Stam, C. (2010), Making sense of Knowledge Productivity, In: Rodriguez-Castellanos, A., Vallejo-Alonso, B. and Arregui-Ayastuy, G. (2010) Identifying, Measuring, and Valuing Knowledge-Based Intangible Assets: New Perspectives. IGI Global.

Making sense of knowledge productivity

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ABSTRACT

In the knowledge economy knowledge productivity is the main source of competitive advantage and thus the biggest management challenge. Based on a review of the concept from two distinct perspectives, knowledge productivity is defined as *the process of knowledge-creation that leads to incremental and radical innovation*. The two main elements in this definition are 'the process of knowledge creation' and 'incremental and radical innovation'.
The main aim of this chapter is to contribute to a better understanding of the concept of knowledge productivity in order to support management in designing policies for knowledge productivity enhancement. After elaborating on the concept of knowledge productivity, the two main elements are combined in a conceptual framework – the knowledge productivity flywheel. This framework appeared to be an effective model for supporting initiatives that aim for enhancing knowledge productivity.

INTRODUCTION

Our economy has changed from an industrial into a knowledge economy (Drucker, 1993; Toffler, 1981), in which the competitive advantage of organizations is based on the ability to exploit knowledge resources. The increased importance of knowledge as an economic resource has been reviewed from many perspectives, resulting in slightly different denotations, each usually emphasizing a different but related aspect of the same phenomenon. Some examples of this are the "knowledge society" (Toffler, 1981), "knowhow society" (Sveiby & Lloyd, 1988), "information society" (Giddens, 1994), "information economy" (Shapiro & Varian, 2003), "learning society", "learning economy" (Harrison & Kessels, 2004), "network society" (Castells, 1996), "intangible economy" (Andriessen, 2004) and the "creative economy" (Florida, 2002). Within the different denotations of the new reality, we see that authors are either referring to society as a whole, or to the economy. However, as Jacobs (1999) argues, the term knowledge society is a tautology – a needless repetition – as society and mankind have always been dependent on the interpretation of knowledge. Yet, the knowledge *economy*, in which knowledge has become the main factor of competitive advantage, is a new phenomenon. The transition to the knowledge economy is about the increase in scale of knowledge as a production factor. Knowledge is not a new production factor, but the relative importance of knowledge, related to land, labour and capital, has substantially increased during the past few decades (Castells, 1996; Weggeman, 2000). In line with this reasoning, Stewart reminds us that, "not for nothing are we *homo sapiens*, thinking man" (Stewart, 1997, p.5, italics in original).
Inspired by Stewart (2002) and Drucker (1999), the essence of the knowledge economy can be summarized in three characteristics. First, in the knowledge economy, knowledge is what we buy, sell, and do. Second, intellectual capital (IC) is the new wealth. Third, knowledge productivity (KP) is the biggest challenge (Stam, 2007). Whereas the first and second characteristic of the knowledge economy are extensively elaborated on, the third remains relatively unexplored. If we accept as true that knowledge productivity is the main source of competitive advantage and the biggest management challenge in the knowledge economy (Drucker, 1999), this might threaten organizational effectiveness. Therefore, the aim of this chapter is to contribute to a better understanding of the

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concept of knowledge productivity in order to increase management effectiveness to develop policies that aim at enhancing knowledge productivity. This chapter is based on the findings in a case-based research related to knowledge productivity (Stam, 2007).

KNOWLEDGE PRODUCTIVITY IS…

Although KP is a relatively new concept, the combination of the concepts of *knowledge* and *productivity* is not new. The awareness that knowledge and productivity are closely related already goes back for many decades. Some would argue that it goes back for several centuries (Warsh, 2006). In a sense, the importance of knowledge as an economic factor has always been the core of the economic sciences. The famous story about the pin factory in The Wealth of Nations (Smith, 2000, original publication 1776), already stressed the importance of knowledge accumulation (through specialization). However, as mathematics started to dominate the economic sciences, and as knowledge was hard to quantify, knowledge was long considered to be a *side-effect*, a *spill-over*, or *residual*. The acknowledgement of knowledge as an important wealth creating factor, has been an "underground river" that came to the surface every now and then, but only recently started to get accepted in mainstream economics and management sciences (Warsh, 2006).
In a sense, it was in *The production and distribution of knowledge in the United States* that Machlup (1972, original publication in 1962) rediscovered the importance of knowledge as a product. In his recalculation of the national product of the United States, Machlup discovered that "total knowledge production in 1958 already accounted for almost 29 per cent of adjusted GNP" (p.362). In addition, the "knowledge-industry" was not only the largest industry, but also grew faster than the traditional industries. These conclusions led to the observation that there should be some relationship between knowledge, value creation and economic growth.
It was Drucker (1981; 1993) who realized that the increased importance of knowledge as a source of production, had to be followed by a revision of the concept of productivity. As he realized that not only the main source of production (knowledge), but also the tools of production (brains) are owned by the employees, he concluded that the biggest challenge in the knowledge economy was the productivity of the knowledge worker. Therefore, he proclaimed knowledge-worker productivity to be the biggest of the 21st-century management challenges.

> *The most important, and indeed the truly unique, contribution of management in the 20th century was the fifty-fold increase in the productivity of the manual worker in manufacturing. The most important contribution management needs to make in the 21st century is similarly to increase the productivity of knowledge work and knowledge workers. The most valuable assets of a 20th-century company was its production equipment. The most valuable asset of a 21st-century institution (whether business or non-business) will be its knowledge workers and their productivity.* (Drucker, 1999, p.79)

In *The post-capitalist society*, Drucker (1993) stressed the importance of the development of a new economic theory that puts knowledge in the centre of the wealth creating process. In *Knowledge worker productivity: The biggest challenge* (Drucker, 1999) he elaborates on this new economic theory and describes a set of management guidelines for knowledge-worker productivity. According to Drucker, knowledge-worker productivity is primarily a management responsibility and it is "the biggest of the 21st-century management challenges" (Drucker, 1999, p.92).

