Learning to innovate

a series of studies to explore and enable learning in innovation practices

suzanne verdonschot

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LEARNING TO INNOVATE
A SERIES OF STUDIES TO EXPLORE AND ENABLE LEARNING IN INNOVATION PRACTICES

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Suzanne Verdonschot
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1

Introduction

Our economy has changed from an industrial economy to a knowledge economy (Drucker, 1993). This thesis deals with learning and working in such a knowledge economy. Practices that determined success in the industrial economy, like the replication of products and the focus on productivity, need re-examination in an economy in which the value of knowledge is seen as a major economic resource. In a knowledge economy an organization's success is more determined by intellectual than by physical resources (Harrison & Kessels, 2004). The goal is not so much to produce more products and work more efficiently, but rather to develop new products and services and smarter ways of working. The success of organizations in a knowledge economy is determined by the extent to which they manage to create new knowledge and to apply that new knowledge to the improvement and innovation of their products, services, and working processes. This has implications for the way learning is viewed in the context of work. In order to be successful, learning with the intention of innovating becomes increasingly important. The goal of this research is to better understand the learning processes that contribute to innovation, and to learn more about the design of favourable learning environments. This chapter introduces the research questions that are central to this thesis and elaborates upon the relevance of these questions.

1.1 Learning in the context of work

Learning in the context of work may be initiated with varying intentions. At least three main intentions can be distinguished, of which the last is becoming increasingly important for organizations in a knowledge economy.

For a long time, learning in the context of work was initiated with the intention of preparing employees to do their work. Formal training activities were an important way to shape the learning processes in the context of work. The relationship between learning and work in this case could best be characterised as a serial connection: first people learn, then they apply what they have learned in their work (Nieuwenhuis & Van Woerkom, 2006). However, the effects of these training programmes in terms of the transfer of what had been learned to the workplace was disappointing (see Baldwin & Ford, 1988; Burke & Baldwin, 1999). Therefore, attention for the workplace itself as a place for learning increased.

Learning at the workplace can be initiated with the intention of learning how to better do the job, or with the intention of innovating. In both forms, the work environment can be regarded as a learning environment (Dixon, 2000). Learning with the intention of doing the work better takes place for instance through a process of socialisation. By participating in the work process, employees can learn from their more experienced colleagues. When learning is done with the intention of innovating, the aim is not to help employees in doing their current job, but rather to add value to their work by changing it. Indeed, learning is then pointed at the development of innovations. In this case the work process itself will increasingly look like a learning process (Kessels, 2001b). It is this form of learning, learning with the intention of innovating, that becomes more and more important for organizations in a knowledge economy.

Learning with the intention of innovating is closely related to the concept of knowledge productivity (Kessels, 1995, 1996a, 2001b). In this concept the notions of learning and innovation come together. Kessels (1995) defined knowledge productivity as the process in which employees trace relevant information, use this information to develop new abilities, and apply these abilities to gradual improvement and radical innovation of products, services and work processes. It was Drucker (1993) who concluded that productivity in a knowledge economy takes on a different form than in an industrialised society. In a knowledge economy productivity is not defined as the act of 'making and moving things', but as the extent to which members of the organization, referred to as knowledge workers, succeed in making their knowledge productive (Drucker, 1999). In knowledge work, the tasks are not given but determined by knowledge workers themselves. This requires a different work environment. Instead of executing tasks that are imposed on them, employees constantly ask critical questions such as 'Why are we doing the work this way?' 'Is there a smarter way to do this work?' Usually, there is not one correct answer to these questions, but several choices instead, choices that sometimes demand risky decisions (Drucker, 1993). Organizations are faced with the challenge of designing a work environment that is open to these critical questions, that supports employees in finding smart solutions, and that supports the learning processes that take place with the intention of innovating. In short, there is a need for a work environment that supports the process of knowledge productivity.

1.2 All members of the organization participate

Organizations could easily interpret the appeal which the knowledge economy makes to them as an invitation to simply intensify their actual way of working on innovation. These organizations however, may run the risk to develop an approach in which the attention lies overly on the development of new technology, applied in new products, with an emphasis on the isolated R&D departments. Innovation in a knowledge economy is broader than that. It is, in fact, a process in which all members of the organization participate.

In this respect, an observation made by Volberda and Van den Bosch (2004) is important. They found that, in The Netherlands at least, the innovation debate is strongly biased towards technological innovation. At the same time administrative innovation, also referred to as social innovation (Volberda, Van den Bosch, & Jansen, 2006) , is somewhat neglected. Technical innovation represents new products, services, and production process technology, whereas administrative innovation involves organizational structure and administrative processes (Damanpour, 1991). Although new technology offers an important source for innovation, too narrow a scope could diminish an organization's opportunities. Volberda, van den Bosch and Jansen (2006) point out that technological innovation makes up only 25% of the innovation success of organizations. In contrast, social innovation, consisting of management, organization, and labour aspects, make up 75% of the ultimate innovation success of organizations. Recognising social innovations has implications for the learning processes undertaken with the intention of innovating. Then, these learning processes are no longer confined to R&D departments, but stretch out to all departments in the organization including production, marketing and finance (Kanter, 2006). In fact, all members of the organization can be regarded as knowledge workers who contribute to the process of innovation (De Jong, Kessels, & Verdonschot, 2008; Kessels, 2001b). Innovation no longer consists of the products and new ideas that are developed in one place and implemented in another. Innovation is developed in various places within organizations, by the employees who encounter problems that require new solutions.

This observation shows the importance for organizations of better understanding the process of knowledge productivity. It is not something solely practiced within the isolation of laboratories or R&D departments but something that concerns all members of the organization.

1.3 Learning across the borders of organizations

Two developments in our society are causing people to view learning processes for innovation as occurring not only within the borders of the organization, but also across organizations, sectors, and even countries. The first is brought about by mere technical developments, and the second by problems that society as a whole faces nowadays.

With the emergence of the Internet an abundant source of information has become available to many people. Access to information is no longer restricted to the very few. In this scenario it is not the access to information and the collection of information that matters, but rather the use of this information to create new knowledge that can be applied to the improvements and innovation of products, services, and processes. This development caused many organizations to adopt a more open model of innovation (Chesbrough, Vanhaverbeke, & West, 2006). In an open innovation model organizations do not work on innovation in isolation and do not invest large amounts of money only in R&D. Instead, they use ideas inside as well as outside of the organization to develop smarter solutions. The focal point is no longer to prevent others from using developed ideas, but rather to collaborate with them in order to make maximum use of everyone's knowledge (Groen, Vasbinder, & van de Linde, 2006). A study done by research centre Twynstra the Bridge (2006) confirms that collaboration between organizations leads to better results.

The other, second development is that problems faced by both single organizations and society as a whole cannot be resolved by measures taken by one government, nor by innovations developed in one organization. Despite technological progress and improved material standards of living for many, "the gap between 'haves' and 'have-nots' is growing, and people sense unprecedented dangers from environmental imbalances that could provoke disaster" (Senge, Laur, Schley, & Smith, 2006, p. 7). If problems such as water shortage, climate change, or poverty are seen as separate problems, and approached each one on its own, solutions will be short-term and often opportunistic, not addressing deeper imbalances (Senge, Smith, Kruschwitz, Laur et al., 2008). In contrast, when these problems are seen as symptoms of a larger global system that is out of balance, one can see the extraordinary opportunities for innovation. For these problems to be solved in an innovative way, people need to collaborate in unconventional ways. Tony Blair, in his speech at the opening plenary at the annual meeting of the World Economic Forum in 2005, referred to this as interdependency. He stated that "we may disagree about the nature of the problems, and how to resolve them, but no nation, however powerful, seriously believes today that these problems can be resolved alone. Interdependence is no longer disputed" (2005, p. 1). The challenge today is that the kind of collaboration that is needed to solve these long standing problems has yet to be developed.

Kanter (1999) mentions collaboration between organizations and the social sector as a promising way of dealing with these problems. However, this collaboration should not be designed as a charity. On the contrary, the collaboration between private enterprises and public interest must be shaped as a shared learning process in which both parties participate. Only then it can produce profitable and sustainable change for both sides (Kanter, 1999).

1.4 Research questions

The transformation of our economy into a knowledge economy makes an appeal to organizations to design their work environments in such a way that they support the learning processes undertaken with the intention of innovating. It is important to better understand these learning processes since this learning is not restricted to a small group of people. Instead, all members of the organization take part in these processes. Also, these learning processes will take place across the borders of single organizations, in order to meet the current issues faced by organizations and society as a whole. This makes it necessary to design adequate ways of collaboration that support these learning processes. The first main research question that the present research therefore will address, is:

First Research Question

> *What factors enhance the learning processes that lead to gradual improvements and radical innovations?*

Besides a better understanding of such influencing factors it is important to find out more about the way in which these learning processes might be deliberately stimulated. In environments where the desired outcome is to achieve standardisation, repetitive routines, and fixed procedures, the desired level of performance can be clearly described. In these environments a gap analysis of the actual and the desired situation helps to identify the required learning interventions (Plomp, Feteris, & Pieters, 1992). However, this is not the case for learning which takes place with the intention of innovating. For learning processes that bring about innovation, a clear path of interventions cannot be defined up front since it is unknown how the process will look like. In highly novel and uncertain situations, such as innovation processes, precedents and routines do not exist and predictions about future states of events are not reliable (Van de Ven, Polley, Garud, & Venkataraman, 1999, p. 67). Therefore, the design of a work environment that promotes innovation is not something that is easily planned in advance. In this case the application of instructional design models, adequate for situations in which the actual and desired situation can be known in advance, is not self-evident.

As the use of available instructional design models is not obvious, it becomes interesting to find out how work and learning environments that support learning with the intention of innovating could be designed. The factors that are found to matter might serve as starting points for this design. However, it is not self-evident that factors found to be descriptive, can be used as prescriptive. A description of reality is not per se sufficient to optimize that reality (Lowyck, 1995), and 'knowing that' cannot be directly linked to 'knowing how' (Burkhardt & Schoenfeld, 2003). This makes it necessary to investigate the extent to which the relevant factors can be applied in a design approach. This brings us to the second research question:

Second Research Question

To what extent can the factors identified be deliberately applied to design a work environment that promotes innovation?

1.5 Relevance

Scientific relevance

The present research aims to contribute to the existing knowledge about innovation and the related learning processes taking place in work environments. From the perspective of learning in the context of work, we can build on previous research that considered the work environment as a learning environment. It mainly focused on what and how people learn (e.g. Eraut, Alderton, Cole, & Senker, 1998), and on how to guide learning in the workplace (e.g. Billet, 2001). This present research aims to elaborate on these insights by exploring the specific learning processes in work environments that focus on bringing about gradual improvements and radical innovations.

For a long time, research on innovation presented innovation as a linear process of design, development and implementation. Movement, interaction, and feedback did not have a prominent place in the underpinning theories. If knowledge was acknowledged, the emphasis was on learning from external knowledge sources (Harkema, 2004). Currently, innovation is seen as a cyclical, interactive process in which learning plays an important role (Tidd, Bessant, & Pavitt, 2005). This requires a better understanding of the concept of innovation by considering it as a learning process, which the present research aims to contribute to.

Practical relevance

Organizations in a knowledge economy should design work environments that promote knowledge productivity and invite all employees to participate. Mechanisms of planning, command and control are not likely to be effective in work environments that aim to support the process of knowledge productivity (Kessels, 2001b). It becomes increasingly important for organizations to know more about factors that matter in learning environments intending to bring about innovation, and about ways to design a work environment that facilitates the desired learning processes. The present research aims to deliver guidelines that could help organizations in designing such learning environments.

Relevance to society

The application of knowledge to the process of innovation is not deployed within the isolation of single organizations. The long standing issues society is facing, require collaboration of individuals across organizations, sectors and countries. The present research aims to contribute to the understanding of the learning processes in which more and more members of society will take part. By better understanding these learning processes and by finding out how these can be supported, it will become easier to support participation and promote inclusion. One of the studies carried out within the framework of the present research project took place in the context of Habiforum. This organization aims to find innovative solutions for questions relating to the limited space in The Netherlands. These questions cannot be solved by single organizations. Economical and social developments must be connected, and this requires that various parties take part in these innovation processes. Public parties, private parties, and even inhabitants not belonging to an organization, are engaged in these processes that address questions relevant to our society as a whole. Their collaborative effort to be knowledge productive is studied in order to better understand these processes.

1.6 Outline of the thesis

In order to refine the research questions, the main concepts and their relationships are explored in a conceptual framework in chapter 2. Chapter 3 explains the research design of the present research project. Chapters 4, 5 and 6 describe the studies that address the first main research question. Chapter 7 presents a design study that addresses the second research question. In chapter 8 conclusions are drawn. Chapter 8 also offers a critical reflection on the concepts, as well as the reliability and validity of the research. Table 1.1 shows the outline of the entire research project.

Table 1.1

Composition of the research project

Chapter		Yield
2	Learning and working in a knowledge economy, a conceptual framework	Conceptual framework
3	The research design: a building block approach	Research methodology
4	Meta-analysis of reconstruction studies of 18 innovation practices	Confirmation and refinement of the elements of the conceptual framework
5	Parallel study to trace factors that enhance learning in innovation practices	11 validated design principles that matter in the innovation process
6	Expert consultation to reflect on the design principles	Three themes that underlie the principles, and critical reflections
7	Inquiry into the prescriptive quality of the design principles	A new model showing the factors that matter in the design of learning environments that enhance innovation
8	Conclusion and discussion	Answers to the research questions and critical reflections on the concepts, methodology and relevance

2

Learning and working in a knowledge economy — a conceptual framework

This chapter elaborates upon the relationship between learning and work, and how this relationship is changing under influence of an emerging knowledge economy. After a description of three different forms of learning in the context of work, the kind of learning that is essential in a knowledge economy is described in greater detail. In a knowledge economy, the application of new knowledge to the gradual improvement and radical innovation of products, services and work processes, becomes one of the most significant processes for organizations. This implies that it becomes increasingly important for organizations to organize learning with the intention of innovating. The present research project uses the concept of knowledge productivity to explore this kind of learning. Knowledge productivity refers to the connection between learning and working in a knowledge economy and connects the notions of learning and innovation. The chapter ends with a conceptual framework that forms the basis for the research activities to be undertaken.

2.1 Three forms of learning in the context of work

Learning in the context of work can take different forms. There are at least three different intentions that could guide the learning process. First, learning can be undertaken with the intention of *preparing* for the job. Second, learning might be done in order to *become better* at doing the work, and third, learning might serve as a process through which employees *innovate* at work. Each of the forms of learning gained interest in different time periods, and they are closely linked to beliefs about learning and knowledge that emerged during those periods. At the same time all three forms still have value today. They each are of different value for the work, and cannot replace one another. This is illustrated by the examples presented in Figures 2.1, 2.2, and 2.3, which describe learning in the context of a supermarket (De Jong et al., 2008). These examples demonstrate the three different forms of learning by picturing a youngster who works as a shelf stacker at the supermarket. Figure 2.1 shows an example of learning with the intention of preparing for the job. The content of what these youngsters must learn was known in advance. The result of the induction course was that they were better prepared for doing their work. Figure 2.2 shows an example of learning in the context of work that helps employees do their work better. The shelf stacker consults his colleagues and learns new techniques that help him improve his performance. The third example (Figure 2.3) shows how the supermarket manager and the shelf stackers develop a new way of working. This is an example of learning that is undertaken with the intention of innovating at work.

In the first two examples (Figures 2.1 and 2.2) the learning needs of employees form the starting point for learning. In the third example (Figure 2.3) the work itself offers the starting point for learning. In this case, learning is not driven by the idea of helping employees be better prepared for their job, or become better at doing the work, but by the idea that learning itself adds value to the work. This form of learning is regarded as very important for organizations that want to be successful in a knowledge economy (Drucker, 1993; Kessels, 2001b; Sveiby, 1997). Indeed, these organizations must work on gradual improvements and radical innovations in the products and services they deliver, and in the way they organize their operating procedures. Regarding work as a form of learning that brings about these improvements and innovations is conducive to success in the knowledge economy.

