analogy one should use. Conceptual combination can be used both in a physical sense, as in the case of a Swiss army knife, or in a conceptual sense. In the former case the properties are maintained. In the latter the combination of concepts requires a new interpretation and the old properties are therefore lost. An example of the latter is 'computer-dog'. Some concepts are more associated than others. Feathers for example are more associated with birds than fish. A way to create more novelty may therefore be to combine more unassociated concepts. The further the concepts are apart the more likely it is that new properties will emerge. The authors call this divergent thinking.

Exploration

In this phase, the ideas that have been generated in the generation phase are explored further. The ideas may be explored by using mental models and visualization. By using mental models we can visualize how a system might operate in practice.

Incubation

Sometimes the solution to a problem may come a long time after our search. This is called incubation. One explanation of the incubation phenomena is that we simply become active to a solution, which may then emerge unconsciously because we eventually overcome fixations that have blinded us.

Discussion on concepts and inventions

In can be difficult to distinguish concepts and ideas. A concept is usually one word or a few words put together to explain some kind of essence. A concept may be void or rich depending on the world that is expressed through it. We have seen that ideas emerge in relation to a mental structure when focused upon. Curiosity in terms of interests and necessity in terms of problems initiate focus. Concepts belong to the past. In that sense we can never create new concepts but only ideas. Ideas are therefore new per definition,

but only from the perspective of the person who has got the idea. An idea is therefore not necessarily new to the world. We can imagine a continuum with ideas in one end and concepts in the other. A new idea is open for definition and moves toward concept status as its essence becomes clearer.

If we follow Csikszentmihalyi, inventions are socially valued. 'Good' technology etc. is therefore not absolute but dependent on a social context. A domain is constituted of a number of fields and the inventor can choose to operate within or outside these fields. By accepting rules and opinions he may experience less resistance in transforming his ideas into inventions. The other path is to advocate a whole new field that reflects a new idea, thus make it become an invention.

Wrapping up on creativity

We have seen that the creative literature in general reduces creativity to mind and language. Creativity is the recombination of mental components. Ideas emerge in relation to existing mental structures that are being focused upon. The focus is either problem-driven or interest-driven. Motivation is therefore essential for getting ideas. We cannot know what ideas will emerge but we can give the direction. What emerges is always related to this direction, thus logical in hindsight.

Our mental construction ultimately consists of everything we can talk about; scientific theories, definitions, rules and opinions and so on. Literature on creativity and metacognition are therefore also just mental constructions. From a creative perspective there are no hierarchies and boundaries as such as everything in this space can be combined.

Movement (absence of judgment) is vital to being creative. Analysis and gathering of information are ways to increase our number of mental components, however without some degree of movement we just fortify old structures. In relation to (Argyris & Schön, 1996) it is movement that makes us capable of double-loop learning, however there is more to movement than problem solving. From the perspective of movement there are no real problems but only focus points. It is us that turn some focus points into problems by attributing them a value of necessity. We may choose to solve a 'critical' business

issue or simply move on. Without movement we cannot switch between different focus points.

Based on the creativity literature we can reject the idea of a muse. Ideas are no mysterious entities but are relational and must be logical in hindsight. An idea is therefore void without a corresponding mental construction. According to (Schilling, 2010) the inventor is a generalist who pursues more fields simultaneously, is more interested in problems rather than solutions, and questions assumptions in previous work in the field. I believe this confirms my findings on motivation, movement and the building up of mental constructions.

Knowledge creation theory and movement

In the innovation literature a popular distinction is made between exploration and exploitation (March, 1991). Even though Nonaka doesn't apply these terms directly they are implicit in his works. Whereas exploration is an action on organizational level, movement expresses an attitude on the individual level. Because Nonaka has neglected the individual aspect on knowledge creation it is difficult to apply the term movement to his cases. In the baking case there were three cycles. The first cycle resulted in a prototype that did not meet the standards. The radical solution of becoming an apprentice at a baker may have been the result of movement in the mind of a specific team member.

Part four: Epistemology and difference

In western epistemology the 'I' is taken as the starting point for any knowledge of the world. Many empiricist philosophers hold the view that there is no direct relationship between what is out there and what 'I' experience. This I call a representational view. In this view, inputs are being transformed into a representation, and it is then the representation that is perceived, not the inputs. De Bono and his account on the brain as a self-organizing system is therefore a representational view. Kant, Bergson, Deleuze and Pirsig are example of philosophers who also hold such a view.

When the 'I' rather than the 'We' is taken at the starting point, in some sense Berkeley's idealistic account becomes the conclusion. According to Descartes I cannot know if I am being deceived by a demon. In other words, I can never know if my senses can be trusted. Therefore I can never proof that a material world exists beyond my perception. Hence I can only believe that it might be the case. If the conclusion is 'belief', my perception of a world in the first place may be nothing but belief.

If 'We' on the other hand is the starting point, we never come to the point where we question the senses. This is the view Nonaka holds and this is the reason why he commits the error of applying an epistemology to a social setting. From Nonaka's perspective the world with all its appearances simply just is. Nonaka therefore understands the world very socially (Nonaka & Takeuchi, 1995).

In this part I will follow the western philosophical tradition and take the 'I' as the starting point. I will draw on Pirsig who holds a representational model of the world that mirrors that of De Bono. From such an epistemological perspective we perceive of our patterns of sameness rather than of each unique piece of information. 'Difference' is therefore beyond our representation. From a creative perspective this difference beyond our mental models is interesting.

In this part I aim to answer my second research question. To do so I draw on Pirsig's metaphysics of Quality. I will then discuss Pirsig from a Deleuzian perspective and talk about learning. Having clarified Pirsig's epistemological view I will discuss Pirsig in relation to creativity and to the generation of new forms (Tsoukas' argument). I will end this part by applying Polanyi's epistemology properly to Nonaka case.

ZMM and Lila

Zen and the art of motorcycle maintenance (ZMM) (Pirsig, 1974) and Lila (Pirsig, 1992) are the two philosophical novels written by Robert M. Pirsig. Lila follows from where ZMM left off. The focus in this thesis is on the philosophical content of the books. ZMM is a reflection of Pirsig's real life. It is a life where he has suffered from two nervous breakdowns, has spent time in psychiatric hospitals between 1961 and 1963, and has been diagnosed with paranoid schizophrenia. ZMM is written in a first person narrative.

We are introduced to a third person called Phaedrus who turns out to be the protagonist's old identity. In Lila the narrative changes from a first person to a third person perspective following Phaedrus. Pirsig's philosophy can be classified as a process philosophy where the world is ever changing and identities are nothing but static labels, hence ghosts. What characterizes Pirsig's and his philosophy is its scientific orientation. Pirsig aims at making a metaphysics that is capable of explaining scientific theories such as evolution and quantum mechanics.

Metaphysics of Quality (MOQ)

"Quality isn't something you lay on top of subjects and objects like tinsel on a Christmas tree (Pirsig, 1974)." Quality is neither subjective nor objective, but the world is itself a moral order composed of an undefined Quality. Therefore according to Pirsig, Quality is ontological first. Quality is not a thing but an event. It is the event at which the subject becomes aware of the object. Hence Quality is the parent of both mind and matter, and therefore also the very foundation of both science and art. Because Quality is ontological first it cannot be defined. "To take that which has caused us to create the world, and include it within the world we have created is clearly impossible (Pirsig, 1974)."

"Any person of any philosophical persuasion who sits on a hot stove will verify without any intellectual argument whatsoever that he is in an undeniably low-quality situation… this low quality is not just a vague, wolly-headed, crypto-religious, metaphysical abstraction. It is an experience. It is not a judgment about an experience. It is not a description of experience. The value itself is an experience (Pirsig, 1992)."

The MOQ is no idealism. Pirsig claims that there is indeed a world we share socially. However according to Pirsig, the MOQ is also no scientific materialism since the world is ultimately composed of value, not matter. The MOQ subscribes to empiricism. "It claims that all legitimate human knowledge arises from the senses or by thinking about what the senses provide (Pirsig, 1992)."

Quality events

Since we are dealing with a monism there is but one Quality. We could therefore conceive of Quality as a 'sun', that continuously lights up the world in the form of events. Due to the nature of events reality is always new and different. Subjects however do not

perceive reality this way. Rather we perceive of our existing patterns. “Categories that are unessential to a given culture … will, on the whole, not be found it its language. Categories that are cultural important will be found in detail. Eskimos see sixteen different forms of ice, which are as different to them as trees and shrubs are different to us… Every language is a means of categorizing experience (Pirsig, 1992).” Pirsig holds a similar representational model to that of De Bono. We are born without any mental content (a tabula rasa), and as we gain experience we start perceiving of our patterns rather the unique pieces of experience. Instead of talking about self-organizing systems, Pirsig coins the term ‘classic mind’. According to Pirsig it is Aristotle who is the ‘inventor’ of the classic mind, which dominates modern society. “Walk into any of a hundred thousand classrooms today and hear the teachers divide and subdivide and interrelate and establish ‘principles’ and study ‘methods’ and what you will hear is the ghost of Aristotle speaking down through the centuries – the desiccating lifeless voice of dualistic reason (Pirsig, 1974).” The classic mode is analytical and rational and sees the world primarily as underling form itself. However since the world is ever changing it ultimately means that our categories of experience cannot fully comprehend the world. “The law of gravity exists nowhere except in people’s heads. It’s a ghost! (Pirsig, 1974).” Opposed to the classic mind, Pirsig coins the term ‘romantic mind’. The romantic mind has been dominant before Aristotle separated reason and Quality. The romantic mode is primarily inspirational, imaginative, creative and intuitive. It sees the world in terms of immediate appearance. According to Pirsig the romantic mode is closer to Quality because it perceives reality as it is without subjects and objects. “It is the leading edge that contains an infinite possibilities of the future… it is always the moment of vision before the intellectualization takes place (Pirsig, 1974).” See Appendix Y. It should however be noted that the romantic mode always contains a few classic elements and vise versa. It is therefore a continuum.