The two interpretations of the concepts of knowledge related to productivity by Machlup and Drucker illustrate the two main approaches of the concept of knowledge productivity. Whereas Machlup, based on economic theories, interpreted knowledge productivity as a result, Drucker, based on management theories, interpreted knowledge productivity as an organizational ability. Whereas Machlup predominantly aims at explaining, Drucker predominantly aims at improving the knowledge-based production process. Similarly, in recent literature we see two different interpretations of the concept of knowledge productivity (Figure 1), of which one uses *knowledge* as a starting point, whereas the other uses *productivity* as a starting point (Stam, Evers, Leenheers, De Man, & Van der Spek, 2004).

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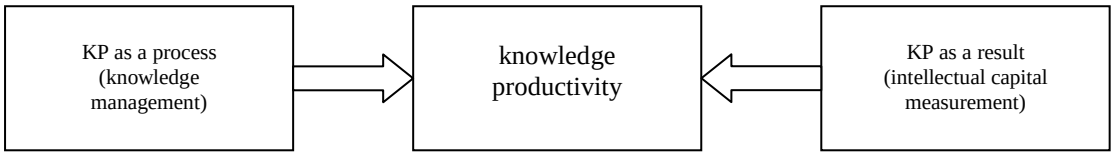

Figure 1: Two perspectives on knowledge productivity (KP)

Although distinct approaches, they are related in the sense that they both search for more appropriate instruments to reveal and improve knowledge-related performance. The main concern of the first approach is to identify the sources, or conditions for knowledge productivity. The hypothesis is that improvement of the conditions will obviously lead to better performance. The concepts of knowledge management (Nonaka & Takeuchi, 1995; Weggeman, 1997), the Corporate Curriculum (Kessels, 1996; Van Lakerveld, 2005), and knowledge productivity (Kessels, 2001), are examples of this first approach in the sense that they present theories and methods to improve the conditions for knowledge creation. Core to the second approach is the quest for indicators that can measure and value the output of knowledge-based work. The hypothesis is that these measures will lead the way towards improving conditions. Some examples of this approach are intellectual capital measurement (Andriessen, 2004; Edvinsson & Malone, 1997; Stewart, 1997; Sveiby, 1997) and the productivity of knowledge as interpreted by Zegveld et al. (2000; 2002; 2007; 2004) in the sense that they provide methods to calculate knowledge-based performance. Considering the nature of these two approaches to the concept of knowledge productivity, the first approach, aiming at improving the process of knowledge creation, is labeled knowledge management. The second approach, aiming at measuring the effects of the knowledge creation process, is labeled intellectual capital measurement. Both knowledge management and intellectual capital measurement aim at improving knowledge-based performance or knowledge productivity. Furthermore, both knowledge management and intellectual capital measurement can enhance each other in the sense that increased awareness about the knowledge-based performance will improve the ability to develop policies for improvement (Bontis, 2002; Marr, Gupta, Pike, & Roos, 2003; Mouritsen, Bukh, Larsen, & Johansen, 2002; Roos, Roos, Dragonetti, & Edvinsson, 1997; Stam et al., 2004; Wiig, 1997).
Based on a review from both the perspective of knowledge management and the perspective of intellectual capital measurement, knowledge productivity is defined as *the process of knowledge-creation that leads to incremental and radical innovation* (Stam, 2007). The two main elements in this definition are 'the process of knowledge creation' and 'incremental and radical innovation'. These two elements are inherently bound together, because innovation (new knowledge) is the unavoidable result of the process of knowledge creation (Nonaka & Takeuchi, 1995).
In both knowledge management and intellectual capital literature the concepts of "learning" and "knowledge creation" are frequently used interchangeably. Although both concepts refer to the process in which knowledge is developed, the concept of knowledge creation was chosen because it gives better expression to the combination of organizational knowledge processes as defined in the KM literature. Similarly, the concepts of "innovation" and "knowledge" are frequently used interchangeably. Although both concepts refer to the result of the knowledge creation process, the concept of innovation was chosen, because it better expresses the results of the knowledge creation process at an organizational level. In this sense we can make a distinction between knowledge as a personal ability to perform a task, and innovation as an organizational ability to create value. The following sections further elaborate on the two main elements of the above definition of knowledge productivity.

…THE PROCESS OF KNOWLEDGE CREATION…

Closely related to Drucker (1993), Kessels (1996; 2001) introduced the concept *knowledge productivity*. "Knowledge productivity concerns the way in which individuals, teams and units across an organization achieve knowledge-based improvements and innovations" (Harrison & Kessels, 2004,

p.145). Whereas Drucker (1999) interpreted knowledge worker productivity as a management challenge, Kessels puts the individual in the centre of his theory. The assumptions of Kessels' work are that:

> *The character of labour is changing: routine work is more and more taken over by machines and computers. The work that remains requires independent decision-making and creative thinking; the physical activities of employees are being replaced by mental and social activities. In the economic context the value added to products and services is mainly due to the capability of applying knowledge. Constant incremental improvement and radical innovation are becoming critical in the endeavour of staying ahead or keeping up with competitors.*
> *As this change of the character of labour takes place, it is inevitable that the workplace turns into a learning environment. New work is to be described in terms of learning and work processes take the characteristics of learning processes. This implies not only to managerial work, but also to almost all work of every individual in the company. This transition is not only dependent on theoretical knowledge and formal schooling, but it is also based on adequate day-to-day learning in the social work environment. The conditions for good work become similar to the conditions for good learning.* (Kessels & Van der Werff, 2002, p.20)

As a consequence knowledge productivity requires a good learning environment. In order to help organizations improve their knowledge productivity, Kessels introduced the *Corporate Curriculum*: "the plan for learning to increase knowledge productivity, leading to constant improvement and radical innovation, and ultimately to economic advantage" (Kessels & Van der Werff, 2002, p.23). The Corporate Curriculum consists of all the intended and unintended conditions that affect the learning processes among workers in organizations (Van Lakerveld, Van den Berg, de Brabander, & Kessels, 2000) and identifies seven critical *learning functions* (Kessels, 1996). These learning functions are critical in the sense that their quality determines the effectiveness of the process of knowledge creation.