Figure 2.1.

Example of learning with the intention of preparing for one's work.

A shelf stacker prepares for his work

He spent his first day at the supermarket with other employees who, like him, were scheduled to begin work as shelf stackers. They gathered to follow an induction course that aims to prepare them for their new job. They learned the rules that apply for their work (e.g. always be on time, don't wear short trousers). They learned the basic things they need to know about their work (e.g. what to do when the truck arrives with the new supplies), and they spent time working on concrete cases that describe situations they could encounter in their work. They discussed how each of them would react to such situations.

Figure 2.2.

Example of learning with the intention of doing the work better.

A shelf stacker becomes better at his work

Learning in order to do the work better, played a role a couple of weeks after the shelf stacker began work. He'd become good at stacking the shelves and enjoyed his work. However, what he did notice was that doing the tasks took him longer than his colleagues. It even took him longer than the colleagues who started the same week he did. He started to ask his colleagues how they did their work and whether they had noticed him doing things differently. This exchange with his colleagues provided him with helpful tips for doing his work faster. After practicing some of these techniques, he managed to become more efficient, and therefore better, at his work.

Figure 2.3.

Example of learning with the intention of innovating at work.

Shelf stackers develop an innovative solution

The supermarket manager encounters a problem. The supplier brings in new stock every day. Somehow, too many new products are being delivered. New products arrive even when the shelves are full. The effect is that the stock room becomes too full. The manager found out that the number of products actually in stock often does not match the number of products shown in the computer. Apparently, the shelf stackers do not always check the computer status for the products they put on the shelves. The supermarket manager has already warned them about not forgetting to fill in the right values, but somehow the shelf stackers are not motivated to enter these values every day. They needed to find a new solution. The supermarket manager and the shelf stackers developed a new way of working. Instead of working on different aisles at different times, every shelf stacker became responsible for his own aisle. This included stacking the shelves for this aisle, lining up the products near the front of the shelves, and checking the actual stock against the figure indicated by the computer. This new solution implied a radical innovation of their operating procedure.

2.1.1 Knowledge as inextricably linked to the individual

In all three forms of learning, knowledge can be seen as a personal competence that is difficult to separate from the individual. Malhotra (2000, p.249) says that "knowledge needs to be understood as the potential for action that doesn't only depend upon the stored information but also on the person interacting with it." This view is reminiscent of Sveiby (1997), when he states that knowledge is embedded in each individual. Knowledge reflects their experience, and their ability to communicate and to act. It is a continual process which gives people the capacity to act.

This view is the opposite of the representation of knowledge as something that could exist on its own, disconnected from people. The latter image of knowledge originates from a confusion between knowledge and information. Indeed, information is data that exists on its own, and that can be made available through databases, books or memos. Knowledge, in contrast, is linked to individuals and cannot be stored in media separate from people. Sveiby (1997) argues that the confusion between knowledge and information causes many organizations to invest large amounts of money into expensive IT systems. They hope that these systems could help them to 'transfer' or to 'share' the available knowledge throughout their organization.

Although the desire to make use of each other's knowledge is understandable, the image of knowledge as something that can be stored in a database does not reflect reality. Research has shown that the large investments made in technology have produced little improvement in the effectiveness and efficiency of organizations and their employees (Malhotra, 1998). A database can contain a success story of an employee who managed to radically reduce absenteeism, but by reading this success story someone does not suddenly possess the same ability to reduce absenteeism. Such a database in fact contains *information* about the knowledge of a person. Indeed, knowledge is inextricably linked to the person, the activity and situations in which it was developed (Brown, Collins, & Duguid, 1989). Entering information in a database might help others acquire the ability referred to by the information, but a social process of collaborating and building on each other's ideas (Brown & Duguid, 1991; Malhotra, 1998) is also necessary.

Using this view of knowledge as a starting point puts concepts such as knowledge transfer, knowledge sharing and knowledge development in a different perspective. Knowledge transfer, taken literally, suggests that knowledge could travel from the head of one person to the head of another. However, this is not possible when knowledge is regarded as a personal competence. At best, one can obtain information about the knowledge of another person (Keursten, Verdonschot, Kessels, & Kwakman, 2006). Following the same reasoning, sharing knowledge is at best telling someone else what you know. The other person must still acquire the ability to use this information, and to construct his or her own knowledge. Presumably, knowledge development is a more useful concept. The view of knowledge as inextricably connected to people, implies that individuals must develop their own knowledge. Knowledge development is in fact the only way learning can take place. In everyday language the concept of knowledge sharing is often used to indicate processes in which knowledge development (i.e., learning) takes place. When professionals jointly work on a specific task, or collaboratively write an article, then knowledge development takes place. Often, these processes are referred to as to knowledge sharing. Moreover, it is worthwhile to note that authors who adhere to concepts such as knowledge transfer or knowledge sharing (e.g. Cummings & Teng, 2003; Dixon, 2000; Huysman & De Wit, 2002; Orr, 1990) do not necessarily hold a view of knowledge as something disconnected from people. If these authors make distinctions between different knowledge processes, it is often to point at different functions of learning, different goals that learning might have, or different intentions with which learning is undertaken. To avoid confusion, this thesis will not differentiate between different forms of knowledge processes.

The next section introduces three metaphors to characterise the learning processes that are central in the three forms of learning in the context of work (see Figures 2.1, 2.2 and 2.3). In all cases, learning is seen as an active process in which participants construct meaning socially (Berger & Luckmann, 1966).

2.1.2 Three metaphors to characterise three forms of learning

This section introduces three metaphors to better understand the learning processes that are related to three dominant forms of learning in the context of work. Learning as a means of preparing for the job will be characterised as a process of *acquisition* (Sfard, 1998). Learning as a means to do the work better, is depicted as a process of *participation* (Sfard, 1998). Learning initiated with the intention of innovating, is characterised as a process of *creation* (Paavola & Hakkarainen, 2005). The concepts of acquisition, participation and creation can be seen as images, or metaphors, to better understand the differences between each of the three forms. They should not be read as literal descriptions of the learning process. The function of these metaphors is to help "highlight certain basic attitudes and approaches towards learning" (Paavola & Hakkarainen, 2005, p. 537) in the three forms of learning in the context of work.

Learning as a process of acquisition

In learning with the intention of preparing for the job, the content is known in advance. In the example of the shelf stacker (see Figure 2.1), the content consisted mainly of the tasks that the youngsters would encounter during a normal working day and the rules they would have to follow. Learning with the intention of preparing for the job can be linked to what Sfard (1998) refers to as the 'acquisition metaphor'. This metaphor shows a way of thinking that conceives learning as *acquisition*. This approach supposes pre-given structures of knowledge that an individual learner, under guidance, needs to construct (Paavola & Hakkarainen, 2005, p. 538). Although one might link the metaphor of acquisition to a cognitive approach that stresses mental models while often failing to recognise the importance of the context, the acquisition metaphor can also be linked to a constructivist theory of learning (Paavola & Hakkarainen, 2005; Sfard, 1998). Forms such as simulation games can particularly encourage learners to construct their own reality and support the acquisition metaphor as well. S. D. N. Cook and Brown (1999) refer to the understanding of the nature of knowledge that underlies this metaphor as an 'epistemology of possession'. This epistemology treats knowledge as something people possess and can use in action. Although other metaphors came into use over the course of time, the acquisition metaphor is still present. Sfard (1998, p. 9) expresses this as follows:

> "Our ability to prepare ourselves today to deal with new situations we are going to encounter tomorrow is the very essence of learning. Competence means being able to repeat what can be repeated while changing what needs to be changed. How is all of this accounted for if we are not allowed to talk about carrying anything with us from one situation to another?"

Learning as a process of participation

In learning with the intention of becoming better at doing the work, the content is not set in advance. However, this content is already known in the specific context in which the learner operates. In this case, learners do their job and interact with colleagues in order to learn. Here, the content is not separated from its context in order to be learned, unlike the situation in which learning serves as a preparation for work. Learning with the intention of becoming better at the work takes place while employees do their work.

Sfard (1998) uses the metaphor of participation to characterise this kind of learning. For the shelf stacker from the example (see Figure 2.2), *participation* in the community of shelf stackers is an important way to develop knowledge related to the work he is doing. In this kind of learning it is the activity in practice, and not the individual mind, which shapes the learning (Paavola & Hakkarainen, 2005). 'Having' was an important aspect in the acquisition metaphor, but 'doing' plays an important role in the participation metaphor. Learning is focused on becoming member of a certain community.

S. D. N. Cook and Brown (1999) speak of something similar when they refer to the belief that knowledge is an epistemology of practice. They place this epistemology next to the epistemology of possession and declare that there is another form of knowledge in addition to the knowledge we possess. They refer to it as knowing. "Knowledge is commonly thought of as something we *use* in action but it is not understood to *be* action." (S. D. N. Cook & Brown, 1999, p. 387). With knowing they refer to a form of knowledge that actually is part of action. This view on knowledge does not focus on what is possessed in one's head, but on the interactions in the social and physical world.

Learning as a process of creation

The learning process undertaken with the intention of solving difficult questions, and which results in improvements or innovations, can best be characterised as a process of *creation*. Learning as a process of creation emphasises the way people collaboratively develop mediating artefacts (Paavola & Hakkarainen, 2005). Paavola and Hakkarainen (2005) position the metaphor of learning as knowledge creation next to the metaphors of acquisition and participation introduced by Sfard (1998).

The creation metaphor combines an aspect that is central in the acquisition metaphor, with an aspect that is central in the participation metaphor. The acquisition metaphor stresses the creation of conceptual knowledge, and the participation metaphor stresses the creation of social structures and collaborative processes. The creation metaphor acknowledges the importance of the development of new ideas and concepts. At the same time, learning as a process of creation takes place when social structures and collaborative processes support knowledge advancement in innovation (Paavola & Hakkarainen, 2005). The creation metaphor goes beyond a possible opposition of the two other metaphors. S. D. N. Cook and Brown (1999) make a comparable connection between the forms of knowledge involved. They argue that *knowledge* plays a role in the epistemology of possession, whereas the process of *knowing* plays a role in the epistemology of practice. They state that knowledge actually gives shape and discipline to the process of knowing. They provide the image of a generative dance between these two epistemologies in which new knowledge and new forms of knowing are generated. Accordingly, the generative dance is the source of innovation.

Paavola and Hakkarainen (2005) also link the creation metaphor to innovation. They recognise that learning as a process of acquisition and learning as a process of participation can incorporate innovative aspects, but believe that innovation is not the domain where these approaches are best used. In their view, learning as a process of creation in which new concepts are developed, and in which people interact with each other, is especially important for the process of innovation.

2.1.3 Summary

Table 2.1 presents a summary of the three forms of learning in the context of work and the dimensions on which they differ.

Table 2.1

Three forms of learning in the context of work

Intention	Relationship learning and working	Metaphor for learning	Content of the learning process
To prepare for the job	Learning precedes working	Acquisition	Content is known in advance
To become better able to do the work	Learning supports the work processes	Participation	Content is available as part of the work context
To innovate at work	Learning itself is a means to add value	Creation	It is not known in advance whether the content is available

2.2 Learning as a preparation for work

In the first form of learning (see Table 2.1), learning is seen as a preparation for work. A common association with this perspective might be that of learning in educational settings. The educational system is focused on the preparation of youngsters and adults for their personal as well as their professional life. This kind of learning has the intention of preparing people for doing their work. Organizing learning and its application at work serially (*first* learning, *then* working) is not reserved to educational settings (Nieuwenhuis & Van Woerkom, 2006). Training programmes organized in organizational settings also have the aim of preparing people for their job. In this case, learning precedes the application of the learning results at work. This section explains the situations in which this kind of learning is appropriate, and explores the design of suitable learning environments.

2.2.1 Learning processes in which the content is known in advance

When learning precedes working, classroom training usually comes to mind first. Classroom training is useful for teaching procedures generally acknowledged within the organization, and for supporting the acquisition of insights that fit within the actual way of working of the organization (Bolhuis & Simons, 2001). An induction course for new employees is an example of classroom training to learn about procedures and rules which the organization agrees upon. The trainer or facilitator can be regarded as an expert who helps employees in their learning process. Besides classroom training there are various other examples of off-the-job learning activities. In classroom training the transmission of information from one knowledgeable person to others takes a central place. In these settings learners are relatively passive. Examples of off-the-job learning activities in which the learner is more actively engaged are simulation games and role playing games.

Learning in a simulated reality

In a simulation game, reality can be reflected (simulated), sometimes in a simplified version. Such a game is also referred to as a business game (Goldstein, 1993), or management game (Elgood, 1988). It is an adequate way of preparing employees for participating in a complex work environment. Elgood (1988, p. 5) says: “by simulating the conditions that will exist in the real state, it is possible to acclimatize people so that they will know what to expect and can be physically and psychologically ready. It is also possible to allow them to practice their skills so that they have greater chance of success”. By simulating a reality, a learning environment is created in which people can practice with old and new rules and conventions (De Caluwé & Stoppelenburg, 2001). De Caluwé and Stoppelenburg state that in a simulation game participants get to know each other’s opinions and beliefs by exploring collaboratively the simulated reality.

Lane (1995) mentions several reasons why simulation games are an adequate means for stimulating learning. First, simulation games fit very well with the view of knowledge as something constructed by learners. In a simulation game the all-knowing teacher or trainer is absent. Rather, there is a facilitator who helps learners discover for themselves the content of the learning process. Second, simulation games provide for a rich experience: participating in a micro-world evokes personal and even emotional learning. Furthermore, simulation games offer safe learning environments, they provide metaphors which foster understanding and communication, and finally, they are enjoyable for participants.

Practicing skills in a role playing game

A role playing game is suitable for training in human relations and skills, and for working on interpersonal problems (Goldstein, 1993). In role playing games trainees or trainers act out simulated roles. These games offer learners the opportunity to experience and explore a variety of situations from their work context (Goldstein, 1993). Skills are practiced in isolation in order to apply them to real situations afterwards. An advantage of role playing games is that learners can practice in a safe learning environment. Another advantage is that learners can choose the situations they want to practice with. They might even work with situations that do not occur frequently in day-to-day practice.

2.2.2 Designing learning environments that prepare for the job

Design models are helpful starting points for designers to design learning environments that prepare employees for their job. The ADDIE model is one of the most widely known models used by instructional designers and training developers. The acronym ADDIE refers to the major steps of the instructional design process: Analysis, Design, Development, Implementation, and Evaluation. This model prescribes a systematic approach to instructional development. The ADDIE model does not have one founder but was developed informally via oral tradition (Molenda, 2003). The sections below explain three important aspects of this systematic design model.

Task analyses

Task analyses are important in the phase of analysis. Conducting a task analysis can prevent a course from containing too general and theoretical information of questionable relevance to learners (Kessels & Smit, 1996). A task analysis is an aid for defining learning goals for a training that prepares learners for a specific task or function. Different techniques are suitable for this purpose such as the critical incident technique (Zemke & Kramlinger, 1991), or a think-aloud protocol (Grotendorst, 1998).

Instructional design theories

In the design phase, various instructional design theories are at the disposal of the designer. Instructional design theories offer explicit guidance on how to better help people learn and develop (Reigeluth, 1999). The US army training services laid the foundations for instructional design during the Second World War, when militaries needed to train large numbers of employees to perform complex tasks. Frequently used instructional theories include mastery learning (Block, 1971), instructional events (Gagné, 1974) and programmed learning (Lumsdaine & Glaser, 1961). These theories are respectively applied in the design of instruction on course level, on the level of one educational unit (a training session or lesson hour) and on the level of the steps learners should take. All these theories aim to design training programmes that focus on observable behaviour. This means that tasks were broken down into subtasks, each serving a different instructional objective. Mastery was believed to be possible for every learner, given sufficient training and feedback. Later on, models emerged that did not only emphasise the efficiency and effectiveness of instruction. Jonassen (1999) for instance looked at instructional design from a constructivist perspective. Constructivists assume that knowledge is constructed by learners based on their interpretations of experiences in the world. From this point of view, instruction should consist of experiences that facilitate knowledge construction.