According to Pirsig, the dominance of the classic mind has caused an alienation of science and technology in today’s society. Due to the lack of Quality, science and society have become uncontrollable autonomous giants who have lives of their own. To get of this dangerous track is by no means easy because the classic mind tends to see the romantic mind as unintelligent, unethical and shallow.

In Lila, Pirsig abandons the classic and romantic split, and uses the terms static and dynamic instead. I believe that the reason for this switch is, that he in Lila is concerned with morals on the society level, in contrast to ZMM where the focus is on the single individual. It makes little sense to talk of a society that enters a romantic mode. Hence we need the term dynamic mode. I will therefore argue that there is little difference between the terms classic-romantic and static-dynamic. This will become clearer in the following paragraph on freedom and evolution.

Freedom and evolution

Whether we think in physical terms such as the evolution of life, or in more abstract terms such as the evolution of a society, any evolution requires both static and dynamic elements. "Sometimes a Dynamic increment goes forward but can find no latching mechanism and so fails and slips back to a previous latched position. Whole species and cultures get lost this way. Sometimes a static pattern becomes so powerful it prohibits any Dynamic moves forward…. The increase in versatility is directed toward Dynamic Quality. The increase in power to control hostile forces is directed toward static quality. Without Dynamic Quality the organism cannot grow. Without static quality the organism cannot last. Both are needed." (Pirsig, 1992).

To Pirsig evolution is not relative and vague (As it is with Darwin). Evolution is absolute. The world is not just composed of value, but of organized value. The world is a moral order. Pirsig defines five value patterns; inorganic-chaotic, biological-inorganic, social-biological, intellectual-social, and dynamic-static. The lowest morals are inorganic-chaotic followed by biological-inorganic. These are equivalent to matter. The social-biological and intellectual-social are equivalent to mind and are on a higher moral level. Finally on the highest moral level there is dynamic Quality. Without dynamic Quality evolution is not possible. This moral hierarchy can be seen as a ladder where higher moral levels are depending on the presence of lower once. Ideas on the intellectual level can therefore only emerge in an established society with laws. "Mental patterns do not originate out of inorganic nature. They originate out of society, which originates out of biology, which originates out of inorganic nature." (Pirsig, 1992).

Pirsig presents a 'mythos over logos' argument, which may compliment our understanding on evolution. "The term logos, the root word of 'logic', refers to the total sum of our rational understanding of the world. Mythos is the sum total of the early historic and prehistoric myths which preceded the logos... the mythos over logos argument states that our rationality is shaped by these legends… The mythos-over-logos argument points to the fact that each child is born as ignorant as a caveman. What keeps the world from reverting to the Neanderthal with each generation is the continuing, ongoing mythos, transformed into logos but still mythos, the huge body of common knowledge that unites our minds… Quality is the generator of mythos… Religion isn't invented by man. Man is invented by religion. Men invent responses to Quality…" (Pirsig, 1974). With the mythos over logos argument it is the past that creates the future. This coincides with a scientific worldview where all states of affairs must be necessary. Pirsig however does make room for personal freedom. This personal freedom lies within the romantic mode where we can escape the static structures of the past. However from an outside perspective it is a finalist world.

Phaedrus' only tool

According to Pirsig we have but one single tool. It is with the knife that we carve up the world in order to make sense of it. "The application of this knife, the division of the world into parts and the building of this structure, is something everybody does… From all this awareness we must select, and what we select and call consciousness is never the same as the awareness because the process of selection mutates it. We take a handful of sand from the endless landscape of awareness around us and call that handful of sand the world. Once we have the handful of sand, the world of which we are conscious, a process of discrimination goes to work on it. This is the knife. We divide the sand into parts. This and that. Here and there. Black and white. Now and then. The discrimination is the division of the conscious universe into parts. The handful of sand looks uniform at first, but the longer we look at it the more diverse we find it to be. Each grain of sand is different. No two are alike. Some are similar in one way, some are similar in another way, and we can form the sand into separate piles on the basis of this similarity and dissimilarity. Shades of color in different piles – subtypes of grain shapes in different piles – grades of opacity in different piles – and so on, and on, and on. You'd think the

process of subdivisions and classification would come to an end somewhere, but it doesn't. It just goes on and on." (Pirsig, 1974).

Pirsig and inventing

According to Pirsig we live in a shared world composed of Quality. Everything is Quality. Our mental models enable us to see some facts but also hinder us from seeing others. According to Pirsig the inventor must therefore balance the classic and romantic mode. "We have artists with no scientific knowledge and scientists with no artistic knowledge and both with no spiritual sense of gravity at all, and the result is not just bad, it is ghastly." (Pirsig, 1974). Because everything is Quality the duality split between subjects and objects is an illusion. It is the knife that has separated the 'I' from the world. "You want to know how to paint a perfect painting? It's easy. Make yourself perfect and then just paint naturally… What appears to be 'out there' and the person that appears to be 'in there' are not two separate things. They grow toward Quality or fall away from Quality together." (Pirsig, 1974).

"Ultimately it does not matter what you invent as long as it has Quality." (Pirsig, 1974). What has Quality is therefore not necessarily an invention that can be commercialized, thus an innovation. We have seen that the classic mind is alone capable of innovation. "When the knife is applied to experience, something is always killed in the process… but something is always created too." (Pirsig, 1974). Pirsig's point of critique is that we have all become slaves of the past by spinning around in classic modes. It is only as long as the classic mind dominates that we can talk of science or society as being uncontrollable giants. When we open our eyes for the present moment we will start encounter Quality rather than our patterns. "The difference between a good mathematician and a bad one is precisely this ability to select the good facts from the bad ones on the basis of quality. He has to care! When you are really stuck it's not any subjects or objects, but Quality that tell you where you ought to go. The facts are there but you don't see them. You are looking right at them, but they don't yet have enough value." (Pirsig, 1974).

Discussing Pirsig from a Deleuzian perspective

According to Pirsig the duality of subject and object is illusory, as everything is one Quality. It is a Quality that manifests itself as events – always different. In 'Metaphysics'

(Sachs, 1999) and 'Categories' (Edghill, 2014), Aristotle shows us the difficulties there are with defining the highest being. In order to define the highest being something higher is required and so to infinity. In that sense it therefore matters little if we call the highest principle; God, Quality, or Difference, as these labels are necessarily empty.

Pirsig's MOQ and Deleuze's MOD (Metaphysics of Difference) contain many similar aspects. It is a world that is composed of repetitious events. For Pirsig it is Quality that expresses itself. In Deleuze's MOD it is the 'Eternal return' (Deleuze, 2004). In a Deleuzian way of speaking we may say that Quality repeats itself in different ways. Even though Quality carries a positive connotation there is a dark side to it. This becomes more clear when we compare it with the 'Eternal return'. Against Pirsig, I argue that the MOQ is no historical account. We cannot talk of cause and effect but only about cause. I am writing in this specific moment because a Quality event has been caused. However we cannot expect the subsequent event to have any logical connection to the prior one. If this were the case process philosophy would merely be a philosophy of being in disguise. Therefore I argue it is like Bertrand Russell's skeptical hypothesis that the world started to exist five minutes ago with all human memory and signs. Quality is therefore no friend but a foe. It is a torturous circle without a center. Death is the most common part of life because every form is constantly being dissolved while something new is created. Every event is a radical break – a thunderstorm (Deleuze, 2004). From the perspective of the 'Eternal return' we can therefore not talk about substances that acquire and loose properties in time and space, the way Aristotle does it. The Eternal return is truly mad, creative and unpredictable.

Both Pirsig and Deleuze are concerned with difference. More specifically they are concerned with the ontological difference that is beyond our mental models. Holding a representational view, it is the patterns of the past that mediate the present moment by putting it into forms. We therefore perceive of our representations of sameness, rather than of the unique differences out there. What we perceive is therefore nothing but our own narcissistic image (Deleuze, 2004), or a reflection of ourselves (Pirsig, 1974). A perspective on learning should therefore be concerned with the internalization of this ontological difference. This is exactly the case with Deleuze. Building on Kant, for Deleuze the learning encounter is pre-representational, thus with signs. Learning is therefore practical not theoretical (Jeanes & Cock, 2005). For Deleuze it is about opening

ourselves to the outside without letting the plane of immanence (assumptions, distinctions, images etc.) act as a foundation to 'territorialize' (Jeanes & Cock, 2005). For Pirsig however, the encounter corresponds to the moment of Kant's first active synthesis (transcendental aesthetics). With Pirsig the encounter therefore occurs within representation, but before the representation has been analyzed for specific objects.