Learning function 1: Subject matter expertise

The first learning function has been defined as acquiring *subject matter expertise* and professional knowledge directly related to the organization's business and core competencies (Kessels, 1996; Keursten, Verdonschot, Kessels, & Kwakman, 2006). In a sense, the first learning function covers the main part of the concept of knowledge management (Davenport & Prusak, 1998; Nonaka & Takeuchi, 1995; Stam, 2004; Weggeman, 1997). Subject matter expertise stresses the importance of "strategic grounding" (Stam, 2004) as it is about knowledge which is directly related to the main work processes and work-related objectives (Keursten, 2001; Keursten et al., 2006; Van Lakerveld, 2005). Furthermore, subject matter expertise is both about tacit and explicit knowledge (Kessels, 2002; Polanyi, 1974), and it is about the way knowledge is developed, shared and codified throughout the organization (Kessels & Keursten, 2001; Keursten, 2001). Subject matter expertise refers to the strategic grounding and processing of knowledge and therefore asks for knowledge-based strategies and the support of the knowledge processes.

Learning function 2: Solving problems

The second learning function has been defined as learning to identify and deal with new problems using the acquired subject matter expertise (Kessels, 1996; Keursten et al., 2006). From a knowledge management perspective, solving problems refers to the process of applying (Davenport & Prusak, 1998; Weggeman, 1997), combining (Nonaka & Takeuchi, 1995; Van der Spek & Spijkervet, 1994) or exploiting (Sprenger, van Eijsden, ten Have, & Ossel, 1995) knowledge. Within these processes, which are at the "end" of the knowledge value chain, knowledge is put into use, or in other words "made productive". In this respect, all other knowledge processes support this second learning function.
The distinguishing characteristic of this learning function is that it stresses the gap between existing subject-matter expertise (as a result of the first learning function) and the knowledge that is needed in order to find solutions for new challenges. Solving problems is the competency with which this gap

can be closed. However, the gap will never be closed entirely. New situations always require new interpretations of existing knowledge, therefore the need for the ability to solve problems will remain. Solving problems is a personal capacity and cannot be separated from its context (Sveiby, 1997). If the context is complex and dynamic, the professional's work should be based on a body of knowledge which has to be interpreted and applied depending on the specific circumstances (Weggeman, 1997). Solving problems refers to the ability to renew and stretch expertise and therefore asks for creativity and room for experimenting with new ways of working.

Learning function 3: Reflective skills and meta-cognitions

The third learning function has been defined as cultivating reflective skills and meta-cognitions to find ways to locate, acquire and apply new knowledge (Kessels, 1996; Keursten et al., 2006). The main message of this learning function is that we should not only learn how to develop, share and apply knowledge (first two learning functions), but also reflect on the effectiveness of these processes (Kessels & Keursten, 2001). Meta-learning reflects an organisation's attempts to learn about (and improve) its ability to learn (Argyris & Schön, 1978). The main questions related to this learning function are: Why are we good in solving problem A, and why is it that we do not know how to handle problem B? What can we learn from our experiences and can we do it better? Reflective skills are necessary in order to learn from past processes (Van Lakerveld, 2005). This learning function enables organizations, teams and individuals to manage their own learning processes. "How can we improve our ability to develop, share and utilise knowledge in the workplace, and help others to do so" (Harrison & Kessels, 2004, p.156). From a knowledge management perspective, this learning function refers to the process of evaluation (Stam, 2004; Weggeman, 1997). In addition, this process makes the connection to the concept of the learning organization (Senge, 1992). Reflection stresses the idea that the output of the process also serves as input for a new (production) cycle (Nonaka & Takeuchi, 1995; Zack, 1998). Reflective skills are of vital importance for the development of meta-cognitions. Important preconditions for the development of reflective skills are open communication, constructive feedback and creating time and space to look backward (Kessels & Keursten, 2001).

Learning function 4: Communication skills

The fourth learning function of the Corporate Curriculum has been described as acquiring communicative and social skills that help people access the knowledge network of others, participate in communities of practice and make learning at the workplace more productive (Kessels, 1996; Keursten et al., 2006). Communication skills stresses that knowledge is processed through people. More and more research is being done to identify the critical skills of the knowledge worker (A. Abell & Ward, 2000; Sprenger et al., 1995; Tissen, Andriessen, & Lekanne Deprez, 1998). Some important skills are the ability to communicate and collaborate, as it is through communication and collaboration that knowledge is developed and shared. Another aspect of this learning function is the extent to which the environment supports knowledge sharing. From a knowledge management perspective, this aspect refers to the preconditions for knowledge management in terms of structure and culture, as these aspects have an important impact on the knowledge processes and the knowledge friendliness of the company (Stam, 2004; Weggeman, 1997). Communication skills refers to the ability to communicate and collaborate and the knowledge friendliness of the organization in terms of structure and culture.

Learning function 5: Self-regulation of motivation

This fifth learning function has been defined as acquiring skills to regulate motivation, affinities, emotions and affections concerning working and learning (Kessels, 1996; Keursten et al., 2006). This learning function, also at the heart of the Corporate Curriculum, is the most implicit learning function (Keursten et al., 2006) and refers to the importance for knowledge workers to identify personal themes and ways to develop these. It is about skills that give meaning to learning and enhance commitment (Kessels, 1996), because "in a knowledge economy it is useless when a manager says: Be smarter, or show more creativity! Being smart and creative depend heavily on personal interest" (Kessels & Van der Werff, 2002, p.22). People are only smart if they want to be (Harrison & Kessels, 2004). Personal interest is closely related to the process of inspiration, passion or motivation and sense-making

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(Leenheers, 2004). In their reconstruction study, Keursten et al. (2004) conclude that "personal motivation and affinity with a particular topic was the driving force behind innovations and improvements" (p.167, translation CS). A positive correlation has been found between attention to intrinsic motivation and the performance of individuals in the learning process (Van Lakerveld, 2005; Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004). Self-regulation of motivation puts the locus-of-control with the individual, because it implies that the extent to which organisational objectives are achieved, heavily depends on personal entrepreneurship. "A personal entrepreneur works from an intrinsic passion and primarily strives for personal interest. He has the ability to organize his work in such a way that it suits his personal preferences. He sees himself as a firm, although he is an employee" (Rondeel & Wagenaar, 2002, p.123, translation CS). Although motivation cannot be "managed" in the sense that it can be controlled, it can be supported by providing space for personal entrepreneurship.