Transfer

In the design of learning environments in which learning takes place prior to the intended application at work, it is important to pay attention to the transfer to the workplace of what has been learned in the learning situation (Kupritz, 2002; Tannenbaum & Yukl, 1992). Simons (1999) states that in order to optimise transfer, one needs to help learners solve the problems and paradoxes they encounter. This can be achieved by applying several strategies. Simons (1990) sums up conditions found in literature that could help learners retrieve the acquired information in situations different from the situation in which the information was obtained (far transfer). For instance the amount of metacognitive skills plays a role; when learners are conscious of what they know, they are better able to use their knowledge at the right moment. Another condition is that learners must see the relevance of the acquired information. Furthermore, Simons (1999) mentions measures that can be taken by staff members to promote transfer to the workplace. For instance, several people in the organization should agree that the goals are important for the organization, and at the same time they should convince others that this is the case. Bolhuis and Simons (2001) refer to some aspects of the knowledge process that should be taken into account: learners must be interested; they must process the information; they must learn to utilise the information; and they must be able to practice reflective action on the basis of the newly acquired information.

2.3 From training to learning

In the past decades, organizations used training activities as an important means to stimulate the learning of their employees. Only recently the focus has moved from preparing employees for the work off-the-job, to helping them improve their performance in the workplace itself. Marsick and Watkins (1990) refer to this change as a shift from training to learning. They state that "an overriding interest in how best to organize learning through training has taken attention away from the natural opportunities for learning that occur every day in a person's working life" (p. 4). This attention for the combination of learning and work was actually not new. In medieval guilds where apprentices learned their craft from their master, combining learning and work was common practice. The roots of workplace learning can be found in these guild systems (Streumer & Kho, 2006). Two reasons can explain the renewed interest for organizing learning in closer connection to the work people are doing.

First, the effects of training programmes in terms of transfer to the workplace were disappointing. Conditions of transfer include both the generalisation in the job context of material learned in training, and the maintenance on the job of the learned material over a period of time. Many formal training programmes were found not to achieve these goals (Baldwin & Ford, 1988; Burke & Baldwin, 1999).

Second, training programmes can be characterised as instructor-led, content-based interventions, leading to desired changes in behaviour, whereas what is needed in the workplace is employees who learn in a work-based process in order to increase their adaptive capacity (J. Reynolds, 2004). Off-the-job learning activities cannot be used for this purpose, since they miss the context in which the newly acquired subject matter expertise or skills must be applied.

2.3.1 Learning at the workplace

The focus on learning that precedes work shifted to an orientation in which learning and working were brought together. Notions such as work-based learning, work-related learning, informal learning, workplace learning, and on-the-job learning emerged. The desire to organize learning closer to the work context was matched by a growing desire to better understand the work environment as a powerful learning environment. This led to studies that aimed to answer questions such as: What is being learned at work? How is learning taking place? What factors influence this process? (Streumer & Kho, 2006). Studies that evolve around these kinds of questions aim to learn more about the learning potential of the workplace (Onstenk, 1997).

Eraut, Alderton, Cole and Senke (1998) for instance made a study of how learning takes place within the day-to-day work environment without any form of education or training. They conducted interviews with managers, professionals and technicians from engineering, business, and health care industries to find out how they learn, what they learn and what factors determine the amount of learning at work. Ruijters (2006) explored the diversity of learning in organizations, and found different ways of learning related to work, different employee preferences with respect to learning, and different thought processes related to these. There are also examples of studies that explored learning in one particular context. Berings (2006) studied learning on the job in the context of the nursing profession, Doornbos (2006) examined work-related learning at the Dutch police force, and Kwakman (1999) studied the learning of teachers at the workplace throughout their career.

These researches helped gaining a better understanding of the learning potential of the workplace. According to Onstenk (1997) learning at the workplace has three main sources. First, employees learn from the work itself. Demands and challenges that come from the work lead to problem-solving activities, to an improvement in quality, and to an increased ability in coping with change. These activities are an important source of learning from the work itself (Eraut et al., 1998). Second, the social work environment is a source of learning. Interaction with colleagues, customers and clients stimulates the learning of employees (Eraut et al., 1998). Kwakman (1999) found that employees learn especially from activities in which interaction with others occurs, and from activities in which reflection takes place. Third, information available at the workplace is a source of learning. Information, such as manuals or job aids, offer learning opportunities and at the same time help employees solve problems (Onstenk, 2001).

The purpose of learning at the workplace and the direction it should take are determined by the purpose and direction of the work goals (Eraut et al., 1998). The next sections explain learning at the workplace undertaken with two different intentions. Section 2.4 elaborates upon learning undertaken with the intention of doing the work better, and section 2.5 elaborates upon learning aimed at innovation.

2.4 Learning to do the work better

When employees focus on doing their work better, the content of the learning process they engage in is known within the context of their work. They learn from the context they're in and from their colleagues around them.

2.4.1 Learning processes in which the content is known within the work context

Socialisation is an important form of learning that employees can undertake in order to become better at doing the work. Socialisation is a learning process through which members of the organization learn from the tacit knowledge of their colleagues. Tacit knowledge is a form of knowledge that remains implicit. Nonaka and Takeuchi (1995, p. viii) define it as “personal knowledge embedded in individual experience … [that] involves intangible factors such as personal belief, perspective, and the value system”. The concept is taken from Polanyi (1983) who emphasised that most of our knowledge cannot be put into words. Polanyi says that we “know more than we can tell” (p. 4). As an example Polanyi describes our ability to recognise faces. We know a person’s face, and just recognise it. Yet, it is difficult to explain how we recognise this face among thousands of other faces. Socialisation is learning through which this implicit knowledge might be learned.

Master-apprentice learning

A well known form of learning with the intention of becoming better at doing the work, is apprentices who work with their masters and learn their craftsmanship through observation and participation. Nonaka and Takeuchi (1995, pp. 63-64) give the example of a company that wanted to design a home bread-making machine. The dough-kneading process is tacit knowledge possessed by master bakers. In order to optimize the dough-kneading process of the machine, one of the employees joined one of the best bread makers as an apprentice. One day the apprentice noticed that the baker not only stretched the dough, but also ‘twisted’ it. This appeared to be the secret for making nice and tasty bread. The learning process of socialisation is mainly based on observing and imitating the behaviour of a role model (Brockmöller, 2008, p. 51).

Legitimate peripheral participation

Observing and imitating a role model consists of more or less conscious actions taken by learners. Lave and Wenger (1991) emphasise that learning also occurs through a process of legitimate peripheral participation. A newcomer is as assistant involved in real work projects. In a collaboration, colleagues at the centre of the community tell stories. These stories acquaint the learner with the way of working of the community. He or she may gradually move from the periphery of the community to its centre. The tasks he or she executes might change as well. There is no explicit instruction, but through participation, employees become better at their work. Through this process, they are socialising in a community of colleagues. Being given the chance to participate in the community of colleagues, people pick up relevant jargon, imitate behaviour and gradually start to act according to prevailing standards (Brown et al., 1989).

Arrange for feedback, evaluation, and reflection

Although the process of socialisation is described as an interactive process that happens in daily work situations, opportunities for feedback on the effects of one's behaviour, as well as evaluation and reflection on the behaviour are essential for facilitating learning at work (Ellström, 2002).

One form this can take is mentoring (Kram, 1988). In contrast to the characterisation of mentoring as a single relationship between a more senior employee and a protégée, Higgins and Kram (2001) focus on mentoring as a multiple relationship phenomenon. Another possible form is the use of 360-degree feedback as a means of self-evaluation. In this form of feedback, employees collect feedback from subordinates, colleagues, customers, and their manager. Although the purpose of such feedback is often regarded as measuring performance, it can also be used as a method to enhance employee development (Tornow, 1998).

2.4.2 Designing learning environments for doing the work better

Section 2.3 described the transition of an era in which formal training was dominant to an era in which learning took a central place. This shift also has implications for the design of learning environments that support learning in the context of work.

Because of the long tradition of formal training programme design, many validated models and design aids exist. However, there is much less available for the design of learning activities at the workplace. This has not only to do with the shorter tradition of the design of learning environments compared with that of training programmes, but also with the nature of the learning processes (Lowyck, 2001). In training programmes, the progress of the design process is more or less predictable, whereas in learning at the workplace, learning is owned by the employees themselves. Many actors collaborate in an iterative process, because complexity increases, and the possibility of monitoring and predicting diminishes (Lowyck, 2001). In this type of design process, there is no educational designer or manager who has the exclusive responsibility for the design of the learning environment. Rather the learners themselves are co-creators of this environment (Harrison & Kessels, 2004). Eraut et al. (1998) do point to the role of managers, who can stimulate people's willingness and their ability to learn from and with each other.

2.5 Learning to innovate at work

Preparing employees for their work implies a learning process in which the content is completely known in advance. Employees who learn to do the work better, use for this learning process content that is available within their work context. However, there are situations that require a different kind of learning. This form of learning is not so much initiated from the perspective of learning (How can I become better at this task?), but rather from the perspective of work (How could we solve this problem?). Learning with the intention of innovating at work starts with the employees' intention of solving a difficult question, for example, a question that they previously tried to solve, but for which actual ways of working do not offer a satisfactory solution. The content of this kind of learning is not necessarily available within the context. Sometimes it is, and then the solutions developed elsewhere within the organization can be used as a starting point to solve the problem. But sometimes it is not, and then a completely new solution must be developed. The learning processes that make up these two scenarios are different, and their outcomes may be too. The first kind of learning is more associated with the development of gradual improvements, whereas the latter can be linked to the development of radical innovations. The first type of learning processes are similar to what Ellström (2002) refers to as productive learning, whereas the second type of learning processes correspond with what Ellström calls creative learning. Section 2.5.2 will further elaborate on these different learning processes. But first, Section 2.5.1 introduces the concept of knowledge productivity. This is a concept in which learning and innovation are brought together. After an explanation of this concept, and an elaboration on the different forms of learning related to it, Section 2.5.3 explores the design of learning environments that could support this kind of learning.

2.5.1 Knowledge productivity

A concept in which the notions of learning and innovation come together, is the concept of knowledge productivity. Kessels (1995, 2001b) introduced this concept and described it as the process by which new knowledge is created in order to contribute to innovation in the workplace. Knowledge productivity refers to the process of tracing relevant information, using this information to develop new abilities, and applying these abilities to the gradual improvement and radical innovation of products, services, and work processes. The concept is inspired by the work of Drucker (1993). Drucker describes the important role of knowledge in the knowledge economy and the challenge for employees to become knowledge workers in their organization (Drucker, 1999). These knowledge workers should contribute to the organization's processes by developing gradual improvements and radical innovations. From this perspective the work environment is actually the learning environment in which employees develop the necessary abilities for the improvement and innovation of products, services and their working processes. Work processes then take on the characteristics of learning processes (Dixon, 1999; Kessels & Van der Werff, 2002).

Working rather than learning as the starting point

As stated in Section 2.3, the transition from training to learning is marked by concepts such as work-based learning, work-related learning, informal learning, and on-the-job learning. Although there are differences and communalities between these concepts (see for instance Streumer & Kho, 2006), what they all have in common is that they point to a specific form of learning. This is either the kind of learning (informal or non-formal learning), the content of the learning (related to the work), or the location at which learning takes place (the workplace - on the job). What would it be like to turn this around? What if these concepts were focused on the work, rather than on learning? Doing so literally would result in word combinations such as learning-based work. Although this is a non-existing term, the phrase shows a different perspective on the relationship between learning and work. The starting point is not an employee who wants to learn something, or the opportunities to learn that are offered by the day-to-day work environment, but rather the work itself in which difficult questions arise that can be answered by developing gradual improvements and radical innovations.

2.5.2 Learning processes related to knowledge productivity

The process of knowledge productivity manifests itself in learning that can be characterised as developmental learning (Ellström, 2002) or double loop learning (Argyris & Schön, 1978). Ellström describes developmental learning as opposed to adaptive learning. Adaptive learning refers to learning processes that cause changes within a given framework or a given organizational structure, whereas developmental learning causes changes “that represent a break with the past and go beyond the given” (Ellström, 2002, p. 423). The difference between adaptive and developmental learning may be compared to the distinction made by Argyris and Schön (1978) between single loop learning and double loop learning. Argyris and Schön regard learning as the detection and correction of errors. Single loop learning takes place when, in an attempt to correct an error, given goals, values and plans are operationalised rather than questioned. In double loop learning, learners follow a different strategy. They question the governing variables, which may result in changing the goals, values and existing plans.

Knowledge productivity refers to learning processes in which learners break with the past, and develop new approaches. Within this form of ‘breakthrough’ learning, another distinction can be made, namely between the type of learning processes that precede the development of gradual improvements, and the learning processes that precede the development of radical innovations. Following Ellström (2002), the first might be characterised as productive learning, and the second as creative learning. Productive learning is required when employees encounter novel situations for which no knowledge is available from previous experience. Learners then engage in a process of problem solving through experimentation in which they invent and test solutions (Ellström, 2002). Creative learning takes place when the learner encounters an unclear and puzzling situation. In order to develop a satisfactory way of dealing with this situation, it is necessary to question implicit taken-for-granted premises, and established definitions of problems, and then transform these.

The two types of learning may be used in order to serve two kinds of strategies. Von Krogh, Roos and Slocum (1994) distinguish between survival and advancement. Survival strategies aim to secure current profitability whereas advancement strategies aim to influence future profitability (Scardamalia & Bereiter, 2003b). Productive learning may be a necessary form of learning for organizations to secure their survival. Creative learning may help them influence future profitability.

Productive learning for gradual improvement

In productive learning, learning that occurs in parallel with the development of gradual improvements, the application of knowledge and solutions developed elsewhere in the organization plays an important role. March (1991) refers to this as the process of exploitation. The aim of exploitation is to make lessons learned by people at one place available to others elsewhere. March uses the concept of exploitation in contrast to exploration, a learning process through which entirely new approaches and solutions are developed.

In productive learning, the concept of common knowledge is promising. Dixon (2000) introduced this term and described it as "the knowledge that employees learn from doing the organization's tasks" (p. 11). Examples of common knowledge comprise the ability to introduce a new drug into the diabetes market, or the ability to reduce costs on a specific project. Common knowledge is always linked to action. Dixon describes different types of learning required to make use of common knowledge. These are all learning processes in which the content is known within the context: some employees within the organization have common knowledge, and others want to learn from it. Dixon uses the word transfer to indicate the process by which knowledge developed by persons in one situation can be used by persons in another situation. In the remainder of this section the word transfer will only be used to indicate the different forms Dixon distinguishes. The concept of transfer is easily associated with a conception of knowledge as a package that can be seen detached from people, whereas in this thesis -as in the work of Nancy

Dixon- knowledge is seen as something that is connected to people (see Section 2.1.1). The five forms of common knowledge transfer are (Dixon, 2000):

- Serial transfer: this learning process takes place when a team that has gained knowledge in a project or task applies that knowledge to a new setting in which the team performs the same task.
- Near transfer: this is the case when the knowledge which a team has developed by executing a task frequently is used by another team in a similar setting.
- Far transfer: this is the case when teams who have developed knowledge by doing a non-routine task make their knowledge available to another team that uses this knowledge for a similar task in another part of the organization.
- Strategic transfer: in this type of learning, the knowledge that is available in several teams within an organization is needed to accomplish a strategic task that occurs infrequently but that is important for the whole organization.
- Expert transfer: expert transfer takes place when a team faces a question that goes beyond the scope of its own knowledge and when the team seeks the expertise of others in the organization.

Creative learning for radical innovation

The process of creative learning, in which the given variables are questioned, and in which new solutions are developed that radically break with the existing way of working, can be characterised as an insecure process. Important elements of this kind of learning are the processes of combination, experimentation and reframing.