Further investigation shows that Pirsig's epistemology has problems accounting for the internalization of ontological difference. According to Pirsig, the romantic mode always contains classic elements and vise versa. Because it is a continuum it is never fully possible to escape the classic past of sameness. It is this classic background that creates the romantic picture in the premature phase of representation. Without any classic elements there cannot be any representation. Because the classic mind is always present the ontological differences cannot be internalized.

Because creativity is combinatorial in Pirsig's epistemology, the romantic mode is therefore not about exploring ontological difference and Quality. Rather its purpose is similar to that of movement we saw part three: "… The most striking example of value rigidity I can think of is the old South Indian Monkey Trap, which depends on value rigidity for its effectiveness… There is a fact this monkey should know: if he opens his hand he's free. But how is he going to discover this fact? By removing the value rigidity that rates rice above freedom. How is he going to do that? Well, he should somehow try to slow down deliberately, and go over ground that he has been over before, and see if things he thought were important really were important and, well, stop yanking and just stare at the coconut for a while. Before long he should get a nibble from a little fact wondering if he is interested in it. He should try to understand this fact not so much in terms of his big problem as for its own sake. That problem may not be as big as he thinks it is. That fact may not be as small as he thinks it is either. That's about all the general information you can give him." (Pirsig, 1974).

Polanyi (building on Heidegger) is also concerned with this ontological difference. For Polanyi these ontological particularities are internalized into bodily knowledge when engaged in action. Just as with Deleuze, learning is therefore purely practical. By carrying out a given practice, particularities are internalized into an irreversible tacit knowledge. Due to this non-theoretical nature we can come to know more than we can

tell. Like Deleuze, Polanyi's epistemology can therefore account for ontological difference.

Discussing Pirsig and forms

In part three it was argued that knowledge both enables and hinders creativity. Pirsig describes these old mental structures as ghosts. "The law of gravity exists nowhere except in people's heads. It's a ghost!" (Pirsig, 1974). A clock is merely movement, and it is I who interpret this movement as time passing by. It is not enough to be concerned with ones own ghosts. If one is too inventive, the audience will experience the outcome as madness. This may have been the case with Van Gogh and his paintings. The audience must therefore possess the right ghosts to make 'proper' sense of radical invention. The inventor should be aware that it might be necessary to educate the audience before an invention can become an innovation.

According to Tsoukas, knowledge creation is about finding new ways of talking, fresh forms of interacting, and novel ways of distinguishing and connecting. I argue that the essence of this argument is that we should generate new forms – or ghosts. By inventing new forms we may be able to extract hidden gems, however not only from our practices but from appearances in general (its all appearance).

Tsoukas does not come up with any suggestions how new forms come about. This is the reason why an inquiry into epistemology has been necessary. Further investigation has shown that Pirsig's epistemology cannot account for the internalization of ontological difference. Therefore according to Pirsig, creativity is necessarily combinatorial. This is the same view Schumpeter holds and the view that was dominant in part three. According to Pirsig the only tool the inventor can dispose of is the knife. The inventor must use this knife to explore new forms within his representation by synthesizing other forms of sameness. In the following I propose three aspects of combination within representation.

First I turn to Bergson in 'Matter and memory' (Somers-Hall, 2013). To Bergson memory is not fragmented, but it is always the whole past that is played out to mediate the present moment. As we acquire more experience it is a longer and longer past that is

played out. Therefore to Bergson, even though we perceive our past of sameness, it is always a different and longer past from a new perspective. In accordance with this view, scientific experiments have shown that nobody is consistent in defining the same things over time. Among cognitive psychologists this view is called the 'active construction view' (Ward, Finke, & Smith, 1995). The inventor should be aware that his ghosts are dynamic, and should therefore not be afraid to reopen old cases. Also he should be aware that it is not possible to apply being to becoming. Tomorrow I have different ghosts.

Second, inspired by Deleuze and Guattari I turn to (Malins, 2004): "The meaning of a thing is not given but multiple. A body becomes a cyclist when connected with a bicycle, a smoker when connected to a cigarette, and a tripper when connected to LSD". A thing is not independent of the rest of the world. Rather its meaning is a relation to the rest of the world.

The third aspect of combination is 'creative play' and is connected to Pirsig's romantic mode. Within this mode, goals and purpose are kept to a minimum in order to escape more dominating concepts. By zooming in or out on things, primary functions may be obscured. The painter may turn a picture upside down to explore new forms, lines, shadows, colors etc.

Discussion on Nonaka and Polanyi

Because Pirsig stays within representation he cannot account for the internalization of ontological difference. For Polanyi however learning is pre-representational and practical. With such an account ontological difference can become internalized. Returning to the baking case, Polanyi's epistemology can now be applied on the 'I' rather than the 'We'. Tacit knowledge is not something out there, but instead I can only talk of my own focal awareness with an assumed tacit background. Taking the perspective of Tanaka 'my' focal awareness is on the baker and the bread. By way of scientific method I imitate the baker and the way he kneads the bread. In the process of imitating the baker I come to internalize particularities that I am unaware of. I therefore build up a bodily irreversible tacit knowledge. This bodily knowledge however plays a crucial role, because without it I would never have been able to put forward the right questions and

hypotheses. Had I not engaged in the practice of bread kneading, but had instead been passively watching, I would never have been able to extract the hidden gem. Building up bodily knowledge is therefore crucial for the inventor.

Part five: Ending

Understanding the innovation process is a complex task. One fundamental issue is that we don't have the total 'universe' of inventions and innovations (Freeman & Soete, 1997). Because innovation is about the new itself, also it may not follow the same patterns as previous ones. Another issue is the difficulties that lie in distinguishing the rare novel idea that will prove successful from the numerous novel ideas that will be unsuccessful (March, 2010). Finally, ideas and inventions unlock new doors, which in turn may unlock new doors and so on infinitely (Johnson, 2011). A study on the process of innovation that focuses only on a single moment in time and space therefore seems inadequate. To deal with these issues I have approached the innovation process through knowledge creation. It is assumed that there is a positive correlation between innovation and knowledge. I have used Nonaka and colleagues' knowledge creation theory as a starting point, as it has received almost paradigmatic status (Gourlay, 2003). Two issues have been identified, confirmed, and explored. In part three of this thesis I have been looking into the creativity literature to explore the individual dimension on knowledge creation. In part four I have been looking into epistemology to explore how new forms can be created. In this part I will initiate a final discussion of findings related to the two research questions. I will then discuss these findings in relation to Nonaka's theory. Finally I will end this part with a brief conclusion followed by a few final remarks.

Discussion

In the creativity literature it was shown that ideas are relational. Ideas emerge in relation to mental structures that are being focused upon. When we ask a certain question we focus upon a mental structure and ideas emerge in relation to these structures. In order to generate ideas it is therefore required that we invest some energy. Problems and interests are the triggers of this energetic focus. As the inventor doesn't run into problems all the time, passion and interest are critical. It is assumed

that creativity is positively correlated to the richness of our mental structures. One way of generating new mental structures is to search for external information. Another way is to initiate creative thinking that will result in ideas that eventually turn into mental structures. From a creative point of view no mental structures are better than others. However for an invention to become an innovation it has to have social value. In the end therefore every invention must satisfy a certain need. The generation of new ideas is simple, but it is difficult to generate ideas that have value for others. To hold mental structures of such needs is therefore valuable. It is also possible to advocate for an idea that doesn't meet existing needs. Most companies however are market driven. This is also the case for those Japanese firms Nonaka has studied. Finally mental structures may also hinder creativity. Without an attitude of movement (the absence of judgment) old structures become fortifications. Movement also enables one to switch between focus points, thus making it possible to overcome fixations. To sum up, motivation, mental structures and movement are essential to creativity. These findings mirror Amabile's three components; motivation, expertise, and creative thinking (Hennessey & Amabile, 2009). Expertise is similar to mental models and creative thinking is similar to movement.

According to Nonaka, knowledge conversion is about expanding the previous boundaries of the knowledge of the individuals and teams by constantly mixing different practices (Nonaka & Krogh, 2009). To energize ba conditions such as autonomy, creative chaos, redundancy, requisite variety, and love, care, trust and commitment are recommended (Nonaka, Toyama, & Konno, 2000). With these elements Nonaka accounts for both motivation and mental models. It is argued that motivation is an output of the conditions of ba, and that mental structures are created my mixing different practices. Movement of the individual member is however not an output of these initiatives. I argue that movement can occur in this suggested environment, but it does not prosper as a result of it. In order to facilitate movement an individual orientation rather than a group orientation is needed. The manager must be committed to every single team member's process of personal development, by showing interest in them. A team member's movement is a personal attitude and cannot be forced by the manager. It is therefore important to hire staff that shows this attitude from the beginning. The manager must investigate new members' willingness in action. In order to spot

movement and to become a better coach the manager must constantly be aware of his own degree of movement and how he can improve it.