Learning function 6: Peace and stability

The sixth learning function has been described as promoting *peace and stability* to enable exploration, coherence, synergy, and integration (Kessels, 1996; Keursten et al., 2006). This learning function refers to the need for incremental improvements through further specialization (Ansoff & Sullivan, 1993; Harrison & Kessels, 2004). Peace and stability gives employees the opportunity to explore existing knowledge and search for possibilities to apply this knowledge into their daily practice. Peace and stability also refers to the need for time for reflection, learning and knowledge sharing. Time and peace provide the opportunity to reflect on the efficiency and effectiveness of processes, products and services. Peace and stability provides a context in which people can experiment, without direct consequences. Peace and stability provides the certainty and the time which is necessary for specialization and improvement (Van Lakerveld, 2005).
From a knowledge management point of view, this learning function refers to the organizational need for a certain degree of redundancy in creating knowledge. Redundancy means that the knowledge level within the organization exceeds the minimum level of knowledge needed to perform the necessary tasks (Nonaka & Takeuchi, 1995). "Lack of redundancy and time to reflect exploit existing (intellectual) resources, and consume these without generating new knowledge. Lack of peace and stability results in impoverishment of intellectual assets" (Kessels & Van der Werff, 2002, pp.22-23). However, the drawback of this learning function is that "too much peace and stability might bring about overly one-sided specialization and an excessive internal focus" (Kessels, 2001; Keursten et al., 2006). In this sense, Sveiby (1997) argued that stability should be seen as a counter balance of growth and renewal.
Peace and stability is an important precondition for knowledge productivity in general and incremental innovation in particular. Important elements of this learning function are specialization, time to reflect and redundancy.

Learning function 7: Creative turmoil

The seventh learning function has been described as causing creative turmoil, which leads to radical innovation (Kessels, 1996; Keursten et al., 2006). Creative turmoil refers to the need for creativity as a driver of innovation and improvement (Shapero, 1985). The cause of the turmoil is often "an existential threat: a matter of winning or losing, surviving or going under, being in or out of the game" (Harrison, 2004, p.156). Although Van Lakerveld (2005) found a positive relationship between work-pressure and learning, not all pressure is creative turmoil. Creative turmoil is mainly recognized by pressure which is caused by "the importance that is attached to the outcome of the process or because people themselves feel a strong urge to solve a particular problem" (Keursten et al., 2004, p.168). Although described variously, many authors refer to the need for creative turmoil when they stress the necessity of a certain degree of "strategic ambiguity" (Nonaka & Takeuchi, 1995), "strategic imbalance" (Itami, 1991), "strategic distance" (Senge, 1992), "strategic confusion" (Stacey, 1995) or "strategic disorder" (Levy, 1994). According to Senge (1992) distance between vision and reality is the source of creative tension as distance makes it necessary to take action in order to come closer to the objective. Similar reasoning can be found in Itami (1991) and Nonaka and Takeuchi (1995). A

certain degree of chaos, disorder or even failure may prevent complacency, and could stimulate organizations to stretch beyond their strategic focus. Creative chaos can stimulate individuals to fundamentally change their ways of thinking and create new knowledge.
Keursten et al. (2006) argue that external pressure is important to make a difference in daily work. However, not all unrest is creative turmoil and too much creative turmoil may yield many new ideas but leaves little opportunity to elaborate on them, thus limiting innovation. Creative turmoil without the time to reflect will lead to "destructive chaos" (Schon, 1983). This implies that the sixth and the seventh learning function should be in balance. Creative turmoil is seen as a precondition for creating radical innovation. The main prerequisite for this learning function is strategic ambiguity.

The policy and activities that an organization develops to promote these seven learning functions form its Corporate Curriculum. At the end of the day, the quality of this 'Corporate Curriculum', or 'plan for learning' determines the effectiveness of the process of knowledge creation that leads to innovation.

… THAT LEADS TO INNOVATION.

Considering the pivotal role of innovation with regard to the concept of knowledge creation, it is striking to notice that only so little has been written about this concept in the knowledge management literature. Although (or maybe because), continuous innovation of products, services, and processes is generally accepted as the ultimate goal of knowledge creation, the concept is hardly elaborated upon. Elements of agreement seem to be that (1) today's competitive environment requires continuous innovation, (2) innovation is the result of the process of knowledge creation, and (3) a distinction can be made between incremental and radical innovation (Stam, 2007).

First, it seems to be generally accepted that in today's competitive environment, continuous innovation is a necessary precondition. Therefore, many authors, implicitly or explicitly equate the ability to innovate with competitive advantage (Davenport & Prusak, 1998; Dixon, 2000; Drucker, 1993; Jacobs, 1999; Leonard-Barton, 1995; Nonaka & Takeuchi, 1995; Weggeman, 1997). So, knowledge creation and knowledge management are not a goal in itself, but support the economic goal of continuous innovation as a decisive factor of competitive advantage.

Second, innovation is acknowledged as the result of the process of knowledge creation. Therefore, Amidon (2003) defines innovation as "knowledge in action". According to Nonaka and Takeuchi (1995), innovation is the result of the combination of the ontological and epistemological knowledge spirals. Furthermore, innovation is the ability of organizations to connect internal and external knowledge: the process in which knowledge flows from the market into the company and back again in the form of new products and services. Within this process, both problems and solutions are redefined, in order to adapt to the changing environment. In line with Nonaka and Takeuchi and other knowledge management sources, Leonard-Barton (1995) also considers innovation to be the core capability of today's organization, and therefore stresses the importance of encouraging and combining knowledge creating and –diffusing activities. "It is this process that enables innovation, and it is this combination that managers manage" (Leonard-Barton, 1995, p.8).

Third, distinction can be made between incremental and radical innovation. Based on the paradigm of the punctuated equilibrium (Eldredge & Gould, 1972) and Kuhn's (1996) scientific revolutions, distinction is made between incremental improvements of existing practice and radical changes (Zegveld, 2000). Inspired by evolutionary biology, innovation is not seen as a process of gradual change, but as a process of intermitted change (Figure 2). Relative long periods of relative stability are altered with relative short periods of radical change. This implies that we can make a distinction between two types of innovation: incremental and radical.