Novel combinations

Arthur (2007) did inquiry into the process of invention. Invention can be regarded as the starting step for innovation, the step in which root ideas are established. According to Arthur, and this is in line with the assertion made by Schumpeter in 1912, invention is a process whereby novel technologies come into being as fresh combinations of existing ones. Nahapiet and Ghoshal (1998) also mention the process of combination in relation to the creation of new knowledge. According to them, the process of combination consists of combining elements previously unconnected or developing novel ways of combining previously associated elements.

Experimentation

Kolb (1984) described experimentation as one of the elements of his four stage learning cycle. Active experimentation is the phase in which learners experiment in order to create new experiences which may be reflected upon and which stimulate new learning. Thomke (2003) describes the necessity of experimentation in the context of innovation. Thomke portrays experimentation as an iterative process of understanding what works and what doesn't. He emphasises that both results (something appears to work or it doesn't) are equally important for learning. Experimentation enables people to create and to evaluate new ideas and concepts, and is central to every organization's ability to innovate (Thomke, 2003).

Reframing

Innovation processes are processes in which participants collaboratively work on difficult questions. The negotiation of meaning plays an important role in these collaboration processes. Negotiating meaning doesn't mean that participants need to negotiate in order to agree on definitions and on the meaning of information. Rather, negotiation refers to group members trying to understand one another (Kirschner, 2002). It is a process pointed towards the exchange of ideas that help understand what other participants mean by something they've said.

In the learning processes that occur in parallel with the development of radical innovations, the negotiation of meaning must focus not only on understanding the perspectives of others, but also on creating new perspectives. Nadler and Tushman (1989) describe this in the context of organizational change. They state that frame-breaking changes require a radical departure from the past and a recreation of the future.

2.5.3 Designing learning environments for knowledge productivity

If knowledge productivity is important for an organization to survive in a knowledge economy, and if that means that the work environment should be perceived as a learning environment, one could think of a corporate curriculum that supports employees in acquiring the competences needed for being knowledge productive (Kessels, 1996a, 2001a). This curriculum can help employees turn their work environment into a learning environment. It is not a formal plan for learning that prescribes which courses need to be followed. Instead, the curriculum consists of learning functions that help members of the organization to create an environment in which learning and working are combined. Shuell (1988, p. 285) defined learning functions as the psychological functions that must be performed by the learner (e.g. attention, feedback or evaluation). Learning functions describe what must be performed, but not the specific way in which it must be performed. Furthermore, learning functions can be initiated by either the teacher or the learner (a teacher might capture attention by highlighting and emphasising verbally, and the learner might underline and take notes). The learning functions put forward by Kessels (1996a) refer to learning in the context of work. In this case they can be initiated either by employees themselves or by others who participate in the work environment (e.g. managers or colleagues).

The corporate curriculum serves seven related learning functions that aim to stimulate or create the conditions required for the development of knowledge (Van Lakerveld, 2005). These learning functions comprise (Kessels, 1996a): (1) subject matter expertise, (2) problem-solving skills, (3) reflective skills and metacognitions, (4) communication skills, (5) self-regulation skills, (6) peace and stability, and (7) creative turmoil. Previous research has shown the importance of these seven learning functions in relation to an organization's ability to improve and to innovate (Stam, 2007; Van Lakerveld, 2005). Van Lakerveld (2005) concluded that the first five learning functions each describe different aspects of the learning process, but they are sufficiently related to justify their combination in the overarching concept of the corporate curriculum. The seven learning functions form an important part of the conceptual framework that is central in this research. Section 2.6 presents this conceptual framework and elaborates on each of the principles.

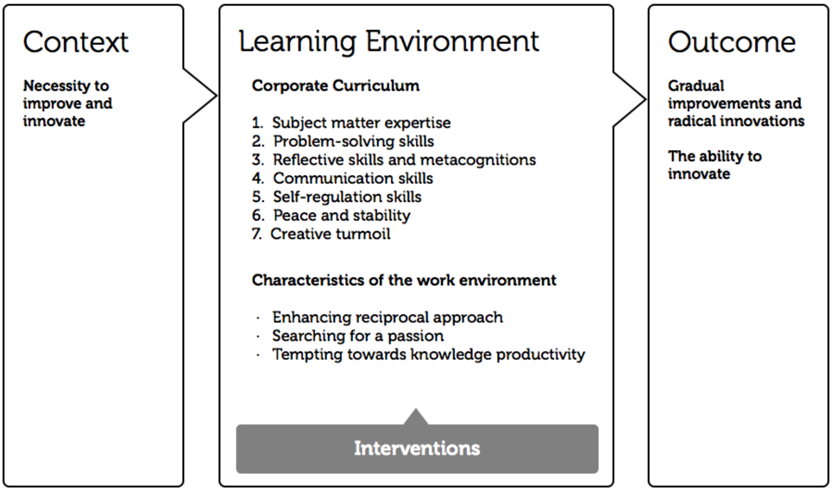
As the corporate curriculum is not situated in an isolated learning centre, but integrated in the work environment, it is necessary to look at conditions in the work environment which support the learning functions of the corporate curriculum. Kessels (2001b, 2004) formulated three provisional development principles for work environments that support this curriculum: 1. Enhancing reciprocal appeal, 2. Searching for a passion, and 3. Tempting towards knowledge productivity. The first principle refers to the creation of a favourable social context, the second refers to the content component that lies at the heart of every innovation process, and the third principle indicates that managing or planning learning for innovation is hardly possible. Enticing people to these learning processes is probably a more suitable strategy. The three development principles, underpinning the design of the work environment, will also take a prominent place in the conceptual framework that Section 2.6 presents.

2.6 A research framework for knowledge productivity

The previous sections elaborated upon three forms of learning in the context of work. It was argued that the last form, learning with the intention of innovating, is the most promising form of learning in a knowledge economy. Knowledge productivity (Kessels, 1995) was proposed as a concept that describes the process of learning leading to gradual improvements and radical innovations. This section presents the conceptual framework that aims to further examine this form of learning and working in a knowledge economy. The framework is based on existing frameworks for researching knowledge productivity proposed by Harrison and Kessels (2004), Kessels and Harrison (2004) and Keursten and Kessels (2002). In Figure 2.4 the elements previously discussed are brought together in a coherent conceptual framework.

Figure 2.4.

Conceptual framework for researching knowledge productivity.



2.6.1 Context

The learning environment that supports knowledge productivity is influenced by the context of the organization. This context creates the necessity for an organization to improve and innovate. The triggers for investing in improvement and innovation may come from both outside the organization (e.g. technological, political, social, or environmental developments), and inside the organization (e.g. a problem with a work process or production line, retention, a change in vision or ambition).

With respect to the first, organizations being confronted with developments outside their organization may follow two different strategies. Either one that promotes survival, or one that promotes advancement (Von Krogh et al., 1994). Survival strategies aim to secure current profitability, while advancement strategies strive to develop future profitability (Scardamalia & Bereiter, 2003b).

With respect to the latter, Ellström (2002) differentiates between two types of problematic situations. Employees may encounter novel or unfamiliar situations for which the solution does not logically follow from previous experiences, or they may be confronted with an unclear or puzzling situation, a situation for which they feel it is necessary to break with existing norms, rules or ways of working.

In line with the above, either the organization's strategy or the encountered problem would define whether gradual improvements or radical innovations are to be pursued. Survival strategies are more likely to result in gradual improvements, whereas advancement strategies are more likely result in radical innovations. Being confronted with an unfamiliar situation for which the solution is not immediately clear, employees might develop gradual improvements. Employees who are confronted with puzzling situations that challenge them to break with existing norms, rules, and operating procedures, are more likely to develop radical innovations.

2.6.2 Learning environment and interventions

A work environment that invokes a process of knowledge productivity should support the seven learning functions of the corporate curriculum. Besides, there are three development principles that could serve as guidelines for designing such a work environment. These seven learning functions and three development principles form the starting point to better understand the learning environment.

Seven learning functions of the corporate curriculum

1. Subject matter expertise

This learning function refers to the acquisition of subject matter expertise and professional knowledge directly related to the organization's business and core competences (Kessels, 1996a). Subject matter expertise forms the basis for improvements and innovations when it is applied to solve problems that occur. Expertise could be seen as a function of a person's talent in a specific domain, as well as a formal and informal education and experience in the field (Amabile, 2000, p. 334). According to Amabile, to stimulate productive creativity, the employees involved must demonstrate, amongst others, high levels of expertise.

2. Problem-solving skills

This learning function can be regarded as the ability to identify and deal with new problems, applying the acquired subject matter expertise (Kessels, 1996a). Within the process of problem solving, knowledge is put into use, or made productive (Stam, 2007). Problem solving is an activity that leads to solutions for problems, but at the same time it is a learning activity. Learning occurs when people look for solutions and experiment (Bolhuis & Simons, 2001). The yield of this process is a solution for the problem at hand, as well as a way of solving future problems. Problem solving in the context of innovation is a typical form of problem solving because the kind of solution is not known in advance. There is no teacher or manager who holds the right solution.

3. Reflective skills and metacognitions

Where the first two learning functions refer directly to the subject matter expertise and the way it could be applied to problem solving, this learning function refers to the ability to reflect upon these processes in order to become better at them. Although reflection can be defined as an individual activity, here it is typically seen as a group process and a social activity (M. Reynolds & Vince, 2004; Schippers, Den Hartog, & Koopman, 2005). Reflection is not a mere cognitive activity (Schippers et al., 2005); it becomes meaningful for the process of knowledge productivity as soon as it is combined with planning and action. The effectiveness of reflection for bringing about change is affected by the extent to which intended changes, detected or planned during the reflection phase, are carried out (Schippers et al., 2005). Van Lakerveld (2005) found that this learning function is clearly connected to improvements and innovations in organizations, although it is also the learning function that suffers most from a lack of time, and it is difficult to organize.

Metacognitions are the skills that people need to regulate their own learning. The development of metacognitive skills is related both to one's learning capacity (Bolhuis & Simons, 2001) and to the improvement of the work environment (McGivern & Thompson, 2004). In the context of knowledge productivity this means that people should not only be concerned with the specific content and context of the innovation at hand but that they also should pay attention to the learning side.

4. Communication skills

This learning function stresses the development of skills that help people access the knowledge network of others, and participate in communities of practice (Kessels, 1996a). Learning in training and educational programmes has long been focused on individual learning. The development of social and communicative skills is therefore not always obvious (Bolhuis & Simons, 2001). This learning function stresses that the process of knowledge productivity is a process between people. It is neither a solistic activity nor is it a matter of exchanging mere facts. Communication skills are a necessary vehicle to gain access to networks and communities, and they also help people share what they know. This is an important starting point for the creation of new knowledge (Kwakman, 2001). Communication skills also enable people to create an environment in which they feel comfortable to exchange views and opinions. This is required for knowledge productivity as well: neither speaking in polite routines, nor debating and defending one's own ideas will lead to the creation of new knowledge (Scharmer, 2007). Conversations in which people listen to each other with an open mind, and in which participants recognise their common ground, are necessary for innovation (Scharmer, 2007). This requires high standard communication skills.

5. Self-regulation skills

This learning function refers to the skills that help people regulate motivation, affinities, emotions and affections concerning working and learning (Kessels, 1996a). Affections, affinities and emotions play an important role in knowledge work. People cannot be inventive in a domain that they are not motivated for (Kessels & Van der Werff, 2002). Self-regulated learning refers to independent, highly effective approaches to learning (Perry, Phillips, & Hutchinson, 2006). Self-regulated learners distinguish themselves by their view of learning as something they do for themselves rather than as something that is done to or for them. Self-initiated motivational, behavioural, and metacognitive processes enable learners to become controllers rather than victims of their learning experiences (Zimmerman, 1998). Self-regulation can be seen as a process that consists of three major phases: forethought, performance, and self-reflection.

The first phase is very important, since this is the phase in which learners' personal beliefs such as self-efficacy play an important role. Self-efficacy refers to personal beliefs about one's capability to learn or to perform at certain designated levels (Bandura, 1977). People who are self-efficacious set higher goals for themselves and are more likely to choose effective learning strategies.

In the second phase, performance, the intrinsic motivation, plays an important role. Learners who have an intrinsic interest in a task will continue with their learning efforts, even in the absence of tangible rewards (Zimmerman, 1998). Setbacks or surprises occur in any innovation project. Understanding the learning process is a more appropriate method to handle these, than attempting to remove all setbacks and surprises (Schroeder, Van de Ven, Scudder, & Polley, 1989). Furthermore, when people are intrinsically motivated for a task, they tend to be more vitalized than people who are extrinsically motivated (Nix, Ryan, Manly, & Deci, 1999). Intrinsically motivated teams will persevere when things are getting tough, while others would rather give up (Kessels, 2001b; Van Lakerveld, 2005).

6. Peace and stability

The first five learning functions are directly related to the process of knowledge productivity of individuals and teams. The two remaining learning functions relate to the organizational environment. Peace and stability as well as creative turmoil are expected to contribute to different kinds of learning processes. Learning that occurs in parallel with the development of gradual improvement is likely to benefit from conditions of relative stability and the time to reflect on what is needed in order to improve current operations and processes. Learning that parallels the development of radical innovations is more likely to benefit from the sense of urgency provided by creative turmoil (Harrison & Kessels, 2004).

This learning function serves to promote the peace and stability in a work environment that enable exploration, coherence, synergy and integration (Kessels, 1996a). Peace and stability are necessary to reflect upon the work and learning processes. They offer the opportunity to deepen existing knowledge and to acquire new subject matter expertise. They also offer the space to experiment with new approaches. However, the drawback is that too much calm and stability may prevent people from moving ahead (Van Lakerveld, 2005).

7. Creative turmoil

Creative turmoil refers to the sense of urgency that evokes creativity. Creative turmoil is often caused by an existential threat (Kessels, 2001b). In innovation processes, ideas can be generated but not acted upon until some form of shock occurs (Schroeder et al., 1989). Shocks include changes such as new leadership, product failure, a budget crisis, or an impending loss of market share. These shocks stimulate people's action thresholds into paying attention and initiating action. Next to shocks, pressure could also trigger creativity. Amabile (2000, p. 336) explains that "if people believe that there is a real urgency to solve the problem, because their unit, their organization, or the world has a clear need for a swift revolution, they may be spurred on to higher levels of creativity by that pressure – as long as there is at least some time to explore alternative solutions …". Senge (2000) refers to the necessity of managing creative tension around the gap between vision and reality. Mastery of such tension allows for fundamental shifts.

Although external pressure is important to make a difference in daily work, not all unrest is creative turmoil. Too much unrest may lead to many new ideas but leaves little opportunity to elaborate on them (Kessels, 1996a).

Characteristics of the work environment

Enhancing reciprocal appeal

Reciprocal appeal is the mechanism that forms the basis for a stable and rich learning environment that promotes knowledge productivity. Employees in these learning environments cannot afford to take a consumer's attitude (Kessels, 2001b). Rather, they must design an environment in which they can collaborate on a basis of mutual respect and mutual interest. The principle of reciprocal appeal indicates that such an environment becomes attractive for participants to engage in, as soon as they can both give something to it and take something out of it.

Searching for a passion

Human beings cannot be smart against their will (Kessels, 2001b). A knowledge productive work environment encourages people to find out what they are passionate about. Obedience, discipline and loyalty might be helpful to overcome a point where one gets stuck. However, they do not lead to excellent achievements if they are not linked to a personal passion for a specific theme (Kessels, 2001b). People do their most creative work, when they are passionate about what they are doing (Amabile, 2000).

This principle indicates that a work environment should support people in finding the themes they are genuinely interested in, in order to deliberately use related topics in the process of knowledge productivity. It is a principle closely related to the concept of intrinsic motivation. Intrinsic motivation could be seen as any motivation that arises from the individual's positive reaction to qualities of the task itself (Amabile, 1996). According to Deci and Ryan (1985) intrinsic motivation is based in people's innate needs for competence and self-determination. The intrinsic needs for competence and self-determination stimulate an ongoing process of seeking and attempting to conquer challenges. When people are free from the intrusion of drives and emotions, they seek situations that interest them and that require the use of their creativity and resourcefulness (Deci & Ryan, 1985, p. 32).