In part four I have inquired into epistemology. Pirsig's two philosophical novels, 'Zen and the Art of Motorcycle Maintenance', and 'Lila', have been my primary sources. To clarify Pirsig's epistemology I have used Deleuze's 'Difference and Repetition'. It is shown that Pirsig's account has difficulties explaining learning. More specifically his account cannot explain the internalization of ontological difference (or Quality in Pirsig's case). By making learning pre-representational and practical, Deleuze and Polanyi on the other hand can account for this ontological difference. To Pirsig creativity therefore is theoretical and combinatorial. As with Pirsig's Quality, the more we talk about creativity, the further away we get from it. "It would be almost like a mathematical definition of randomness. The more you try to say what randomness is the less random it becomes. Or "zero," or "space" for that matter. Today these terms have almost nothing to do with " nothing". "Zero" and "space" are complex relationships of "somethingness"… If he really wanted to do Quality a favor he should just leave it alone." (Pirsig, 1992). However I have identified three aspects of combination within representation. The first aspect is found in Bergson's work 'Matter and energy'. According to Bergson, because our past grows, it is always a different past that is played out to mediate the present moment. This aspect we may call dynamic forms (or dynamic ghosts with Pirsig's terminology). A second aspect is found in the collaboration of Deleuze and Guatarri. According to the two authors, the meaning of a thing is not given but multiple. In other words, objects have a different meaning depending on their context. The third aspect of combination is more 'creative play' (also mentioned in the literature on creativity). Within creative play, goals and purpose are kept to a minimum in order to escape more dominating concepts. A fourth important aspect is pre-representational and practical and has been found in Polanyi's epistemology. By engaging in a practice, particularities are unconsciously internalized into bodily knowledge. This bodily knowledge can never become explicit, but it is a necessary foundation for asking the right questions within a focus.

How can these four aspects of combination compliment Nonaka? Bergson's example of dynamic forms implies that the manager should not be afraid of reopening abandoned cases, as they will be looked upon with a different past (with fresh eyes). Also the

manager should know that he cannot apply being to becoming. Tomorrow is a different day, with a different past. A project must therefore be reassessed and reproduced every day, as its meaning and relevance changes over time. The second aspect of combination, that meanings of things are multiple, is more active than the first one. Nonaka already accounts for this aspect by mixing practices. By doing so, things will appear with new meanings due to new constellations. In relation to the third aspect of combination of more creative play, the manager must sometimes expose the members of his team to more undefined spaces. The market driven approach that is dominant in Japanese firms therefore needs to be counterbalanced with more technology push. In the review on Technomics we saw that this is called coupling (Freeman & Soete, 1997). Finally the fourth aspect of bodily knowledge implies that the creative employee should not spend all his time in the office but needs fields experience. Nonaka already has a heavy focus on practices. The performing of creative sessions is a practice in its own right, and must therefore be practiced on a regular basis.

Conclusion

The first research question was about how the creativity literature could complement Nonaka's theory, as the individual aspect on knowledge creation has been neglected. By exploring this literature, three important aspects were found; motivation, mental models and movement. From the individual point on view, motivation is about giving energy to specific focus points. More specifically, by having problems or interests, ideas emerge when these mental structures are being focused upon. By building up mental structures more unique combinations are possible. Having mental models of needs can be an advantage as inventions are socially valued. Finally movement is crucial, since without movement old structures become fortifications and hinder creativity. Movement also enables the individual to switch between focus points. Nonaka already accounts for the two first aspects in his theory. Individual movement however has not been considered. It is suggested that the manager himself must be constantly aware of his own degree of movement and how he can improve it. By mastering his own movement, he can spot movement when hiring new team members and be a better coach for the single team member.

The second research question was about how we can find new ways of talking, fresh forms of interacting, and novel ways of distinguishing and connecting, as it was argued by Tsoukas that tacit knowledge cannot be converted into explicit knowledge. By looking into epistemology through the works of the philosophical novelist Robert Pirsig, assisted by Deleuze's 'Difference and Repetition', three aspects of combination within representation were found; dynamic forms, meanings of things are multiple, and more creative play. A fourth aspect of combination was pre-representational and practical, and was that of bodily knowledge by Polanyi. Dynamic forms mean that our perceptions of 'what is out there' are constantly changing. With the second aspect, the meaning of a thing is not given but multiple, implies that things have a different meaning depending on their context. The third aspect of more creative play is a mode where goals and purposes are kept to a minimum in order to escape dominating concepts. The fourth aspect is based on Polanyi and is pre-representational and practical. By engaging in a practice, particularities are unconsciously internalized into bodily knowledge. This bodily knowledge can never become explicit, but is a necessary foundation for asking the right questions within a focus. Applied to Nonaka, knowing of dynamic forms the manager should not be afraid of reopening abandoned cases, as they will be looked upon with a different past. Also a project must be reassessed and reproduced every day, as its meaning and relevance changes over time. The second aspect Nonaka already accounts for by mixing practices. By doing so, things will appear with new meanings due to new constellations. The third aspect of more creative play implies that the manager should sometimes expose the members of his team to more undefined spaces. Finally the fourth aspect of bodily knowledge, Nonaka also accounts for with his emphasis on practices.

It is found that movement, dynamic forms, and more creative play, can complement Nonaka's theory.

Final remarks

It has been three years now since I picked up ZMM and was introduced to Pirsig's knife and difference. Since then everything has been connected to it. I believed that the knife was the solution to creativity. Having finished this project I now know that the knife has no handle. When we realize that some objects in our representation are different, it is

not because we apply the knife. Instead it is because of the knife that the objects appear in the first place. It is applied the moment before thinking.

My interest in innovation and difference has taken me on a journey beyond my imaginations. While epistemology may be about knowledge, learning, and creativity, one is also being confronted with more existential issues. When the 'I is taken as the starting point for knowing anything about the world, a personal journey starts. From a 'We perspective' Descartes' words are nonsensical. When the 'I' is understood, Descartes words are clear. According to Kant I can only know my own representation. Deleuze and Pirsig go a step further by making an account for experience.

In this thesis I have had two purposes. One was to become a better inventor. The other was to approach the thesis creatively, to create a novel output. I believe that I have succeeded the former and failed the latter. This does not mean that the thesis is bad or that I should have done differently, but I have realized the difficulties there are creating something new in science. This experience is not reflected in the thesis, but it is what matters the most to me. I have come to see that I have been thinking along the tracks of others. Every idea that I have gotten someone else had before me. I have realized the difficulties there are taking new directions no one else has taken – and it is just fine. Had my thinking been too different, I would not have anyone else to share my ghosts with.

I have realized that feelings and value are crucial for understanding things. Just as we have mental models of knowledge, preferences in terms of value are also in a hierarchy. To know a philosophical concept one must feel it too. Also I have learned that I cannot apply being to becoming. At any point in time and space, I feel that I am in a mode that determines my thinking space. Thinking cannot escape this mode. If there is a storm I must have faith and wait patiently. As for learning it can be challenging to let go of the future, to open up for the present moment. Meditation, Yoga, and Tantra help a lot. When one starts to open up, it is like watching a movie. One can only hope that the main character makes it. By reducing ones ego there is less to defend and stress and anxiety have no target.

This journey has now come to an end. One can always dig deeper but I don't think I would find much – at least not with my current past. I now know I know only a little.

Even though my world has been turned upside down, I have a good feeling about it. I have learned to be thankful rather than skeptical. It is time to leave the old ghosts behind and seek new worlds.

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Appendix

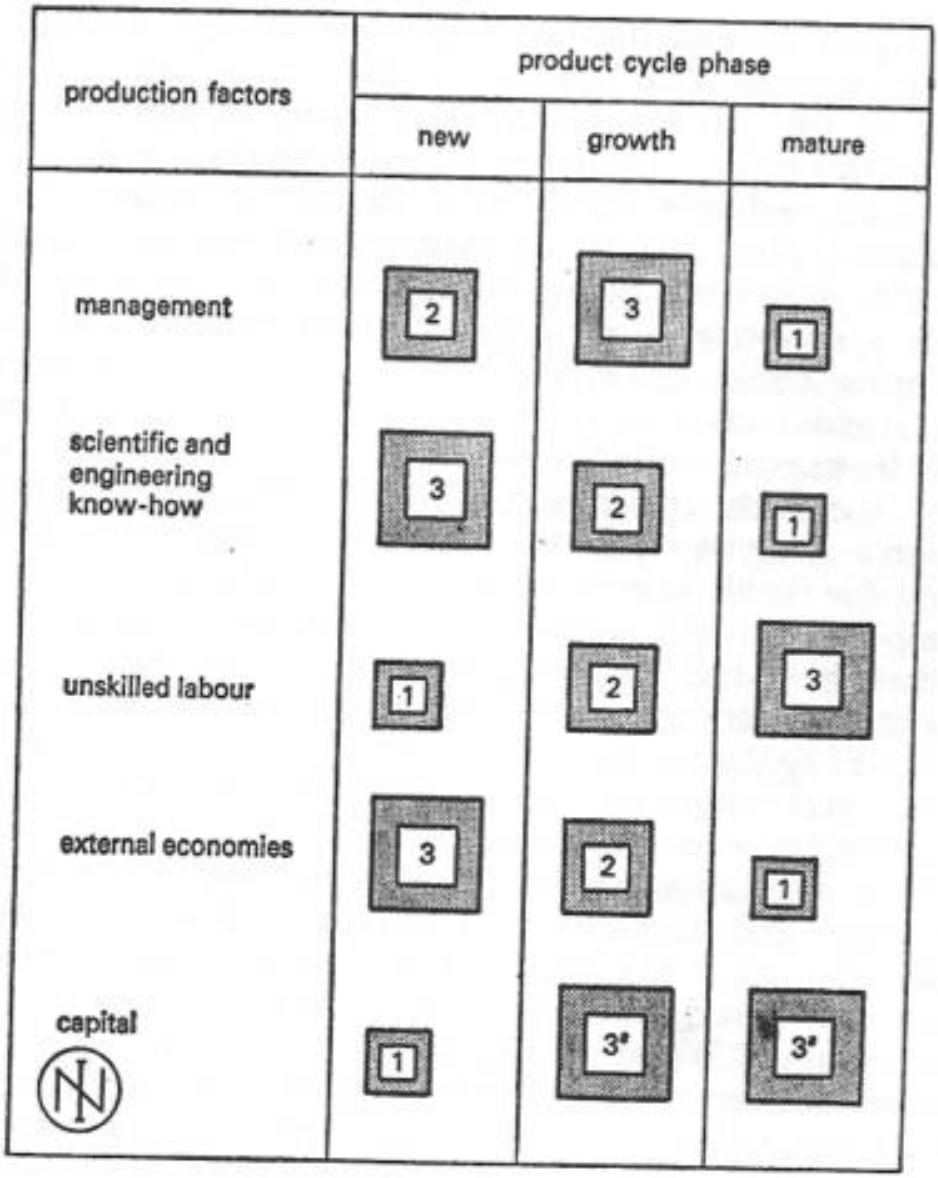
Appendix A; Source: Freeman, Chris; Soete, Luc; The economics of industrial innovation, 1997