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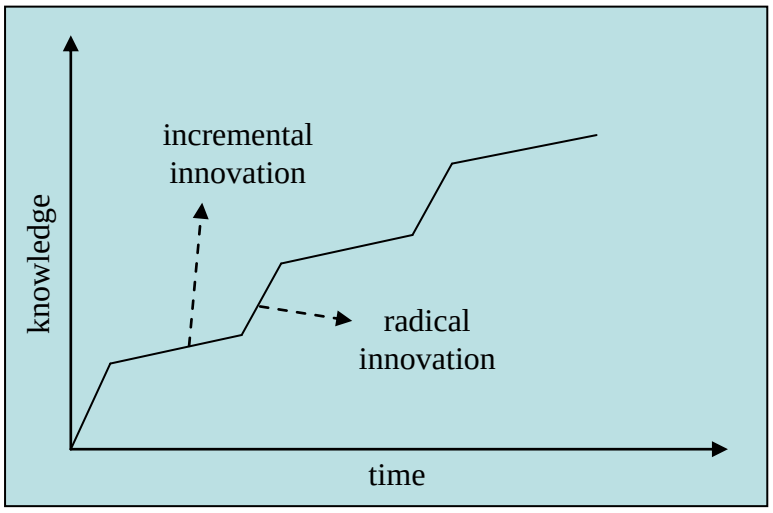

Figure 2: innovation is a process of intermitted change

This distinction is closely related to Hamel and Prahalad's (1993; 1994) distinction between "stretch" and "leverage". Stretch can be defined as "doing the impossible" or where ambition outpaces resources. It requires a total commitment to achieve the desired goal which is communicated to and accepted by the whole workforce. Leverage is about getting the most out of resources. The distinction between incremental and radical innovation can also be related to the exploitation/exploration dilemma (March, 1991; Zack, 1999). This dilemma represents the two strategic options a company has: exploitation of old certainties or exploration of new possibilities. Von Krogh et al. (1994) distinguish between an organization's need to survive (maintain its position in its current environment) and its need to advance (forge ahead in an emerging new environment). Abell (1999) summarizes these innovation strategies as "competing today while preparing for tomorrow". Based on Walz and Bertels (1995), Kessels (2001) makes a distinction between *gradual improvements* and *radical innovation*.

> *Gradual improvement (involving adaptive learning) elaborates on what is already present and leads to additional refinement and specialization. Radical innovation (involving investigative and reflexive learning) involves breaking with the past and creating new opportunities by deviating from tradition.* (Harrison & Kessels, 2004, p.157)

According to Leonard-Barton (1995), these two types of innovations are the essence of the core capabilities of the firm, because they can be either "competence-enhancing", or "competence-destroying". The former refers to possibilities to be combined into current products, the latter refers to, what she calls, innovations that "may wash away the technical foundation of the company" (Leonard-Barton, 1995, p.145). Similarly, Christensen (2005) makes a distinction between "sustaining"[i] and "disruptive" technologies. According to Boisot (1998) the two types of innovation can be explained in Kuhn's (1996) terms of shifting paradigms. The distinction between "cumulative" and "disruptive" knowledge evolution is that the latter involves a paradigm shift; a destruction of existing knowledge assets and the building up of new ones on different foundations. He describes disruptive knowledge evolution as an "edge of chaos" phenomenon out of which new knowledge structures suddenly emerge.

The distinction between incremental and radical innovation also stresses the close relationship between the concepts of innovation and learning as many distinct types of learning can be compared to these two types of innovation. Examples of this are "first order" and "second order" learning (Bateson, 1972), "single-loop" and "double-loop" learning (Argyris & Schön, 1978), "lower-level" and "higher-level" learning (Hedberg, 1981); "adaptive" and "reflexive" learning (Guile and Young [1999] in Harrison & Kessels, 2004). All of these distinctions refer to incremental improvements to existing practice on the one hand, and radical rethinking of basic goals, norms, and paradigms on the other.

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In the knowledge economy, to be successful, organizations should continuously improve their processes, products and services, and radically renew from time to time (Drucker, 1993; Nonaka & Takeuchi, 1995). This distinction between incremental and radical innovation is a first step in the operationalization of the concept of innovation in the definition of knowledge productivity. These two types of innovation, together with the seven learning functions of the corporate curriculum as described in the previous section, serve as a starting point for a framework for making sense of knowledge productivity in the next section.

THE KNOWLEDGE PRODUCTIVITY FLYWHEEL

This chapter is based on a case-based research in which a method was designed and tested to make sense of knowledge productivity in order to help management to design policies that aim at enhancing knowledge-based performance (Stam, 2007). As the aim of this research was to combine elements from both knowledge management and intellectual capital measurement, the method that was tested consisted of elements from both disciplines[ii]. Some of the elements appeared to be more effective than others. This section presents a framework that appeared to be helpful to make sense of the concept of knowledge productivity and to support management in designing policies for knowledge productivity enhancement. This framework – the knowledge productivity flywheel – is based on the seven learning functions of the Corporate Curriculum (Kessels, 1996) and the two types of innovation, as described in the previous sections.

According to Van Lakerveld et al. (2000), a distinction can be made between those learning functions that directly refer to the learning processes (1 to 5) and those that refer to the conditions of learning (6 and 7). Within the five functions that refer to the learning processes we can make another distinction between those that predominantly refer to the knowledge processes (1-3), and those functions predominantly referring to the knowledge workers (4 and 5). The result is that we can make a distinction between three different types of learning functions: those related to the individual (competences and motivation), those related to the knowledge processes (subject matter expertise, solve problems, reflection), and those related to the organizational environment or conditions (calm and stability, creative turmoil). Together they can be visualized in a circle with three layers (Figure 3). These three circles represent the "process of knowledge creation" and try to pay respect to the human-centred definition of knowledge of Kessels (1996). Therefore the inner circle represents the learning functions that are predominantly related to the individual. The outer circle represents the learning functions that are predominantly related to the organizational environment. The circle in between represents a combination of the inner and the outer circle and refers to the learning functions which are predominantly related to the knowledge processes as defined by the knowledge management literature. These knowledge processes are both related to the people and the organization. They are both human and structural capital.

In his research on the Corporate Curriculum, Van Lakerveld (2005) finds evidence for the positive relationship between the learning functions of the Corporate Curriculum on the one hand and quality improvements and innovative potential on the other. In a large reconstruction research of sixteen case studies, Keursten et al. (2006) found a positive relationship between the quality of the Corporate Curriculum and successful innovation processes. Based on these findings, we could represent the relationship between the Corporate Curriculum and incremental and radical innovation as a flywheel (Figure 3). The better the wheel (the process of knowledge creation) functions, the stronger the ability to generate incremental and radical innovation.