Tempting towards knowledge productivity

The use of power, status and pressure do not lead to knowledge productivity. Learning is not a process that can be managed systematically. In this context the term management implies control of processes that may be inherently uncontrollable (Von Krogh, Ichijo, & Nonaka, 2000). Management is a problematic concept when applied to innovation. Indeed, a central problem in managing innovation, is the determination of whether and how to continue a developmental effort in the absence of concrete performance information (Van de Ven et al., 1999). Kessels (2001b, 2004) stated that instead of trying to manage this process, employees should develop the competence to tempt each other to be knowledge productive by creating a favourable social environment in which personal ambition and motives are connected to one another.

Interventions

Interventions that aim to support the learning of employees in a knowledge economy do not consist of mere training activities. Instead, they seek to enhance the learning capacity of employees (Tjepkema, Ter Horst, & Mulder, 2002). There are no trainers or instructors who carry the responsibility for the expected learning process and learning goals. Learners themselves carry this responsibility and facilitators perform the role of mentor, or coach. The facilitators guide the learning process but don't completely control or design it. Employees work as a team, sometimes supported by a learning consultant (Harrison & Kessels, 2004).

2.6.3 Outcome in terms of innovation

One of the outcomes of the process of knowledge productivity, are the concrete improvements and innovations. This section describes a view of innovation that is in line with the view of knowledge and learning introduced in Section 2.1.1.

Innovation is intentional and not objectively defined

West and Farr (1990) defined innovation as the intentional introduction and application within an organization of ideas, processes, products or procedures, which are new to the unit of adoption, and are designed to significantly benefit the organization or society at large. With unit of adoption they mean for instance a team or a department for whom the innovation could mean a substantial benefit. This definition contains two key elements.

First, innovation is intentional. People innovate with the intention of making something that organizations or society at large can benefit from. Not all innovations become commercially successful, but they are always the subject of an attempt to prove their commercial worth. An innovation is something new which is presented in such a way that its value will be determined (Wijnberg, 2004). From the perspective of learning one could state that the intention of this learning process is what matters most. Indeed, at the beginning of an innovation process it is not known whether the innovation will become commercially successful, but even if it will not, learning has taken place.

Second, the innovativeness cannot be determined objectively. An innovation is an innovation as long as it is new to the unit of adoption. This aspect is important in the present research, which regards innovation primarily as a learning process. Even though a new product might exist elsewhere, if it is new for the people who worked on it, it is considered an innovation. After all, they have gone through a productive and creative learning process. In the same line of reasoning, new products, services or ways of working that have been designed by another unit or organization than the unit or organization that buys them (or 'adopts' in terms of West and Farr (1990)), are regarded as innovations for the people who developed them. If innovations were bought (or adopted) by others, the process that takes place is better described as a process of adoption or implementation than as a process of innovation.

Gradual improvement versus radical innovation

The conceptual framework distinguishes between gradual improvement and radical innovation as distinct forms of innovation. This perspective differs from how some scholars depict the outcome of innovation processes. Francis and Bessant (2005), and Tidd, Bessant and Pavitt (2005) describe different forms of innovation in terms of their degree of radicalness. They consider the degree of radicalness as a continuum, with incremental innovation on one side and radical innovation on the other. Other distinctions in the degree of radicalness include variation and reorientation, routine innovations and radical innovations, ultimate innovations and instrumental innovations (for an overview see: Damanpour, 1991).

The present research considers innovation as something that appears in two distinct forms: gradual improvements and radical innovations. In line with Walz and Bertels (1995) gradual improvement is preceded by a process that elaborates on what is already present and leads to additional refinement and specialisation. Radical innovation is preceded by a process that involves breaking with the past and creating new opportunities. This distinction does justice to the idea that the development of gradual improvement and radical innovation each require a different kind of learning process. Gradual improvement is associated with productive learning, a learning process for which the content is available within the context. Radical innovation is linked to creative learning, a learning process for which the content must be developed by participating employees (see Section 2.5.2).

Whether an innovation process results in gradual improvements or in radical innovations will depend on the strategic choice of the organization or the kind of problems employees are faced with (see Section 2.6.1). However, the nature of the innovation process might also depend on the preferences of the employees themselves. Kirton (2003) distinguishes between cognitive styles used by employees with respect to problem solving. These styles vary from highly adaptive to highly innovative. Employees who are highly adaptive prefer a certain structure in the problem that is presented, whereas employees who are highly innovative are flexible on this point. Kirton argues that the division between adaptive and innovative employees is not absolute. This may vary for instance according to their experience.

Innovation of products, services, and processes

A first association with innovation might be a typical group of technical experts, working in a laboratory or an R&D department to invent new products. This association prevents an appreciation of much real life innovation (Jacobs, 2007). Volberda, van den Bosch and Jansen (2006) even found in their study of innovation in Dutch organizations, that only 25% of all innovation is determined by technological knowledge acquired via R&D investments. The rest, 75% of all innovations, came about through changes in the organization and management of the work. Because of the variety of innovation that comes about in this manner, innovation can be referred to as both technical and administrative (Damanpour, 1991). Technical innovation relates to products, services, and production process technology. Administrative innovation relates to innovation in organizational structures and administrative processes.

In the present research this led to a definition of the variety of innovation in terms of product innovations, service innovations, and process innovations. In this distinction product and service innovations are new products or services that are introduced to meet an external user or market need (Damanpour, 1991). Process innovations are new elements introduced into the way of working of the organization. The last category also includes administrative innovation.

2.6.4 Outcome in terms of the ability to innovate

Besides concrete improvements and innovations, another yield of the learning process is a contribution to the ability of learners to innovate. Although improvements and innovations sometimes represent great economic value, it is this ability to innovate that enables people to use their experiences from one innovation process, in another situation.

Two of the learning functions that are said to be important in a work environment which supports learning for innovation, contribute to this sustainable yield of innovation: problem solving, and the development of metacognitive skills. Indeed, the yield of the problem-solving process is to find not only a solution for the problem at hand, but also a way of solving future problems (Bolhuis & Simons, 2001). Also, the development of metacognitive skills is related to one's learning capacity (Bolhuis & Simons, 2001). Since solving problems and the development of metacognitive skills are said to be necessary for innovation, the participation in innovation processes as such may contribute to the future ability of learners to successfully participate in new innovation processes.

In this respect Cohen and Levinthal (1990) mention the absorptive capacity of learners and organizations. An organization's absorptive capacity is the ability to recognise new information, assimilate it, and apply it to commercial ends. In other words, its absorptive capacity refers to its innovative capabilities (Cohen & Levinthal, 1990). According to Cohen and Levinthal this ability is closely related to the available prior knowledge. Prior related knowledge can include basic skills, shared language, but also knowledge about recent scientific and technological developments in a given field. Their statement relates to the contention that prior knowledge enhances learning. They suggest that memory development is self-reinforcing in the sense that the more information is stored in memory, the easier it is for the learner to use this information in new settings.

The above confirms the notion that participation in innovation processes is likely to contribute to the future ability of participants to innovate. However, since no two innovation processes are alike, they require a new learning process each time. Previous experience can at best contribute to a faster learning process the following time. However, it will never completely account for the learning in a new situation.

2.6.5 A series of studies to explore and enable knowledge productivity

The abovementioned elements of the conceptual framework were conceptualised with a literature review. It would now be worthwhile to learn more about the extent to which these elements support a better understanding of learning processes undertaken with the intention of innovating in practice. And, consecutively, to find out the extent to which these elements can be deliberately applied in order to foster innovation. For this purpose a series of studies has been conducted in a variety of contexts. The series was not completely designed in advance. Insights from one study were conducive to determining the direction of the following study. Chapter 3 describes the different studies and their interrelatedness. It also elaborates on the central research questions of each of the studies, and on the research methods that were deployed to answer them.

3

The research design: a building block approach

The research design employed in the present research is best characterised as a building block approach. Such a design combines different data-gathering strategies that are geared to the situation encountered in the research field. This approach has parallels with what Denzin and Lincoln (2000), and Kincheloe and Berry (2004) refer to as methodological bricolage. The first section goes deeper into this approach to research. Then the choice of focusing on 'innovation practices' is explained. The remainder of the chapter elaborates upon the different methods that form the building blocks of the research design. The research started off with a meta-analysis of reconstruction studies of 18 innovation practices. As a next step, in a multiple case study, 10 ongoing innovation practices were followed. The findings from this study together with an additional literature review led to the definition of 11 preliminary design principles. These principles reflect the factors that enhance the learning processes leading to innovation. Participants and facilitators in innovation practices validated these principles. Then, an expert consultation was carried out to both evaluate the principles and obtain critical reflections on them. Finally, a design study was conducted consisting of four types of design labs in which a total of more than 100 participants took part. This study aimed at finding out the extent to which the design principles could be deliberately applied to design a work environment that promotes the learning processes leading to innovation.

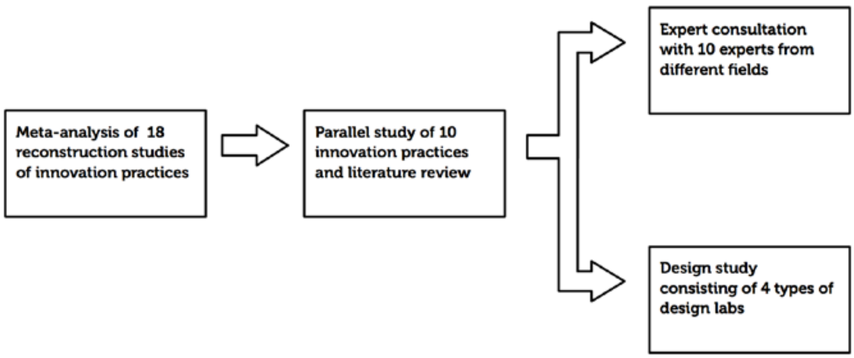
3.1 Methodological bricolage

Denzin and Lincoln (2000) described the qualitative researcher as a bricoleur. The French word 'bricoleur' refers to a handyman who makes creative and resourceful use of the available tools to complete a task. Kincheloe and Berry (2004) have built further on this image. They regard bricolage as a research perspective from which research methods are defined actively instead of passively. Researchers actively construct their research methods on the basis of the available tools, rather than passively receiving one 'correct', universally applicable methodology. From the different kinds of bricolage described by Denzin and Lincoln (2000) (interpretive, narrative, and methodological), methodological bricolage best characterizes the approach followed throughout this present research. In methodological bricolage the researcher combines different methods and adapts these to the situation at hand. The result of this work may be seen as an emergent construction (Denzin & Lincoln, 2000).

In the present research the actively constructed and emergent approach is reflected in the way the building blocks follow one another. Their sequence was not determined by a rigid design. One building block followed another based on the findings in the preceding study, and based on the dynamics in practice. Figure 3.1 presents the different building blocks. The first block consists of a meta-analysis of reconstruction studies of 18 innovation practices. This study was followed by an additional literature review and a parallel study in which ongoing innovation practices were studied. These activities form the second building block. The design principles that resulted from this phase were object of further investigation in two new studies. An expert consultation offered a critical reflection on the content of the design principles, and a design study, consisting of four types of design labs, focused on the application of the design principles in innovation practices. Sections 3.3, 3.4, 3.5, and 3.6 describe the considerations that led to the choice of each of the building blocks.

Figure 3.1.

Building blocks that make up the research design.



In addition to the aim of connecting the research approach to occurrences in the research field, methodological bricolage serves another goal. Indeed, the use of different research methods, or triangulation, "reflects an attempt to secure an in-depth understanding of the phenomenon in question" (Denzin & Lincoln, 2000, p.5). Patton (1990) mentions triangulation, the combination of different methodologies in the study of the same phenomenon, as an important way to strengthen a study's design. The combination of multiple methodological practices in a single study is best understood as a strategy that adds rigor, breadth, complexity, richness and depth to any inquiry (Denzin & Lincoln, 2000, p.5). Table 3.1 shows the relationship between the main research questions and the different research activities.

Table 3.1

Relationship between research questions and research methods

Research question	Research activities
Research question 1: *What factors enhance the learning processes that lead to gradual improvements and radical innovations?*	• Meta-analysis of reconstruction studies of 18 innovation practices • Parallel study of 10 ongoing innovation practices • Literature review in the fields of innovation and learning • Validation of the preliminary set of design principles with participants and facilitators in innovation practices • Evaluation of the set of design principles and critical reflection on them by 10 experts
Research question 2: *To what extent can the factors identified be deliberately applied to design a work environment that promotes innovation?*	• Design study consisting of 4 types of design labs. Each of the types of design labs was enacted several times. In total, 111 respondents took part in one or more design labs

3.2 Focus on innovation practices

It is not organizations, or individuals, but groups of individuals which form the starting point for this research. In answering the research questions, the various studies focus on groups that engage in a learning process with the intention of innovating. Such a group and its effort to work on innovation is here referred to as 'an innovation practice'. An innovation practice is a group of people who work together in order to find an innovative solution to a difficult question.

The choice for innovation practices was made because in a knowledge economy it is not per se departments, or even teams, or project groups that work on innovation. In a knowledge economy employees from different departments (Kanter, 2006), or professionals from different organizations (Twynstra the Bridge, 2006) often collaborate. It might even be a collaboration with individuals outside the organization (Senge et al., 2008), and with customers or users (Von Hippel, 2005). Although these people may not be in the same team, department or organization, they do have a shared concern or passion for something. This is what the word *practice* (Wenger, 1998) refers to. Furthermore, they share the intention or desire of coming up with innovative solutions for a difficult problem they face, or a puzzling situation they have encountered (Ellström, 2002).

An innovation practice is rarely a formal part of an organization. Often, people experience that existing structures, procedures, and rules hinder the innovation process. Therefore, they prefer to create a new and open kind of space that allows them to pursue their ambition. Sometimes facilitators have the responsibility to facilitate these innovation practices. These facilitators are best characterised as 'learning consultants' (Harrison & Kessels, 2004). They are not occupied with the specific content of the innovation, but feel responsible for facilitating the learning processes of the participants.

The cases that were part of the reconstruction studies used in the meta-analysis (see Section 3.3), and the cases that were part of the parallel study (see Section 3.4) are all innovation practices. These innovation practices can all be characterised by three aspects. First, there is an issue or problem that cannot be addressed successfully by doing what was done in the past. The problem requires a new approach in order to arrive at new solutions. Second, there is a manifestation of the issue or problem in a specific place. Third, there is a group of people who are actively involved and who want to help develop new solutions.

3.3 Meta-analysis of reconstruction studies

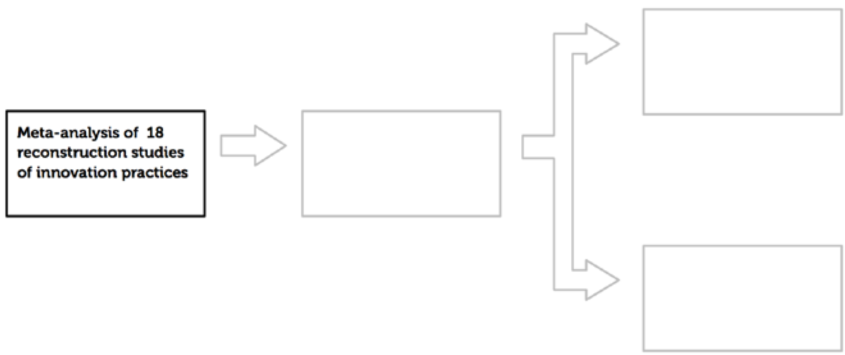


Figure 3.2.

A meta-analysis forms the first building block.

The research began with a meta-analysis of 18 reconstruction studies of innovation practices (see Figure 3.2). The analysis included studies conducted by Derksen (2003), Hartmann and Verdonschot (2007), Suryani (2002), Van de Swaluw (2003), Wang (2002), and Yuan (2002). Reconstruction studies are a specific form of case studies. Case studies are characterized by non-experimental designs that are adequate for descriptive research (Merriam, 1988). "By concentrating on a single phenomenon or entity ('the case'), this approach aims to uncover the interaction of significant factors characteristic of the phenomenon" (Merriam, 1988, p.10).