Successive waves of technical change

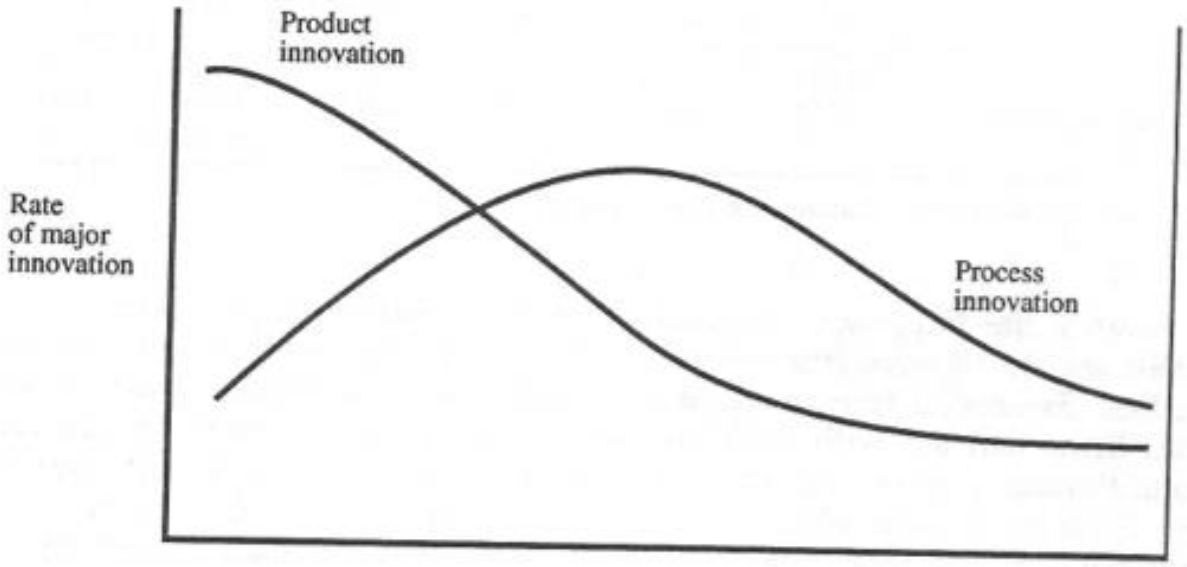
Long waves or cycles			*Key features of dominant infrastructure*		
Approx. timing	*Kondratieff waves*	*Science technology education and training*	*Transport communication*	*Energy systems*	*Universal and cheap key factors*
First 1780s–1840s	Industrial revolution: factory production for textiles	Apprenticeship, learning by doing, dissenting academies, scientific societies	Canals, carriage roads	Water power	Cotton
Second 1840s–1890s	Age of steam power and railways	Professional mechanical and civil engineers, institutes of technology, mass primary education	Railways (iron), telegraph	Steam power	Coal, iron
Third 1890s–1940s	Age of electricity and steel	Industrial RD labs, chemicals and electrical, national laboratories, Standards laboratories	Railways (steel), telephone	Electricity	Steel
Fourth 1940s–1990s	Age of mass production ('Fordism') of automobiles and synthetic materials	Large-scale industrial and government RD, mass higher education	Motor highways, radio and TV, airlines	Oil	Oil, plastics
Fifth 1990s–?	Age of microelectronics and computer networks	Data networks, RD global networks, lifetime education and training	Information highways, digital networks	Gas/oil	Microelectronics

Appendix B; Source: Freeman, Chris; Soete, Luc; The economics of industrial innovation, 1997

INNOVATION AND THE STRATEGY OF THE FIRM



Appendix C; Source: Freeman, Chris; Soete, Luc; The economics of industrial innovation, 1997



Appendix D; Source: Freeman, Chris; Soete, Luc; The economics of industrial innovation, 1997

Strategies of the firm

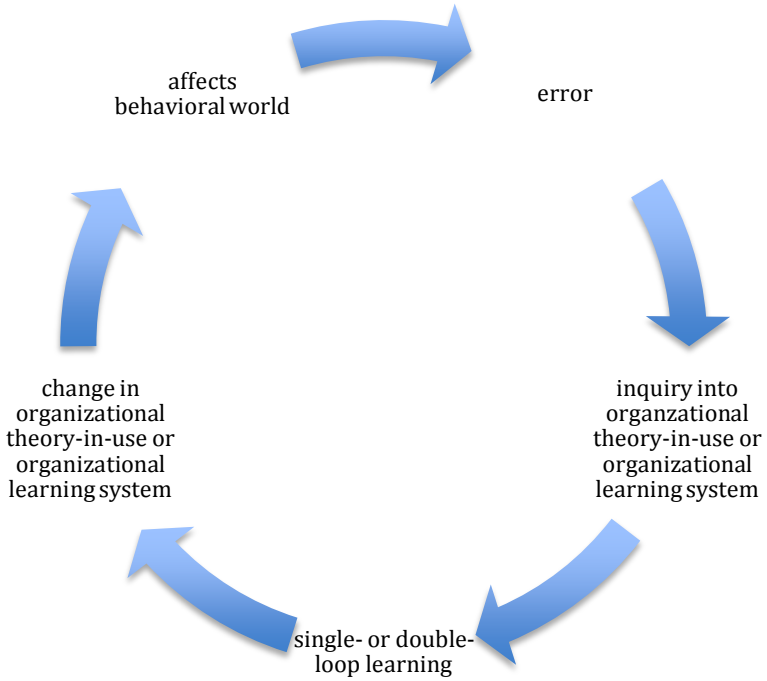
Strategy	*In-house scientific and technical functions within the firm*									
	Fundamental research	*Applied research*	*Experimental development*	*Design engineering*	*Production engineering quality control*	*Technical services*	*Patents*	*Scientific and technical information*	*Education and training*	*Long-range forecasting and product planning*
Offensive	4	5	5	5	4	5	5	4	5	5
Defensive	2	3	5	5	4	4	4	5	4	4
Imitative	1	2	3	4	5	3	2	5	3	3
Dependent	1	1	2	3	5	2	1	3	3	2
Traditional	1	1	1	1	5	1	1	1	1	1
Opportunist	1	1	1	1	1	2	1	5	1	5

Range 1–5 indicates weak (or non-existent) to very strong.

Appendix E; Source:personal, constructed in excel

	Inquiry into a theory-in-use	**Inquiry into the inquiry process (organizational learning system)**
Single-loop	Single-loop learning	Deutero learning
Double-loop	Double-loop learning	Deutero learning

Appendix F; Source: personal, constructed in word



Appendix G; Source: based on; Argyris, Chris; Schön, Donald A. Organizational learning II: Theory, method, and practice, 1996

Model I theory-in-use

Values	Action strategies	Consequences for behavioral world	Consequences for learning
Define and achieve goals	Design and manage environment unilaterally	Defensive, inconsistent, incongruent, controlling, fearful of being vulnerable etc.	Self-sealing and decreased long-term effectiveness
Maximize winning and minimize losing	Own and control the task	Defensive interpersonal and group relationship	Single-loop learning
Minimize generation and expression of negative feelings	Unilaterally protect yourself by being blind to impact on others, use of little observable data etc.	Defensive norms such as mistrust, lack or risk taking, conformity etc.	Little testing of theories in publicly and much testing of theories privately
Be rational	Unilaterally protect others from being hurt by withholding information, creating rules etc.		