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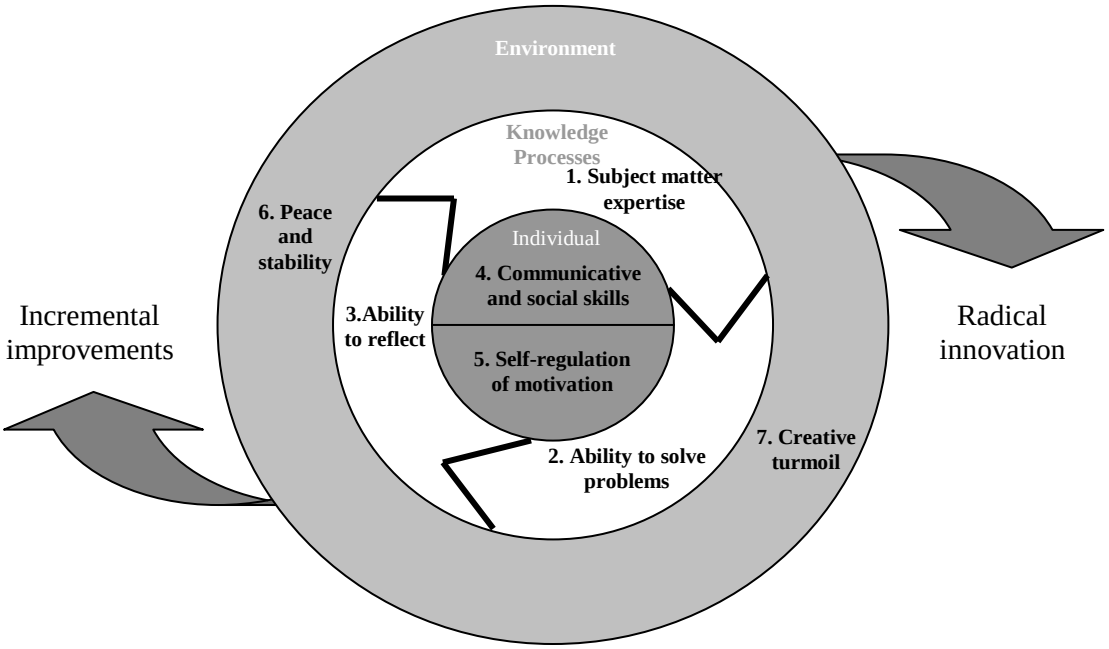

Figure 3: The knowledge productivity flywheel

The knowledge productivity flywheel appeared to be an effective instrument for making sense of knowledge productivity and designing policies that aim at enhancing knowledge productivity (Stam, 2007). Presupposition of the framework is that enhancement of the seven learning functions of the Corporate Curriculum leads to an improved ability to produce incremental and radical innovation, which eventually leads to improved organizational performance. Important to note is that the relationship between knowledge productivity and organizational performance remains implicit. In this respect, further research is needed (Harrison & Kessels, 2004; Keursten et al., 2004; Stam, 2007; Van Lakerveld, 2005; Weggeman, 1997).

THE KNOWLEDGE PRODUCTIVITY ENHANCER

Based on the KP we designed a method for diagnosing knowledge productivity and planning for enhancement (Stam, 2007). This section briefly introduces the KP-enhancer and summarizes the main findings of seven case studies in which this method was tested.

Before elaborating on the method, it has to be noted that the KP-enhancer is not a solution, but a solution concept. This implies that this method is not a standardized solution, but should be translated to the specific context of application. Therefore, this method is not developed for the layman, but for the (knowledge management) professional. In order to be able to successfully apply the KP-enhancer, the person applying the method should:

- be familiar with the main concepts of the method (knowledge productivity, Corporate Curriculum, incremental and radical innovation, knowledge management);
- be familiar with the organization in which the method is applied;
- not only be able to technically understand and apply the method, but also have the ability to facilitate the process.

Context of application

The KP-enhancer can be applied to mid-sized (50-250 employees) knowledge-intensive organizations, or knowledge-intensive departments (50-250 employees) within large organizations. These can be private or public organizations, profit or not-for-profit.

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Design of the KP-enhancer
The KP-enhancer consists of three phases (Figure 4). The method starts with defining the problem at hand, goes through a phase of diagnosing the current situation, and finishes with formulating a plan (KP-statement) for improvement. The implementation of the initiatives that are mentioned in the KP-statement are not part of this method.

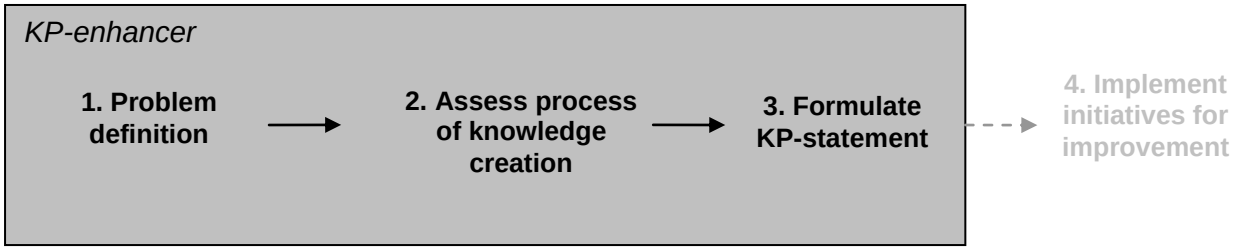

Figure 4: Three phases of the KP-enhancer

The KP-enhancer consists of a web-based questionnaire (with a response time of ±25 minutes) for all employees within the organization (or department), three workshops of three hours with a representative selection of the employees, an interview (two hours) with the client at the beginning of the project, and a presentation to the client or MT at the end of the project. The lead-time of the method is between four and six months.
The remainder of this section provides a broad description of the three phases of the KP-enhancer. The description focuses on the aim of each phase, the main elements and the result of each phase.

Phase 1: Problem definition

The aim of the first phase of the method is to determine the scope of application, define and verify the problem at hand, and check the necessary preconditions for applying the method. Some important questions that have to be answered in this phase are:

- does the organization fit into the class of contexts (see context above) for which the method has been designed?
- does the problem fit into the class of problems (diagnosing and planning KM initiatives) for which the method has been designed?
- does the organization (and the persons involved) meet the necessary preconditions for successful application of the method?