Reconstruction studies are a form of case studies in which a particular phenomenon, that has already occurred, is reconstructed in order to learn more about the phenomenon. Reconstruction could take place by means of interviews with the people involved, or by conducting a document analysis. Such design is also called a retrospective case history (Knapp, 1980).

All case studies, included in the meta-analysis, were innovation practices. These innovation practices were all finished, or partly finished by the time they were examined. The learning processes in these innovation practices were reconstructed in order to learn from them retrospectively. This approach was chosen for two reasons.

First, a case study approach is suitable for situations where it is not possible to separate the phenomenon's variables from its context (Yin, 1984). Since the innovation practices all took place in the complex and dynamic environments of the organizations that initiated them, a case study design was the obvious choice.

Second, a case study approach, in which the phenomenon of interest is studied retrospectively, is suitable to generate a longitudinal understanding of the interaction of many factors within an organizational system over time (Knapp, 1980). This recommendation can directly be linked to the aim of the present research, namely to better understand the factors that influence the learning processes in innovation practices.

The meta-analysis of the reconstruction studies permitted a synthesis of the results obtained in the separate studies that examined common issues (Matarazzo & Nijkamp, 1997). The goal of this meta-analysis was to validate and possibly extend the initial conceptual framework. The research questions central in the meta-analysis each refer to one part of the conceptual framework (see Figure 2.4 in chapter 2):

- *What led to the necessity to improve and innovate?*
- *What was the outcome of the innovation process?*
- *What factors and what interventions enhanced or inhibited the learning processes that led to the improvement or innovation?*

3.3.1 Selection of cases for the reconstruction studies

The meta-analysis applied an intensity sample to select the cases. Such a sample consists of information-rich cases that strongly manifest the phenomenon of interest (Patton, 1990). Cases selected in this manner offer excellent or rich examples of the phenomenon under study, which in this case is the learning processes undertaken with the intention of innovating. In total, 18 successful and less successful innovation practices were reconstructed by different researchers. The cases originate from various organizations and sectors, and three countries (The Netherlands, China and Indonesia). This broad setting was helpful to obtain an overview of the factors that enhanced and inhibited the learning processes. At the same time it offered the opportunity to reflect upon the conceptual framework from the point of view of a variety of practices.

The cases consisted of innovation practices that all took place within or across organizations. In these practices people collaborated to find an innovative solution for a difficult question or problematic situation. It was the organizations themselves that determined whether the cases were successful. Some examples of these practices included the development of a new kind of soap, the implementation of a new operating procedure that saved money for the organization, the integration of two production lines that implied a more efficient way of working, and the development of a beer dispensing system for low volume catering that increased the organization's sales volume.

3.3.2 Meta-analysis of the reconstruction studies

The meta-analysis consisted of a cross-case analysis (Eisenhardt, 1989) of the 18 reconstruction studies. The seven learning functions from the corporate curriculum and the three development principles (see Figure 2.4 in chapter 2) served as a guide to analyse the reconstruction studies and to trace the factors that facilitate or inhibit the process of knowledge productivity. The analysis traced not only the factors that enhance or hinder the learning processes, but also the interventions that improve these processes.

3.3.3 Outcome of the study

The analysis revealed that the seven learning functions of the corporate curriculum and the additional three development principles as depicted in the conceptual framework were clearly recognisable. These findings are in line with the conclusion of a large-scale survey research conducted by Van Lakerveld (2005). That study shows a clear relationship between the seven learning functions of the corporate curriculum and the ability to improve and to innovate. Besides a confirmation of the elements from the conceptual framework, the findings offer material for further refinement of this framework. Figure 3.3 presents some of the elements that were found in the meta-analysis. Chapter 4 offers an in depth description of the meta-analysis of the 18 reconstruction studies.

The findings in this meta-analysis gave rise to a further investigation that did not use the seven learning functions and three development principles as an explicit focus of analysis. The investigation was carried out in the subsequent parallel study.

The choice not to use the original conceptual framework as a starting point for the next investigation was based on two main reasons. First, it proved difficult, in the reconstruction studies, to hold on to the learning processes that occurred. Respondents were mainly occupied with the specific content and context of the innovation process. Consequently, they found it difficult to reflect upon their own learning processes. Therefore, in the parallel study the interviews focus on the innovation process, rather than on the learning processes that occur in parallel. Second, putting the original conceptual framework aside allows for a wider view of events in the innovation practices. Using the original conceptual framework as a starting point raised the risk of constantly affirming the elements of the conceptual framework without being sensitive to new or other things that might come up.

Figure 3.3.

Examples of elements brought about by the meta-analysis.

Creating a learning environment based on personal involvement

In cases in which the participants succeeded in creating a learning environment that fosters innovation, the environment was characterised by personal involvement. It was an environment different from the day-to-day environment in which positions and hierarchy have always been important. As the conceptual framework depicts innovation as a learning process that is closely related to, or even coincides with the work itself, this finding should be examined further.

Overcoming the stage of polite conversations

For innovation it is necessary to go further than polite conversations, and discussions in which everyone defends his or her own viewpoint (Scharmer, 2007). In the cases included in the study, participants often found it difficult to overcome the stage in which they politely exchanged or agitatedly discussed ideas. This finding is closely related to the learning function 'communication skills'. Further examination is called for in order to find out how innovation practices succeed in overcoming this stage.

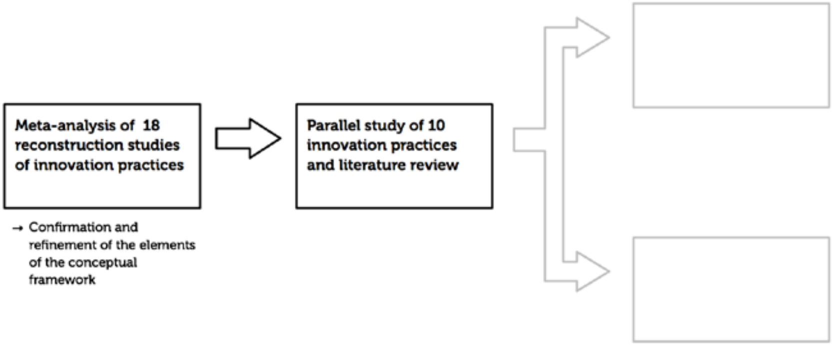
Regulating a sense of urgency

A sense of urgency appeared to be crucial for the innovation process to get started and to continue. Sometimes this urgency was present from the beginning. This was the case when the innovation practice emerged as a result of an urgent problem. It was in all cases necessary to regulate this sense of urgency throughout the process. This finding is related to the learning function 'creative turmoil'. It would be interesting to learn more about the way in which this sense of urgency could be influenced during the process.

3.4 Parallel study and literature review

Figure 3.4.

A parallel study and literature review form the second building block.



The meta-analysis of the reconstruction studies was followed by a parallel study of ongoing innovation practices (see Figure 3.4). Parallel research can be characterised as a prospective case study design (Bitektine, 2008). It is a form of case study research that studies ongoing processes. The reason to follow up the reconstruction studies with parallel studies was determined by the need to investigate the learning processes in innovation practices in real time.

The meta-analysis of the reconstruction studies showed that it is difficult to study all facets of learning processes when examining them retrospectively. Indeed, respondents who look back upon an innovation process that they went through, tend to find it obvious that certain events took place. It seems to them that the situations all occurred logically and all contributed to the innovative solution they found at the end. This effect, also called hindsight bias (Blank, Musch, & Pohl, 2007), is a biased representation of events or facts, when viewed hindsight, e.g. with knowledge of the outcome. In the reconstruction studies the respondents had the tendency to view in hindsight outcomes as more inevitable or foreseeable than they might otherwise seem. The hindsight bias seems to be especially strong in research in innovation practices, when people create things or processes that were not previously there. From a successful innovation it is difficult to imagine that one hadn't thought of this before. Or, as Van de Ven and Poole (1989, p.35) say, "prior knowledge of the success or failure of an innovation invariably biases a study's findings". Looking at the innovation process with hindsight, the respondents tended to forget about the struggles they encountered, and were more apt to remember the solutions they found and the way these contributed to the final outcome of the innovation process.

In order to learn more about the learning processes in innovation practices, a parallel study of ongoing innovation practices was conducted. This approach made it possible to observe participants who struggled during the innovation process, and how they managed to overcome hurdles they encountered. The parallel study was combined with an additional literature review in the fields of innovation and learning, and more specifically in the domain of learning to solve problems. The goal of this study was to identify the factors that enhance the learning processes leading to innovation. The central research question in this research phase is:

> *What factors enhance or inhibit the learning processes at moments that are crucial for the success of the innovation practice?*

3.4.1 Context of the parallel study

The parallel study consisted of a multiple case study design (Yin, 1984). Case studies were conducted in 10 of Habiforum's innovation practices. Habiforum is a network organization consisting of professionals in the field of urban and rural planning. Habiforum conducts a scientific programme and a practice programme in order to develop innovative and sustainable forms of land use in The Netherlands. In the practice programme, Habiforum initiated various innovation practices. These evolved around concrete problematic situations or urgent questions related to the way in which the limited space available in The Netherlands could be used effectively. Public and private parties, and others, collaborate in the innovation practices to find suitable solutions to challenging questions. Examples of innovation practices include a group of participants from public and private parties who have the ambition to develop a multi-layered industrial area, the restructuring of an open and green area between two municipalities, and local authorities of three big cities and three villages who want to develop and carry out a joint vision.

3.4.2 Holding on to important moments

The parallel study offered the opportunity to observe innovation processes as they occurred, and to immediately conduct interviews about important events with the people involved. Since the research took place in ongoing innovation practices, it was necessary to trace meaningful moments as soon as they occurred. The seven learning functions and three development principles that were used as a starting point in the meta-analysis of the reconstruction studies were not used as an explicit starting point in this study. The reasons for this, described in Section 3.3.3, are twofold. First, the idea was that not using the elements of the conceptual framework allowed for a wider view of events in the innovation practices. Another reason not to follow the initial conceptual framework was the desire to better understand the learning processes. In the reconstruction studies it appeared difficult to hold on to the learning process that had taken place. By tracing concrete events, rather than taking the elements from the conceptual framework as a starting point, the parallel study aimed to better understand the learning processes. Collecting concrete events is a strategy for connecting immediately with the specific occupations of the respondents. Using the world of learning as a starting point tempts participants to answer in vague or abstract terms (Berings, 2006). As an alternative, the world of actual work in the innovation practice was used instead. Therefore, the data-gathering in the parallel study was guided by the search for breakthroughs in the innovation process. The next section describes this method in greater detail. The reflection of participants on concrete events in the innovation process seemed necessary for understanding the learning processes and the context from which they emerged.

3.4.3 Search for breakthroughs

The most difficult aspect of a parallel study is determining what to focus on in the data-gathering phase. In order to answer the research question it was necessary to trace factors that enhance or inhibit the learning processes at moments that are crucial for the success of the innovation practice. But how can one determine whether a situation occurring in the innovation practice will turn out to be crucial for its success later on? In other words, how can these crucial situations be recognised at an early stage?

In order to trace crucial moments in the innovation process, the data gathering in the parallel study was guided by the search for breakthroughs. Breakthroughs are moments in an innovation process in which people break with their present way of working and start to think and act differently (Op de Weegh, 2004). Breakthroughs are conceptualized as a change in both 'thinking' and 'acting' leading to a step forward in the innovation practice. The change in 'thinking' refers to the breaking of frames, which is a necessary for innovation. Argyris and Schön (1978) describe how people have two choices, when the outcome of their work processes is not satisfactory. Either, they work with given or chosen goals, values, or plans, or they question these governing variables. The authors refer to the first option as single-loop learning, and to the second as double-loop learning. Double-loop learning may lead to an alteration in the governing variables and, therefore, to a shift in the way in which strategies and consequences are framed. Double-loop learning is the kind of learning associated with innovation (both the development of gradual improvements and of radical innovations, see Section 2.5.2). Senge (2000) refers to this process as the change of mental models, which is required for innovation. It is essential that innovation combines a change of governing variables (Argyris & Schön, 1978), mental models (Senge, 2000), or frames of reference (Hedberg & Wolff, 2001), with a change in behaviour. One must act based on these new ways of thinking (Hedberg & Wolff, 2001). This is the change in 'acting' that breakthroughs consist of.

Tracing such breakthroughs could provide a helpful starting point for data gathering. Patriotta (2003) stressed that disruptions in the form of discontinuities are important indicators in innovation processes:

> "in order to empirically observe how organizations create, use and disseminate knowledge, we have to look for disruptive events conceived as turning points in an ongoing flow of activities. We have to observe the discontinuities and asynchronies, even local or temporary, that breakdowns cause in the smooth functioning of everyday practice, and to follow how they affect the fluid unfolding of action in space and time." (p. 69).

He argues that inquiry into the creation of knowledge must be executed at the "boundary between continuity and discontinuity, permanence and change, organization and disorganization, being and becoming, routines and breakdowns, controversies and steady states" (p. 211).

The approach of tracing breakthroughs has similarities with the critical incidents technique as developed by Flanagan (1954) and Zemke & Kramlinger (1991). In essence, the critical incidents technique involves the collection of real-world examples of behaviour that characterise either very effective or very ineffective performance of some activity. Breakthroughs can be seen as the effective performance of innovation.

It was left up to the participants in the innovation practice to pass judgement on the extent to which a situation would qualify as a breakthrough. This is in line with the definition of innovation that is used in the present research project. Section 2.6.3 argued that innovation is not objectively defined, but rather left up to the subjective judgement of the people involved: Was the innovation new *to them*, or not? The same goes for breakthroughs: the indication of the learning process that took place is not marked by the extent to which a breakthrough is seen as a breakthrough in the eyes of others, but by the extent to which the persons involved experience it as such. Since breakthroughs are traced in order to better understand the learning processes leading to innovation, the participants in the innovation practices defined these breakthroughs.

3.4.4 Thick and thin descriptions

With the collection of breakthroughs as the primary means of data gathering, there is a risk of treating incidents as isolated episodes occurring at specific points in time (Patriotta, 2003). To prevent this from happening, 4 of the 10 cases were studied intensively and the events in these innovation practices were documented in a thick description (Geertz, 1973). Geertz distinguishes between thick descriptions and thin descriptions. Thick descriptions capture various aspects of the case and its context, aiming to give a rich description of the field that is examined, whereas thin descriptions only describe the aspects one is interested in. For four cases thick descriptions were made. These thick descriptions not only portray the breakthroughs that occurred, but also the chronological order of events illustrated with quotations from the conducted interviews (see Appendix A). The other cases were documented as thin descriptions, meaning that only the breakthroughs were described (see Appendix B).

3.4.5 Outcome of the study

The analysis of the collected data in the parallel study was combined with insights from the additional literature review. This led to the formulation of an initial set of 12 design principles that reflect factors that are likely to enhance the innovation process. In the course of the validation study these 12 design principles were combined into a set of 11 design principles:

1. Formulate an urgent and intriguing question
2. Create a new approach
3. Work from individual motivation
4. Make unusual combinations of subject matter expertise
5. Work from mutual attractiveness
6. Build on strengths
7. Create something together
8. Entice to see new signals and to give them new meaning
9. Connect the world inside the innovation practice to the world outside
10. Pay attention to the social and communicative process
11. Actively support the development of competences

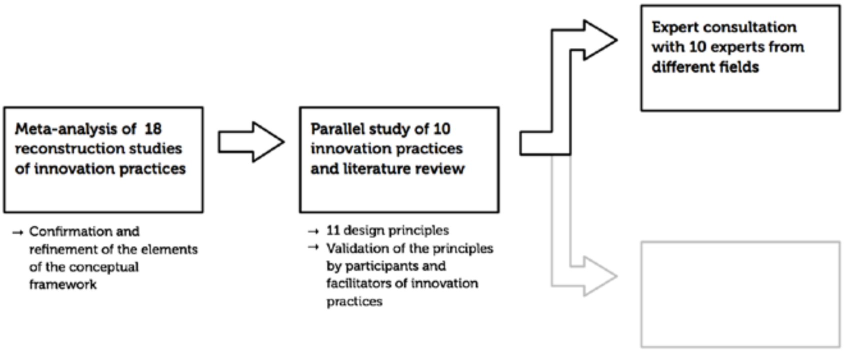
The validation of the design principles took place by means of a respondent validation (Long & Johnson, 2000). It was actually an extensive member check (Merriam, 1988) which was carried out to find out whether the design principles cover the principles that underlie the experienced breakthroughs. Participants and facilitators of innovation practices took part in this validation study. The study revealed that the design principles do not miss essential elements. There were two design principles, however, that turned out to be unclear: design principles 10 (Pay attention to the social and communicative process) and 11 (Actively support the development of competences). Chapter 5 presents an in-depth analysis of the parallel study and the findings of the additional literature review.