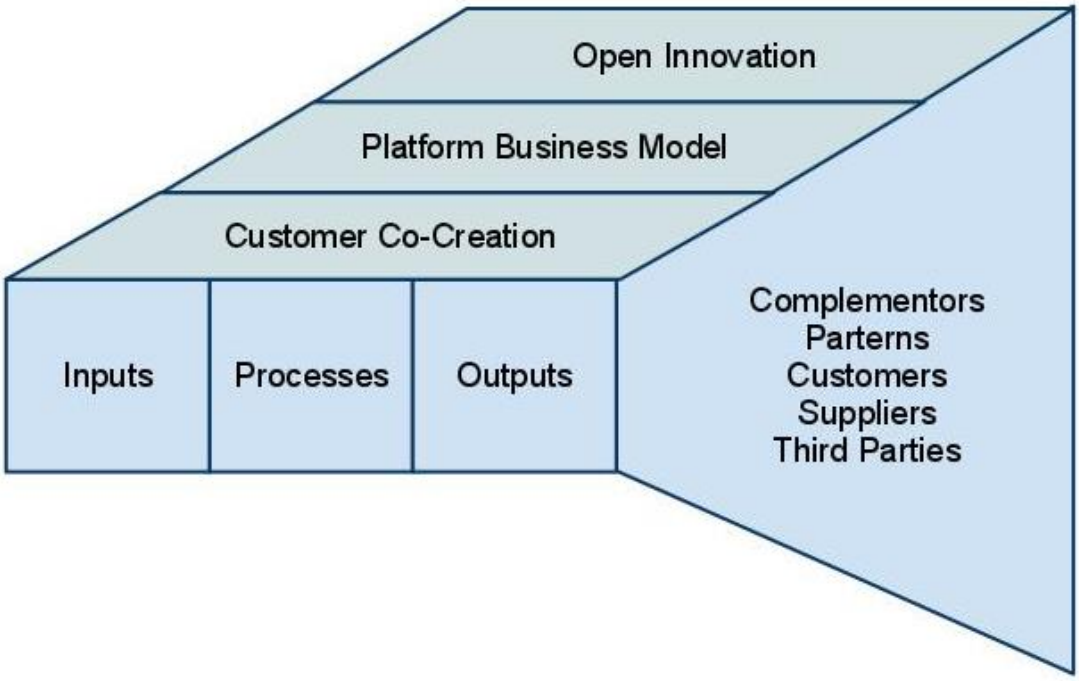
Appendix H; Source: based on; Argyris, Chris; Schön, Donald A. Organizational learning II: Theory, method, and practice, 1996

Model 2 theory-in-use:

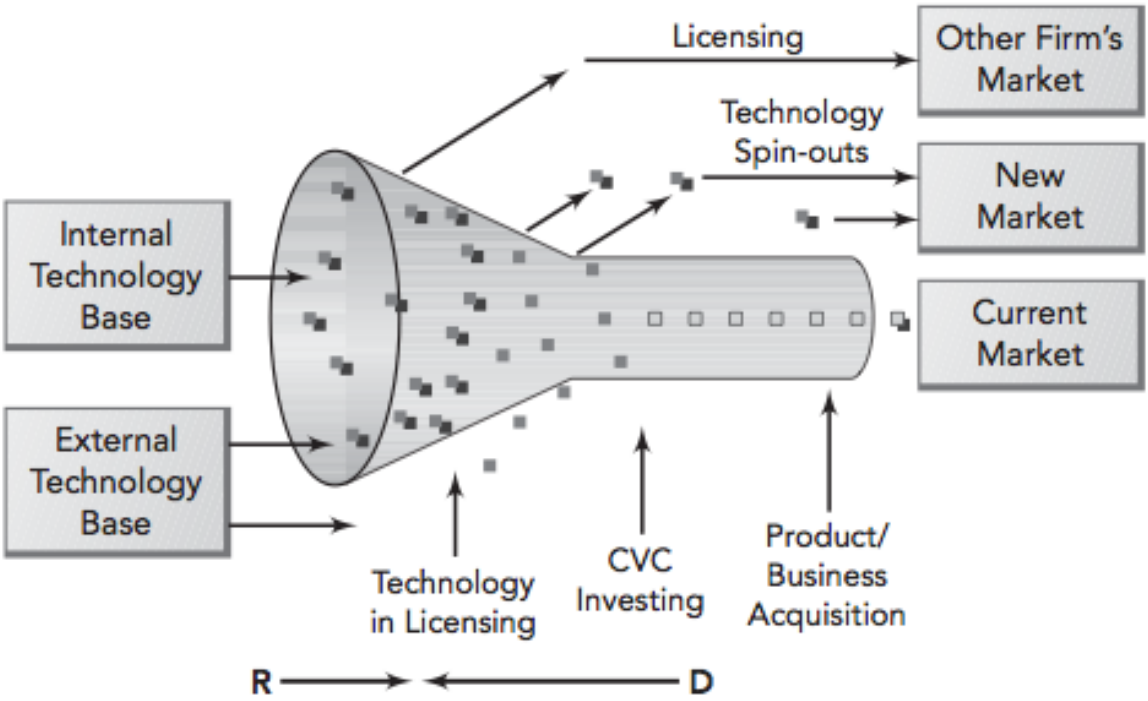
Values	Action strategies	Consequences for behavioral world	Consequences for learning
Valid information	Design situations where participants can be origins of action and experience high personal causation	Actor experienced as minimally defensive	Disconfirmable processes
Free and informed choice	Task is jointly controlled	Minimally defensive interpersonal relations and group dynamics	Double-loop learning
Internal commitment to the choice and constant monitoring of its implementation	Protection of self is a joint enterprise and oriented toward growth	Learning-oriented norms	Frequent public testing
	Bilateral protection of others	High freedom of choice, internal commitment, and risk taking	

Appendix I; Source: Google

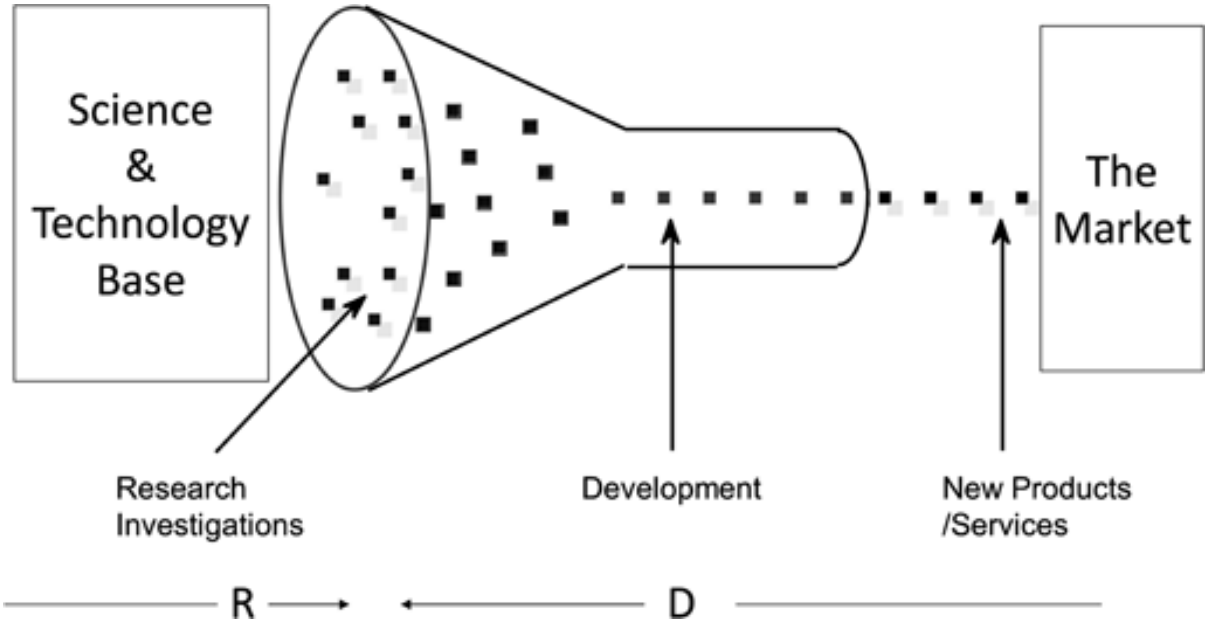
Appendix J; Source: Chesbrough, Henry; Open services innovation: Rethinking your business to grow and compete in a new era, 2011