The result of this phase is the verification that the method suits the situation, a validated problem statement, and a concrete planning for applying the method.

Phase 2: Diagnose current situation

The aim of the second phase of the method is to diagnose the current situation with regard to knowledge productivity, and come to an agreement about possibilities for improvement. The main elements of this phase are a survey among all employees within the scope of application and a workshop for a representative selection of the employees.
The survey consists of two parts. The first part consists of about seventy items related to the quality of the seven learning functions of the Corporate Curriculum. The second part consists of a set of ten items related to the innovation profile of employees in terms of incremental and radical innovation. The aim of the workshop is to introduce the main concepts, present and discuss the outcome of the survey, and collect and formulate shared findings with regard to possibilities for improvement. One important element in the workshop is a KP board game based on the KP-flywheel, in which participants are literally asked to match their cards to the learning functions that, according to them, should be improved.
The result of this phase is a set of possibilities for improvement of the current situation with regard to knowledge productivity.

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Phase 3: Formulate KP-statement

The aim of the third phase of the method is to formulate a plan for knowledge management objectified in a KP-statement. This phase consists of two workshops and a presentation of the final product to the client.
Based on the New Guideline for Intellectual Capital Statements (STI, 2003), the main elements of a KP-statement are the Knowledge Strategy, KP-challenges, KM initiatives and a set of indicators. A Knowledge Strategy is a way of expressing the organizational objectives in knowledge terms. The KP-challenges describe the challenges (related to KP) the organization has to face in order to be able to realize its strategic objectives. The KM initiatives describe the actions that follow from the challenges and the indicators help organizations to monitor the progress of the KM initiatives. As internal consistency is an important element of the (communicative) strength of the method, the consistency of the statement is continuously tested. A final check is performed within this phase to guarantee the quality of the final product.
The result of this phase is a completed KP-statement (See Case 1). The KP-statement tells us which initiatives have to be put in place in order to improve the current situation from a knowledge perspective.

Effects of the KP-enhancer
Based on the implementation of the method in seven organizations (Stam, 2007), the KP-enhancer can be characterized as a method that helps to plan KM initiatives through creating awareness about and assessing the quality of the process of knowledge creation. The method can be used either to translate organizational strategy into KM initiatives, or to connect existing KM initiatives to strategic objectives. The result of the method (the KP-statement) helps to improve communication about KM initiatives. In terms of effects, applying the KP-enhancer contributes to:

1. Creating awareness about the importance of KP;
2. Assessing the quality of the process of knowledge creation;
3. Developing a plan for KM;
4. Aligning (existing) KM initiatives with strategic objectives;
5. Improving (internal) communication about KM.

Although the method is called KP-enhancer, applying the method does not lead to KP enhancement directly. The final product of applying the method is a plan for enhancement (plan for knowledge management). Therefore, the method could also be called a “KP enhancement planner”. KP enhancement comes from implementing the plan for KM.

APPLYING THE KP-ENHANCER AT DE BAAK

De Baak is the Management Centre related to the Dutch federation of industries (www.debaak.nl) and employs 150 people. The core activity of de Baak is learning to learn, among other things through training, coaching and events. De Baak is a typical professional service firm, which is reflected in its mission statement: “De Baak is a special company that takes itself and others forward through learning”.

Problem definition
The main reason for de Baak to implement the KP-enhancer was because it had recently gone through a process of strategic reorientation. This process caused doubts about the quality of the available knowledge in the organization. The main question was: do we have the right knowledge to execute our new strategy? The main aim of implementing the KP-enhancer was to add a knowledge perspective to the strategy statement. Another aim of applying the KP-enhancer was to develop an alternative language (alternative to the traditional financial language of the management) in order to facilitate strengthening of the knowledge focus.

Diagnosing KP

Stam, C. (2010), Making sense of Knowledge Productivity, In: Rodriguez-Castellanos, A., Vallejo-Alonso, B. and Arregui-Ayastuy, G. (2010) Identifying, Measuring, and Valuing Knowledge-Based Intangible Assets: New Perspectives. IGI Global.

Based on a questionnaire, the quality of the seven learning functions of the Corporate Curriculum were diagnosed (Figure 5) together with a representative selection of employees. Important finding was that the concern of the management with regard to the quality of the available knowledge appeared to be justified. After interpreting the data, the employees concluded that the following learning functions needed to be strengthened: Subject matter expertise (learning function 1), Communicative and collaborative skills (learning function 4) and Peace and stability (learning function 6).

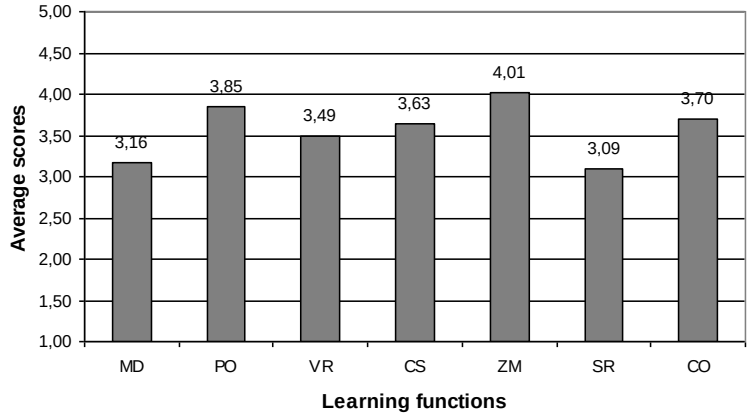

Figure 5: Quality learning functions de Baak.

Formulating a KP-statement

In a second workshop, the strategy statement and the outcome of the diagnosis of the lerning functions were translated into a knowledge strategy, a set of challenges needed to realize this strategy and a set of initiatives needed to face these challenges. Finally, a set of indicators were defined to measure the progress of the initiatives. The result of this workshop was summarized in a KP-statement (Figure 6). Based on this KP statement, the management decided to implement almost all initiatives as proposed.