The set of 11 design principles was object of further investigation in two studies: an expert consultation on their content, and a design study aimed at learning more about their applicability in practice. The next two sections go deeper into these studies.

3.5 Expert consultation to evaluate and critically reflect upon the principles

Figure 3.5.

An expert consultation forms the third building block.



The 11 design principles defined in the previous phases of research describe factors that influence the learning processes undertaken with the intention of innovating. In the previous phase the design principles were validated by participants and facilitators of innovation practices. They recognised the principles from their own innovation practices and were able to use them to describe the most important breakthroughs they had encountered. Following this respondent validation, an expert consultation took place in this research phase (see Figure 3.5). A total of 10 experts from different fields of expertise participated in this research activity, including 3 experts in the field of learning and change and 4 experts in the field of innovation. Another 3 experts were invited because of their expertise with respect to the content of the parallel study cases: urban planning (1 expert), transition management (1 expert) and sustainability (1 expert).

As Tessmer (1993) points out, an expert review is suitable for making an intrinsic evaluation of the materials at hand. An important reason to choose for experts as respondents in this evaluation is that an expert review furnishes a different type of information than opinions of learners or users (Tessmer, 1993). Experts possess different knowledge than the participants involved in the innovation practices that were studied, and they can therefore provide additional perspectives to determine the value of the design principles.

The reason for inviting experts from different fields was mainly to avoid a tunnel vision. Tunnel vision is a medical term that points to the loss of peripheral vision with retention of central vision. This results in a circular tunnel-like field of view. Here it is used as a metaphor that points to the risk of only seeing what was found before, and not being open for new information or perspectives. In conducting research this is a real risk. As Miles and Huberman (1994, p. 263) said, “people as information seekers -and as processors- are far more likely to see *confirming* instances of original beliefs or perceptions than to see disconfirming instances, even when disconfirmations are more frequent". The involvement of experts from different disciplines should offer diverse and critical perspectives on the design principles.

The aim of the expert consultation was to evaluate the design principles and to critically reflect upon them from different fields of expertise. The relevant research questions in this building block are:

- *To what extent do experts recognise the design principles from their own area of expertise, and how would they recommend improving them?*
- *What critical questions do experts have with respect to the principles?*

3.5.1 Outcome of the study

Four expert meetings were organized to answer these research questions. In each of these sessions 1-4 experts took part. The meetings provided new input to improve the accuracy and relevance of the design principles. They also provided input for a reflection upon the set of design principles as a whole.

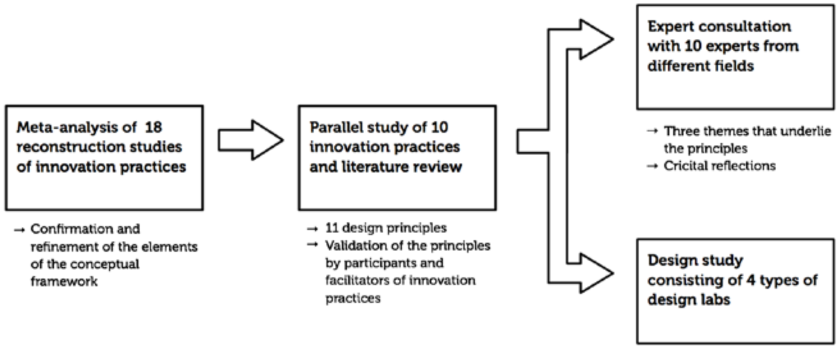
The experts recommended examining the relationship between the principles. A further exploration led to the definition of three themes that seem to underlie the principles: the construction of new meaning, collaboration in innovation practices, and the space required for learning. Another outcome included the experts' reflection on the relationship between the characteristics of the learning environment as shaped in an innovation practice, and the characteristics of the work environment. Participants in innovation practices design a setting that looks different from their day-to-day work environment. This raises the question of the extent to which most regular work environments are suitable for the process of knowledge productivity.

Chapter 6 presents the results of the expert consultation.

3.6 Design study to test the prescriptive quality of the principles

Figure 3.6.

A design study forms the fourth building block.



Until now the research focused on answering the first main research question (see Table 3.1). Several factors, stated in terms of design principles, were found that enhance the learning process leading to innovation. This set of principles proved to be recognisable for people involved in innovation practices and it was refined with knowledge brought in by experts from various fields. The next building block focuses on the second main research question, which aims to find out whether the design principles can be deliberately applied to design a work environment that promotes innovation (see Figure 3.6).

This shift in focus can be characterised as a transition from description-driven to prescription-driven research (Van Aken, 2004), or as a transition from descriptive to normative research (Batens, 2004). According to Van Aken (2004), description-driven research must be complemented by prescription-driven research in order to develop research products suitable for designing solutions for problems in practice.

However, the step from 'know that' to 'know how' must be taken carefully, and design research is considered an adequate means for this (Lowyck, 1995). The previous research steps focused on the design principles as descriptive principles: principles that help to describe, retrospectively, the breakthroughs in an innovation practice and to give meaning to them. The validation with members in innovation practices and the expert consultation both confirmed the descriptive function of the principles. In order to learn more about the deliberate application of the design principles, the prescriptive value of the design principles must be tested. Their prescriptive value is determined by the extent to which the principles help practitioners design interventions in their innovation practice, and by the extent to which these interventions actually lead to breakthroughs in the process.

As the main objective of this study is to find out how the design principles can be deliberately applied by practitioners to develop interventions that promote the innovation process, the research design is characterised as design research (Bereiter, 2002; Van den Akker, Gravemeijer, McKenney, & Nieveen, 2006). The present research uses the term design research, but this type of research is also referred to as 'developmental research' (Gravemeijer, 1999; Richey & Nelson, 1996; Van den Akker, 1999) or 'design science research (DSR)' (Romme & Damen, 2007; Van Aken, 1994). Although they are rooted in different scientific disciplines, these different approaches have in common the aim to increase the practical relevance of research (Stam, 2007, p. 13).

The design study consists of four types of design labs. In all types of design labs participants engaged in the design of interventions for innovation practices with the help of the design principles. Each type of design lab followed a slightly different approach with the aim of learning more about the prescriptive quality of each of the design principles and of the set of principles as a whole. The research questions that refer to each of the design principles are:

- *Which design principles do respondents choose as a starting point for the design?*
- *What interventions are designed to promote each of the design principles?*

For the set of design principles, the following questions are relevant to answer:

- *What are the considerations of respondents when they choose one or more design principles to work with?*
- *How do they translate these design principles into interventions?*
- *Do respondents manage to implement the interventions in practice?*
- *To what extent do the interventions result in breakthroughs?*

3.6.1 Four types of design labs to test the prescriptive quality

Four different types of design labs were developed to test the prescriptive quality of the principles. In these design labs researchers and practitioners from different contexts went through a design process in which they used the set of principles to develop interventions. Each type of design lab emphasised different aspects of the design process.

In one type of design labs participants worked with fictive innovation practices for which they defined a problematic situation and designed interventions based on the design principles. In total, 39 participants took part in design labs of this type.

In two other types of design labs participants went through the entire design process, from the analysis of the problematic situation, to the design of interventions based on the design principles, to the implementation in practice and the evaluation. In one of these types of design labs, participants implemented in their own innovation practice the intervention they had designed. In total 8 participants took part in design labs of this type. In the other type, they implemented the intervention in the role playing game they participated in. In the design labs of this type 32 participants took part.

The last type of design lab stimulated participants to make use of different design principles and to come up with different interventions to create a breakthrough in their innovation practice. The actual implementation of the intervention in practice was not part of this design lab. In total, 32 participants took part in design labs of this type.

3.6.2 Outcome of the study

The findings of the design study revealed that the prescriptive value of the design principles is limited. The design principles do not prescribe the interventions that must be done in order to create breakthroughs in the innovation practices.

It became clear that the design process is not as rational and systematic as simply moving from a difficult situation to the design of an intervention with the help of the design principle, to the implementation of this principle in practice. Other factors appeared to interfere in this process. Clearly, a personal approach in which affinity, creativity and ambition are crucial, needs to be combined with a more systematic approach in which rational analysis, previous experience and the development of abilities play an important role.

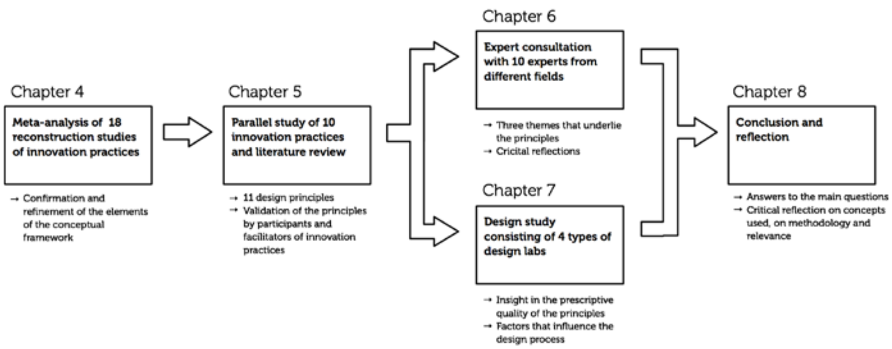
The function of the design principles in the design process is to propose different angles to look at an innovation practice and the difficult situation at hand. This seemed to help participants to generate new ideas for interventions in the innovation practice. Chapter 7 offers a description of the design study.

3.7 Building blocks per chapter

This chapter presented the building blocks that make up the research design. The next chapters will go deeper into each of the studies mentioned. Figure 3.7 shows the chapters where the studies can be found. Chapter 4 describes the meta-analysis of the reconstruction studies. Chapter 5 elaborates on the parallel study and the additional literature review. Chapter 6 presents the results of the expert consultation and chapter 7 the results of the design study. Figure 3.7 visualises the relation between the building blocks and the chapters that describe them. Chapter 8 presents the conclusion to the main research questions. This final chapter also offers a critical reflection upon the main concepts, the reliability and validity of the study, as well as the generalisation of the findings.

Figure 3.7.

Overview of building blocks and thesis chapters.



4

Meta-analysis of reconstruction studies of 18 innovation practices

This chapter presents the meta-analysis of reconstruction studies in which 18 innovation practices were reconstructed. In these studies efforts were made to find out what had happened during the learning processes in the innovation practices. The study at hand comprises a meta-analysis of this work and serves to validate and possibly extend the conceptual framework as presented in chapter 2 (see Figure 2.4). In order to meet this goal the research questions each refer to one part of the conceptual framework:

- *What led to the necessity to improve and innovate?*
- *What was the outcome of the innovation process?*
- *What factors and what interventions enhanced or inhibited the learning processes that led to the improvement or innovation?*

This chapter presents the cases that were part of the meta-analysis and the method that was used to analyse them. It also presents the results of this study.

4.1 Method

The research method consisted of a meta-analysis. Rosenthal (1991) describes two sources of pessimism in the social sciences that meta-analysis could offer a new perspective to: poor cumulation and small effects. The problem of poor cumulation is according to Rosenthal that the social sciences do not show an orderly progress and development in the field. With respect to effects, the complaint of Rosenthal is that even though some programmes work, the size of the effects is often so small that it is of no practical consequence. The meta-analysis conducted in the present study aims to cumulate the results of several studies in the context of innovation. The aim of the meta-analysis is to carry out a synthesis of results obtained by different single studies on common problems (Matarazzo & Nijkamp, 1997).

The case studies included in the meta-analysis were conducted by Derksen (2003), Hartmann and Verdonschot (2007), Suryani (2002), Van de Swaluw (2003), Wang (2002), and Yuan (2002). Each of these researches consisted of the reconstruction of 2 to 6 innovation practices. In these researches the aim was to learn more about the process of knowledge productivity. Two reconstruction studies were carried out within the context of an innovative programme focusing on infrastructure management, initiated by a governmental organization in The Netherlands (Hartmann & Verdonschot, 2007). The other studies were carried out in the context of a research programme on knowledge productivity initiated by the department of Curriculum Studies at the Faculty of Behavioural Sciences of the University of Twente (Keursten & Kessels, 2002). Except for the reconstruction studies carried out by Hartmann and Verdonschot (2007), the data for all studies was gathered between 2001 and 2003. Data gathering for the reconstruction studies conducted by Hartmann and Verdonschot (2007) took place in 2007. These studies were later included in the meta-analysis, because they add further refinement to the conclusions. However, they did not add new elements, so their inclusion did not influence the studies that followed the meta-analysis.

4.1.1 Selection of cases

Qualitative inquiry typically focuses in-depth on small samples selected purposefully (Patton, 1990). In the researches that were part of the meta-analysis an intensity sample was made to select the innovation practices. The sample consisted of information-rich cases that strongly manifest the phenomenon of interest (Patton, 1990). Table 4.1 summarises the basic characteristics of the innovation practices that were selected thus. In all cases groups of employees worked or had worked on innovation projects. The innovation practices took place in various contexts, and in three different countries (The Netherlands, China and Indonesia). The projects were either successful or less successful, and they were at least partly finished . The successful cases were selected since these offered the opportunity to reconstruct the learning process of a group of people who realised a concrete improvement or innovation. The cases in which the efforts of the participants did not (yet) lead to visible results were selected because it was expected that these cases would offer valuable insights in the learning process by exposing some of the difficulties participants in innovation practices encountered.

Case 1

Case 1 — David: dispense system for small volume outlets (studied by Suryani (2002))

A department of an international beer brewery wanted to develop and industrialise a small volume dispense system for draught beer, suitable for low volume catering outlets. Research had shown that 50% of the draught beer outlets sell less than

50 hectolitre per year. These low quantities could possibly cause quality problems because the draught system is not adequately equipped. This possible quality problem motivated the development of a special system suitable for these low volume outlets. After the program of requirements was made, a first concept of a small volume dispense system was created, and after that several prototypes were made and tested. As soon as the small volume dispense system (called 'David') was launched, various operating companies were involved quite fast. The most important benefits of David were: a substantial quality improvement for small volume outlets; no cleaning of beer lines (compared to once every four weeks); no maintenance (for at least five years); no loss of beer when connecting a new beer container. Furthermore the disposable beer tube was completely recyclable. Sales volume increased with 10-15%.

Case 2

Case 2 — Bintang: increasing capacity of a bottling line (studied by Suryani (2002))

Employees at Bintang, one of the operating companies in an international beer brewery, found out that one of their bottling lines had reached its maximum capacity. This was a problem since market demand was increasing. An examination of the actual situation showed that the bottling line only used 52% of its total capacity. The participants in the innovation practice then decided to improve the line's efficiency. In order to improve the current practice, tasks were divided in a new way. For instance, the operator in the new situation was not only responsible to operate the filler and crowning, he also needed to take care of the quality of the product, and of problems with the machine. These new tasks implied that the employees in this company had to learn new skills as well. By improving the actual way of working they managed to reach 70% capacity of the bottling line, the amount of breakdowns was halved and stock accuracy had reached 97%.

Case 3

Case 3 — Producing the limit: maximizing production capacity (studied by Yuan (2002))

Corporate staff, operating staff, and a team of best-practice consultants were active in this innovation practice that was called 'Producing the Limit'. Management of a natural gas producer in The Netherlands wanted to maximize capacity of gas and oil production. They also wanted to increase sales, while decreasing costs. The team occupied with this project worked separate from the rest of the organization. They had their own office, their own computers, and special clothing. They were freed from their other work in order to focus on this assignment. Their devotion resulted in the implementation of a new way of working. The organization gained 400 million cubic meter of gas because of this project.