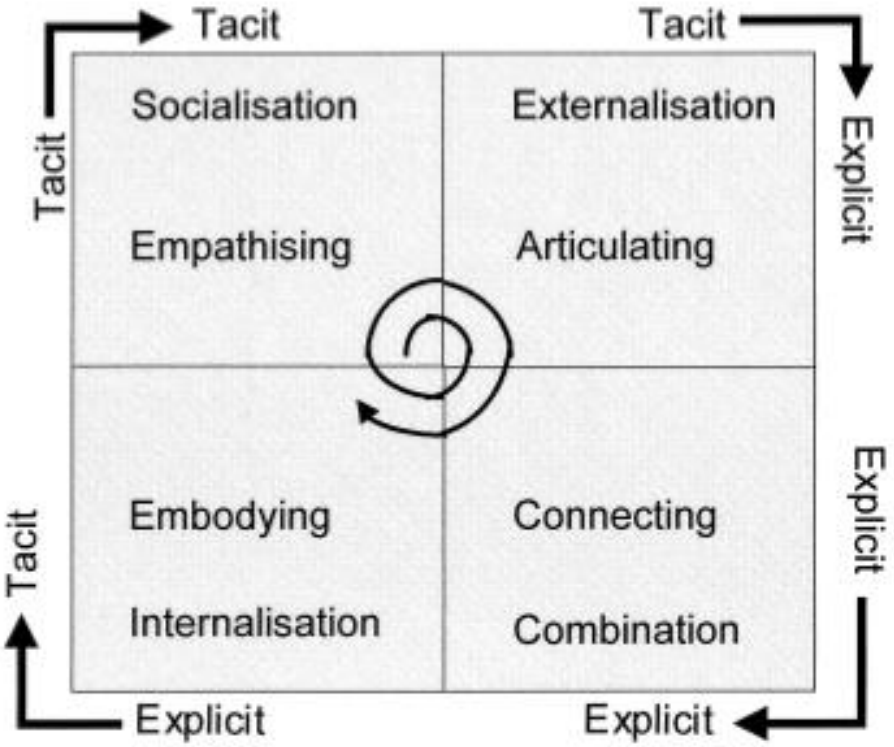
Appendix K; Source: Chesbrough, Henry; Open services innovation: Rethinking your business to grow and compete in a new era, 2011



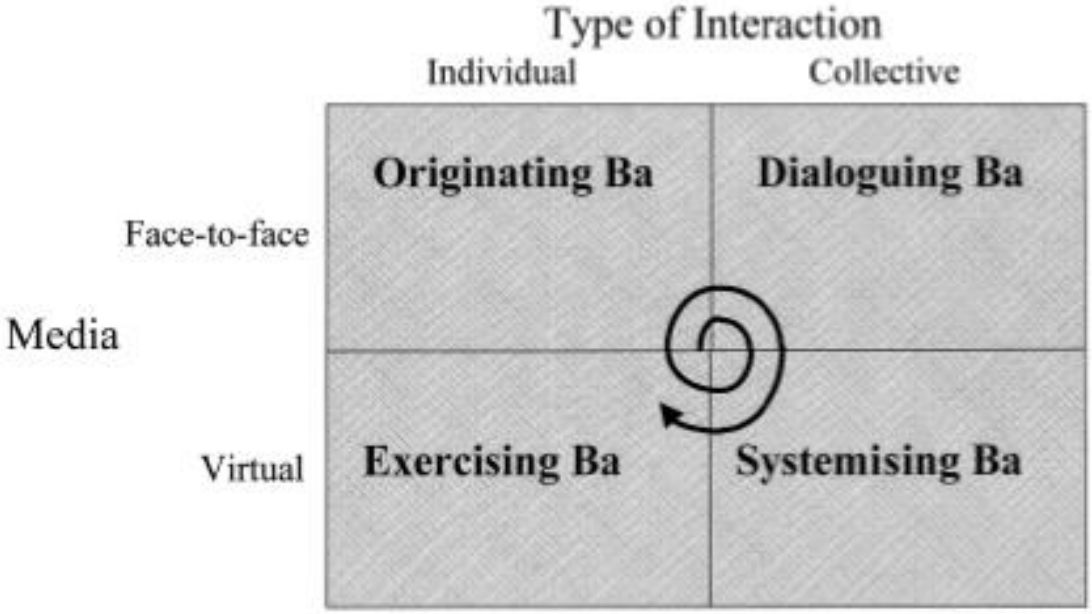
Appendix L; Source: Chesbrough, Henry; Open services innovation: Rethinking your business to grow and compete in a new era, 2011



Appendix M; Source: Nonaka, Ikurijo; Toyama, Ryoko; Konno, Noboru, SECI, Ba and leadership: A unified model of dynamic knowledge creation, 2000



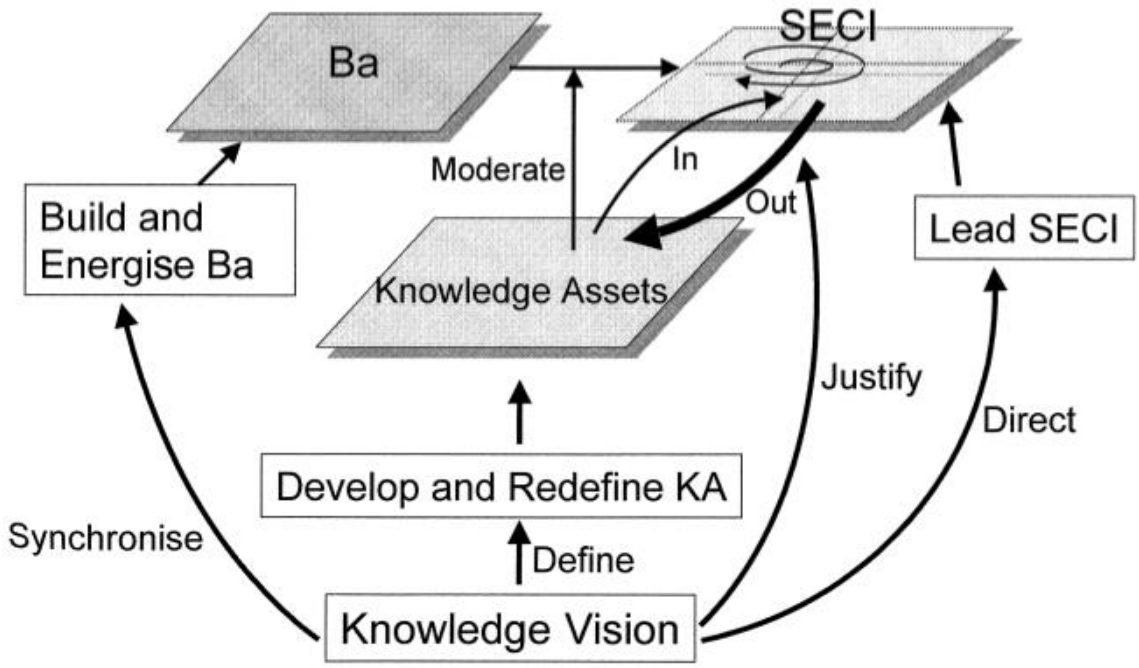
Appendix N; Source: Nonaka, Ikurijo; Toyama, Ryoko; Konno, Noboru, SECI, Ba and leadership: A unified model of dynamic knowledge creation, 2000



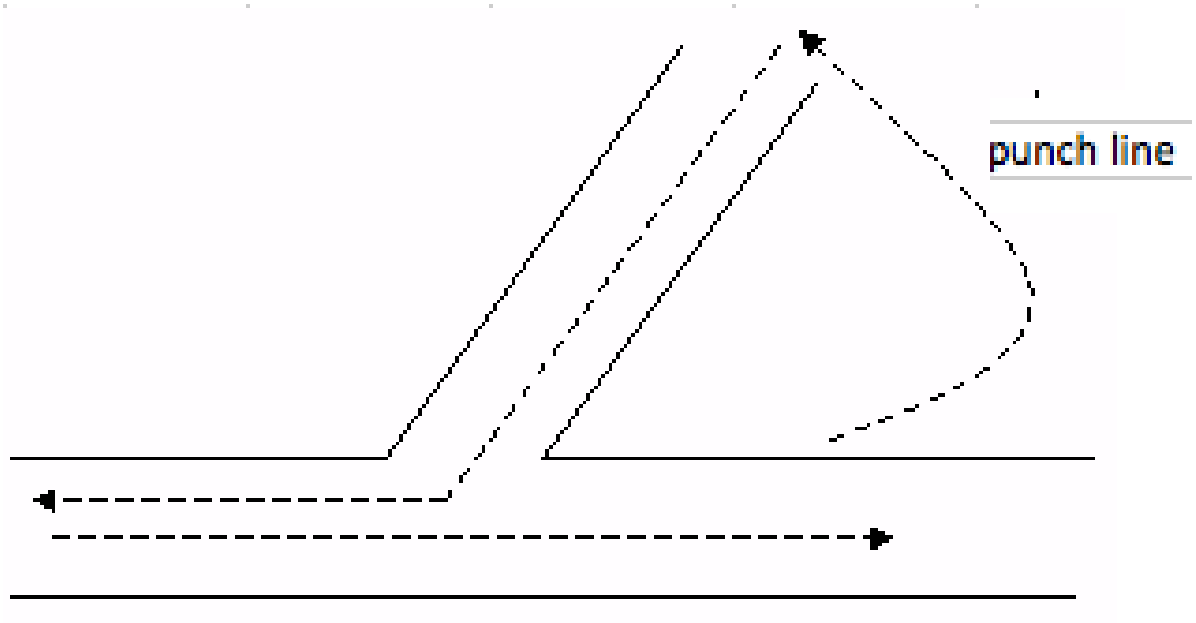
Appendix O; Source: Nonaka, Ikurijo; Toyama, Ryoko; Konno, Noboru, SECI, Ba and leadership: A unified model of dynamic knowledge creation, 2000

Experiential Knowledge Assets Tacit knowledge shared through common experiences • Skills and know-how of individuals • Care, love, trust, and security • Energy, passion, and tension	**Conceptual Knowledge Assets** Explicit knowledge articulated through images, symbols, and language • Product concepts • Design • Brand equity
Routine Knowledge Assets Tacit knowledge routinised and embedded in actions and practices • Know-how in daily operations • Organisational routines • Organisational culture	**Systemic Knowledge Assets** Systemised and packaged explicit knowledge • Documents, specifications, manuals • Database • Patents and licenses