Knowledge strategy	*Challenges*	*Initiatives*	*Indicators*
De Baak is a special company that takes itself and others forward through learning …	Focus on strategic knowledge areas	Make explicit choices with regard to strategic knowledge areas	% activities that are in line with strategic knowledge areas
… in the form of activities that inspire people to learn to learn, such as training, coaching, events and multimedia services.			
To achieve this we need: - Motivated professionals with the ability to learn	Knowledge focused development of employees	Make knowledge ambition of employees explicit	% realized knowledge ambitions
- The ability to design, organize and sell learning programs - The ability to execute learning programs (as an accompanist, trainer or teacher) - Knowledge about topics related to leadership, personal effectiveness and the context in which this knowledge will be applied (organizations, society) - A network of teachers and trainers that inspire us and link us to new customers - A knowledge landscape that supports everyone within our network	Access to the knowledge of each other	Make inventory of employees' specialisms (so that they can find each other more easily) Create knowledge pools (Communities of Practice)	% completed profiles (Yellow pages) # knowledge pools

Figure 6: KP-statement de Baak

FUTURE RESEARCH

Based on the issues raised in this chapter, this section suggests several directions for further research. First, intellectual capital measurement and knowledge management are often treated as distinct concepts. Based on the experiences in this research, an interesting direction for further research would

be to further explore to what extent these concepts are complementary and to what extent these concepts enhance each other.
Second, the concept of knowledge productivity includes both conditions (learning functions) and results (incremental and radical innovation). However, hardly any research has been done to proof the relationship between these two elements (Keursten et al., 2006). In addition, hardly any research has been done to proof the relationship between knowledge productivity and organizational performance. Therefore, a relevant direction for further research would be to test these supposed relationships between conditions and results and between knowledge productivity and organizational performance.
Third, the use of the word 'productivity' in relation to the process of knowledge creation suggests that the effectiveness of this process can be measured in terms of the ratio between input and output. In our research we found out that this suggestion is based on the logic of the industrial era and arouses wrong expectations. Therefore we need new concepts that help us better understand the essence of the knowledge-based production process. Future research could focus on the discovery of better metaphors for phenomena such as knowledge productivity, knowledge management and intellectual capital. This research could build on the work by Andriessen & Van den Boom (Andriessen, 2006; Andriessen & Van den Boom, 2007, 2009).
Fourth, in our research we also experienced the importance of aligning knowledge management initiatives with corporate epistemology (Venzin, Krogh, & Roos, 1998). It can be questioned whether the conceptual framework presented in this chapter fits all different corporate epistemologies. Therefore interesting direction for further research would be to make sense of knowledge productivity from an epistemological perspective.

CONCLUSION

In the knowledge economy knowledge productivity is the main source of competitive advantage and thus the biggest management challenge. Despite the pivotal role of knowledge productivity, this concept remains relatively unexplored, which might threaten organizational effectiveness. Therefore, this chapter attempts to make sense of the concept of knowledge productivity in order to contribute to the management ability to develop policies that aim at enhancing knowledge productivity.
In recent literature we see two different interpretations of the concept of knowledge productivity, of which one uses *knowledge*, and the other uses *productivity* as a starting point. Although distinct approaches, they are related in the sense that they both search for more appropriate instruments to reveal and improve knowledge-related performance. Based on a review of the concept from both perspectives, knowledge productivity is defined as *the process of knowledge-creation that leads to incremental and radical innovation*. The two main elements in this definition are 'the process of knowledge creation' and 'incremental and radical innovation'. These two elements are inherently bound together, because innovation (new knowledge) is the unavoidable result of the process of knowledge creation.
Today's production process is a *process of knowledge creation*. This process is closely related to the process of learning and therefore, the conditions for a productive environment are similar to the conditions for good learning. Based on this reasoning Kessels (1996) identified seven critical learning functions: subject matter expertise, ability to solve problems, ability to reflect, communicative and social skills, self-regulation of motivation, stability and peace, and creative turmoil. These learning functions are critical in the sense that their quality determines the effectiveness of the process of knowledge creation.
In the knowledge economy, to be successful, organizations should continuously improve their processes, products and services, and radically renew from time to time. Therefore, *incremental and radical innovation* is the second main element in the definition of knowledge productivity. Based on the paradigm of the punctuated equilibrium, innovation should not be seen as a process of gradual change, but as a process of intermitted change. Relative long periods of relative stability are altered with relative short periods of radical change. Incremental innovation refers to improvements of existing practice (doing things better). Radical innovation refers to radical changes that deviate from existing practice (doing better things).

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In order to make sense of the concept of knowledge productivity and to support management in designing policies for knowledge productivity enhancement, the seven learning functions and the two types of innovation were combined in a knowledge productivity flywheel. Underlying logic of this conceptual framework is that enhancement of the seven learning functions of the Corporate Curriculum leads to an improved ability to produce incremental and radical innovation, which eventually leads to improved organizational performance. In other words, the better the wheel (the process of knowledge creation) functions, the stronger the ability to generate incremental and radical innovation.
Based on the knowledge productivity flywheel we designed a method for diagnosing knowledge productivity and planning for enhancement. This so called KP-enhancer was tested in a case-based research and appeared to be an effective instrument for making sense of knowledge productivity and designing policies that aim at enhancing knowledge productivity.

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KEY TERMS

- Knowledge productivity: the process of knowledge creation that leads to incremental and radical innovation.
- Corporate Curriculum: the plan for learning to increase knowledge productivity, leading to innovation and ultimately to economic advantage.
- Knowledge management: deliberate initiatives that aim at enhancing knowledge productivity.
- Intellectual capital measurement: the discipline that identifies and measures intangibles.
- Knowledge: the product of learning.
- Intellectual capital: all intangible resources that are available to an organization, that give a relative advantage, and that in combination are able to produce future benefits.
- Learning: the process in which knowledge is created.
- Innovation: the product of learning (knowledge), can be either incremental or radical.
- Incremental innovation: incremental improvements to existing practice (doing things better).
- Radical innovation: knowledge that breaks with the past and opens new opportunities (doing better things).

[i] According to Christensen (2005), sustaining technologies can be either radical or incremental, however, what they all have in common is that they improve the performance of established products. Therefore, within this context sustaining refers to incremental, and disruptive refers to radical innovation.

[ii] The complete method was called the "Knowledge Productivity Enhancer". Other main elements of this method were based on the Quantitative Framework (Zegveld, 2000) and the Danish Guideline for IC statements (STI, 2003). More about the effectiveness of the complete method and the individual elements can be found in *Knowledge Productivity* (Stam, 2007).