Appendix P; Source: Nonaka, Ikurijo; Toyama, Ryoko; Konno, Noboru, SECI, Ba and leadership: A unified model of dynamic knowledge creation, 2000



Appendix Q; Source: deBono, Edward: Serious creativity: Using the power of lateral thinking to create new ideas, 1996



Appendix R; Source: based on deBono, Edward: Serious creativity: Using the power of lateral thinking to create new ideas, 1996

Stage 1, Focus

- Identifying and clarifying the focus
- Information input, if required
- Alternative phrasing and definition of the focus
- Choosing subfocuses for later use

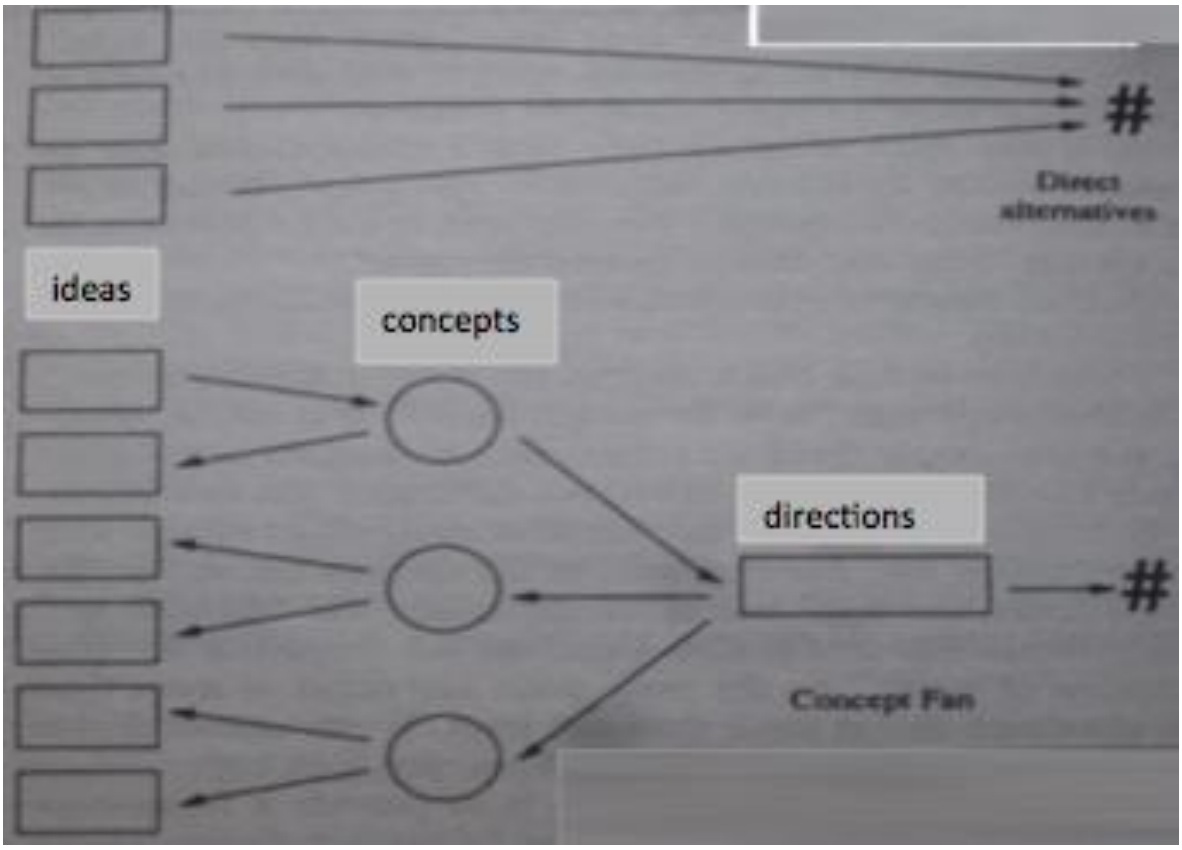
Stage 2, Technique

- Choice of one or more techniques
- Setting up the techniques
- Use of the techniques

Stage 3, Output

- Extracting concepts
- Working with concepts
- Harvesting
- Treatment of ideas
- Formal output

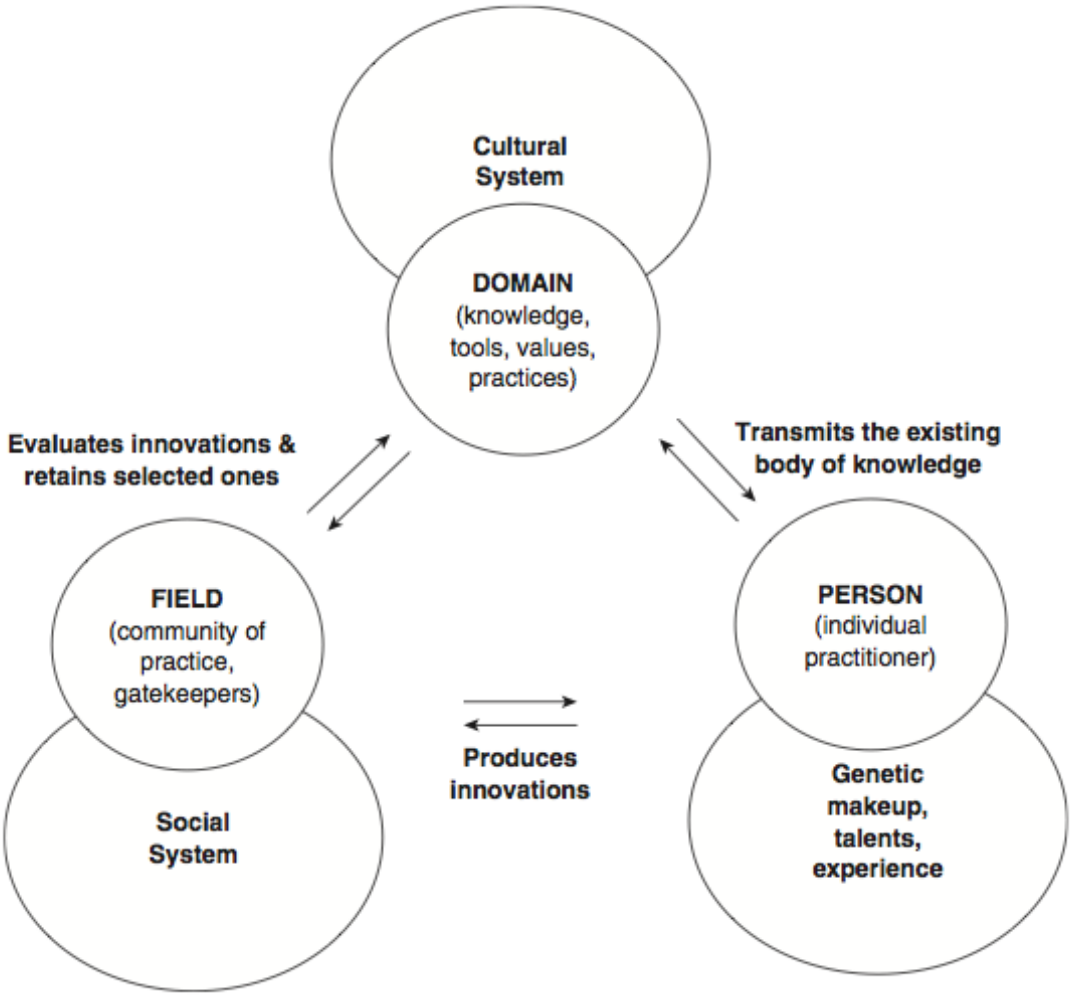
Appendix S; Source: deBono, Edward: Serious creativity: Using the power of lateral thinking to create new ideas, 1996



Appendix T; Source: deBono, Edward: Serious creativity: Using the power of lateral thinking to create new ideas, 1996

Hypothesis:	**Provocation:**
Tries to be reasonable	Tries to be unreasonable
Seeks to reach, justify and prove a hypothesis	Never seeks to reach, justify and prove a provocation
Concerned with a truth	Concerned with getting ideas
Seeks to guide our perception in a certain direction	Seeks to take our perception away from the usual directions

Appendix U; Source: Csikszentmihalyi, Mihaly: Creative management and development, 2006



Appendix V; Source: personal, based on: Ward, Thomas B.; Finke, Ronald A.; Smith, Steven M. Creativity and the mind: Discovering the genius within, 1995

	Generation	**Exploration**
Problem solving	generate solutions	test solutions
Creative play	generate preinventive forms	inteprete preinventive forms

Appendix X; Source: personal, based on: Ward, Thomas B.; Finke, Ronald A.; Smith, Steven M. Creativity and the mind: Discovering the genius within, 1995

Identify goals of problems
• Abstraction
Generate: To meet these goals with solutions
• Analogy • Conceptual combination • Mental synthesis
Explore
• Mental models and visualization
Incubation and illumination

Appendix Y; Source: based on: Pirsig, Robert M.: Zen and the art of motorcycle maintenance: An inquiry into values, 1974.