Case 4

Case 4 — Shangri La: a new business model (studied by Yuan (2002))

Shangri La is a Mandarin word for fairyland. This was the name of the project that was executed in the commercial department of an oil company. The salesmen, responsible for selling oil products like fuels and lubricants, encountered a problem when one of their agents refused to be the wholesaler for the oil company's lubricant. The company then decided to operate as a distributor itself. Developing and implementing this new business model for the commercial department was the core of the Shangri La-project. Although the model was previously used in the fast moving consumer goods industry, this oil organization was the first to apply it in this sector. Implementation of this business model resulted in more competent retail salesmen and increased efficiency.

Case 5

Case 5 — Sateh and boemboe: integrating two production lines (studied by Wang (2002))

A consumer good multinational had a so called 'wet department' that produced both sateh and boemboe. However, this production line was not very efficient, since it could not produce sateh and boemboe at the same time. It could produce either sateh, or boemboe.

A cross-functional team worked together in finding a smart solution for this efficiency problem. Splitting the lines was not an option since that would double the amount of operators working on the production line. This team managed to combine the two production lines in an efficient way. The production line that previously was guarded by three operators, and that could either produce sateh or boemboe, was now guarded by four operators, and produced both sateh and boemboe. The amount of operators increased from three to four, whereas the output redoubled.

Case 6

Case 6 — Hazeline snow cream: improving a moisturizer (studied by Wang (2002))

Hazeline snow cream is a basic moisturizer that provides oil-free moisturizing. It has both a cooling and whitening effect. The organization producing this cream was losing market share. The product had never changed since it entered the market in China in the 1980s, it had an old fashioned image, and there was only a small group of -loyal- customers. Besides, the organization also received complaints: customers were not satisfied with the hardness of the cream, and they found out that the cream contained small air bubbles. A cross-functional team managed to improve the quality of the cream. The number of complaints decreased.

Case 7

Case 7 — Phinda: introduction of a new soap (studied by Wang (2002))

A soap that feels soft, makes you look young, and gives the skin a light colour. Those were the most important wishes of Asian consumers that this international consumer goods company wanted to meet. To achieve this, they introduced a new soap line. Consumers experienced that the soap line delivered the functional benefits they were looking for. As a result of the introduction of this soap line, the company gained more profit and dominated the beauty-soap market in China.

Introduction to cases 8, 9 and 10

At a Dutch railways organization three departments were responsible for planning the logistic processes (e.g. train schedules). Employees who are responsible for long-term planning (one year ahead) collaborate with employees who take care of the day-to-day planning. The employees from these departments made use of a computer programme that supported them in their work. This programme helped to plan all train movements, shunting movements, materials and personnel. However, the programme was based on technology that was developed decades ago. Employees regarded this system as ineffective. The working procedures of the planners on the different levels also appeared to be inefficient. The railways organization initiated several innovation practices in which they involved planners with the aim of improving the situation. Cases 8, 9 and 10 refer to three of these innovation practices.

Case 8

Case 8 — Planning & logistics: one central counter (studied by Van de Swaluw (2003))

The planners experienced difficulties in the way in which orders with respect to the planning were accepted. The team that worked on this issue had a new idea. Their idea was to solve this problem not by looking at the level of the different planning departments but rather by taking into consideration the whole planning process. The participants in this innovation practice wanted to further develop the idea of one central counter for accepting orders. They hoped this would be a solution for the problems the planners experienced. However, the process in the innovation practice got stuck in a dispute between advocates and opponents of this new direction. The project was not yet finished by the time data gathering took place.

Case 9

Case 9 — Planning & logistics: new programme for sharing infrastructure (studied by Van de Swaluw (2003))

The ambition in this innovation practice was to develop new software to make a standardised planning system. The idea was that this would help the planners to share the available infrastructure more efficient. The participants developed a scheme that was translated into a computer programme. In this programme the procedures were the same for every planning phase. The planners brought the programme into use.

Case 10

Case 10 — Planning & logistics: new procedures for correcting imbalances (studied by Van de Swaluw (2003))

The aim of this innovation practice was to develop new procedures for correcting imbalances in material. An imbalance is a surplus or a shortage of material at a specific place (e.g. at the end of the day there are more trains than needed for the next day). This goal was not reached because the process got stuck in exchanging and discussing between the group that developed the redesign and the group that was supposed to further develop and implement these proposals.

Case 11

Case 11 — Living city: a new concept for city design (studied by Van de Swaluw (2003))

This case consisted of a group of around 15 people from various organizations. They aimed to develop new concepts for city planning and design, integrating various functions in a small space. The designs that were developed to make the idea of a living city concrete, were quite diverse. The participants in this innovation practice came up with new ideas and methods that they could use in their own practice. However, it didn't result in common concepts and solutions.

Case 12

Case 12 — Innovative industrial area development (studied by Van de Swaluw (2003))

This innovation practice, just as the previous case, consisted of people from various organizations. They wanted to develop new ways of designing industrial areas in such a way that various needs and functions could be integrated. This group developed an abstract model that described a process with which an industrial area could be developed effectively.

Case 13

Case 13 — Redesigning regional junctions (studied by Van de Swaluw (2003))

In this case a group of people developed new ideas about the way a regional junction could be redesigned from the perspective of multiple space use. The objective was to develop an approach for integrating -often conflicting- demands. They used cases from practice (cases that the participants of the innovation practice were involved in and had stakes in). By looking at these cases from different points of view, they managed to develop a new process plan for the redesign of regional junctions.

Case 14

Case 14 — Design of a cardio-diagnostic unit for General Practitioners (studied by Derksen (2003))

In a hospital's department of cardiology there were too many patients that needed intensive treatments from cardiologists. The expectation was that this number would even further increase. The team that worked on this problem set up a cardio-diagnostic unit. General Practitioners (GP's) can send their patients to this unit to get cardiological examination, lung examination and radiological examination. The patients remain under treatment for the GP while the hospital supports the GP. The new way of working was implemented but it attracted less patients than expected. The cooperation between hospital and GP's was sub-optimal.

Case 15

Case 15 — Integrating care for different patient groups (studied by Derksen (2003))

A hospital experienced a logistic problem. The number of patients that came for surgical matters went down, while at another department the number of patients with gastrointestinal disorders increased. The participants in the innovation practice worked on an integration of the two wards. For the hospital this was a successful innovation since it helped to break through the island culture. At the same time the multidisciplinary cooperation helped the hospital to integrate the available knowledge.

Case 16

Case 16 — Client-centred working in concern staff (studied by Derksen (2003))

The board of a hospital gave the concern staff the assignment to work more client centred. The various departments that constitute the concern staff formed the innovation practice. They made their vision on the subject explicit and discussed about the added value they could have for their customers. Their efforts resulted in a change of functions. This led on the one hand to better contact with clients and a better working atmosphere, and on the other to more uncertainty among the employees. Consequently, employees sometimes focused on competition rather than on collaboration. The project was not yet finished by the time data gathering took place.

Case 17

Case 17 — Growth contract for maintenance waterway corridors (studied by Hartmann and Verdonschot (2007))

This governmental organization responsible for infrastructure in The Netherlands initiated an innovation practice in order to develop a new way to collaborate with market parties. The reason for this was that contractors hesitated to subscribe for tenders for maintenance of waterway corridors in one of the districts. They hesitated because in their opinion the risks that needed to be taken were too high in comparison to the profit they could make. The innovation practice aimed to develop a new kind of contract that determined not the *activities*, but rather the *output* with respect to the management, maintenance, and development of the water corridors in the South of The Netherlands. For this purpose the participants of the innovation practice developed a growth contract, a new way of working that helped the two parties in developing an output-based contract for the next three years.

Case 18

Case 18 — Asset management for maintenance of main roads (studied by Hartmann and Verdonschot (2007))

The planning system used to plan the maintenance of main roads didn't function well. It might, for instance, give the advice to tarmac a particular road, which had, however, been done only one year earlier. Furthermore it had trouble calculating in advance the total amount of costs required for the maintenance of a particular viaduct, for instance. This gave rise to the innovation practice in which people from one of the districts aimed to develop new ways of asset management. They visited the English highways agency and used these experiences to develop a new way of working. The new form was based on the use of several alternatives in the form of scenarios. These scenarios were then discussed via workshops.

Table 4.1

An overview of the innovation practices that were part of the meta-analysis

Case	Name	Initiating organization	Type of innovation	Objective	Result	Persons directly involved
1.	David: dispense system for small volume outlets	Multinational beer brewery (The Netherlands)	Product innovation	To develop a beer dispensing system for low volume catering	The new dispense system increased sales volume by 10-15%	Cross functional core team of 8, 25 R&D people, several suppliers
2.	Bintang: increasing capacity of a bottling line	Multinational beer brewery (Indonesia)	Process improvement	To meet increased market demands by optimising a bottling line	Operational performance increased from 52% to 70%, breakdowns reduced and stock accuracy increased	Whole technical division, divided in an action team, an assisting team and a steering team
3.	Producing the limit: maximizing production capacity	Natural gas producer (The Netherlands)	Process innovation	Maximizing production capacity while minimizing cost	Raise of gas production by 400 million m^3 gas	Core team of 6, cross functional, engineering backgrounds
4.	Shangri La: a new business model	Oil company (China)	Process innovation	To regain control on the distribution channel	A new distribution system, greater efficiency in the distribution, and new partnerships with retailers	Team of 14, sales and staff people
5.	Sateh and boemboe: integrating two production lines	Consumer goods multinational (The Netherlands)	Process innovation	To combine two production lines into one line that could produce both products more efficiently	A reduction of the operators involved and increased production	Cross functional team from engineering, operations, maintenance, HR, logistics
6.	Hazeline snow cream: improving a moisturizer	Consumer goods multinational (China)	Product improvement	Solving a quality problem in order to satisfy loyal customers and attract new ones	An improved product (soap)	Cross functional team from R&D, quality control, production and engineering

Table 4.1 (continued)

An overview of the innovation practices that were part of the meta-analysis

Case	Name	Initiating organization	Type of innovation	Objective	Result	Persons directly involved
7.	Phinda: introduction of a new soap	Consumer goods multinational (China)	Product improvement	To become market leader (in a fragmented market where it was losing market share)	Introduction of a new beauty soap line, and a leading market position	Cross functional team from marketing, R&D, purchasing, packaging and operations
8.	Planning & logistics: one central counter	Railways organization (The Netherlands)	Process innovation	An integral solution for planning problems and improved efficiency	Process got stuck in a dispute between advocates and opponents of a new direction	Group of 8: 1 designer of the system and 7 local planners from different regions
9.	Planning & logistics: new programme for sharing infrastructure	Railways organization (The Netherlands)	Process innovation	To standardise planning procedures throughout different planning stages (long term and short term)	New software design, accepted by participants and others in their work environment	Group of 7: 1 designer and 6 planners, the participants checked new ideas with their colleagues
10.	Planning & logistics: new procedures for correcting imbalances	Railways organization (The Netherlands)	Process innovation	Train availability where it is needed, more efficient use of trains	No results achieved yet, process got stuck in exchanging and discussing	Group of 8: 2 designers of the system and 6 local planners
11.	Living city: a new concept for city design	Network for multiple land use (The Netherlands)	Process innovation	New concepts for city planning and design, integrating various functions in a small space	Some ideas and methods participants use in their own practice, no integrative and common concepts yet	Community of Practice of approx. 15 people from various organizations and disciplines
12.	Innovative industrial area development	Network for multiple land use (The Netherlands)	Process innovation	Integrating various needs in the process of developing an industrial area	Common process model for the development of industrial areas	Community of Practice of approx. 15 people from various organizations and disciplines
13.	Redesigning regional junctions	Network for multiple land use (The Netherlands)	Process innovation	To develop an approach for integrating various (often conflicting) demands and solving dilemmas	A new process plan for the re-design of regional junctions	Community of Practice of approx. 18 people from various organizations and disciplines

Table 4.1 (continued)

An overview of the innovation practices that were part of the meta-analysis

Case	Name	Initiating organization	Type of innovation	Objective	Result	Persons directly involved
14.	Design of a cardio-diagnostic unit for General Practitioners	Hospital (The Netherlands)	Service innovation	To provide diagnostic facilities and expertise while the patient remains under treatment for the GP	Redesign and implementation of different processes, availability of facilities, but less patients than expected and sub-optimal cooperation	Core group of 3: 2 medical specialists and 1 manager. Participation by other stakeholders was limited
15.	Integrating care for different patient groups	Hospital (The Netherlands)	Process innovation	To improve patient-oriented care and to build a more flexible and multi-skilled workforce	Integration of two wards, inter-disciplinary protocols for patient care and interdisciplinary cooperation	Core team of 5 medical specialists and 1 manager, cross-functional involvement of a larger group
16.	Client-centred working in the concern staff	Hospital (The Netherlands)	Process innovation	Changing from a prescriptive approach to a client-centred approach.	Better contact with clients, but also more uncertainty (innovation not yet finished)	A whole department that work in subgroups on different assignments
17.	Growth contract for the maintenance of waterway corridors	Governmental organization responsible for infrastructure (The Netherlands)	Process innovation	To develop a new way of collaborating with market parties	Development of a growth contract.	A team consisting of employees from the district that encountered the problem, and employees from the central level (with a broader scope)
18.	Asset management for the maintenance of main roads	Governmental organization responsible for infrastructure (The Netherlands)	Process innovation	To develop a new way of working that would solve the problems caused by the current programme used for asset management	Development of a new approach to asset management, and an improvement of the position of the people involved (they feel more secure of themselves)	Team consisting of employees from the district that encountered the problem, and employees from the central level (with a broader scope)

4.1.2 Data gathering

Interviews and document studies were used as means to gather data in the cases. The researchers who conducted the case studies selected a representative and accessible group of key players in the innovation practices under study. Per innovation practice, 2 to 7 participants were selected.

Table 4.2

Number of participants per case

Case		# participants
1.	David: dispense system for small volume outlets	5
2.	Bintang: increasing capacity of a bottling line	5
3.	Producing the limit: maximizing production capacity	7
4.	Shangri La: a new business model	7
5.	Sateh and boemboe: integrating two production lines	7
6.	Hazeline snow cream: improving a moisturizer	5
7.	Phinda: introduction of a new soap	6
8.	Planning & logistics: one central counter	7
9.	Planning & logistics: new programme for sharing infrastructure	4
10.	Planning & logistics: new procedures for correcting imbalances	6
11.	Living city: a new concept for city design	3
12.	Innovative industrial area development	4
13.	Redesigning regional junctions	4
14.	Design of a cardio-diagnostic unit for General Practitioners	3
15.	Integrating care for different patient groups	6
16.	Client-centred working in concern staff	5
17.	Growth contract for maintenance waterway corridors	5
18.	Asset management for maintenance of main roads	2

In cases 1-16 standardised open-ended interviews (Patton, 1990) were held. Appendix C shows a large selection of questions. Every researcher made a selection of questions appropriate for the cases they studied. The interview guides thus composed, consisted of questions about the following issues:

- The nature of the innovation that was realised or that was aimed for, the people involved, and the steps that the process consisted of.
- The context the innovation originated from and the outcomes it resulted in.

- The extent to which the seven learning functions of the corporate curriculum and the three development principles played a role.
- The interventions that were done.

The document study included the analysis of available project proposals, project progress reports, minutes of meetings, event reports, and e-mails of participants. These documents were used as reference material and as background information to help build the story. The reports, one for each of the cases, were verified by the respondents.

In cases 17 and 18 a different approach was used. In these cases there was no elaborate interview guide that served as a starting point. The main focus in these cases was to interview stakeholders and to reconstruct their personal stories, without taking the seven learning functions and three development principles as an explicit starting point. The interviews were used to understand the story of the innovation practice chronologically, and to define critical moments that took place. The approach was based on the critical incident technique (Flanagan, 1954; Zemke & Kramlinger, 1991), in the sense that the approach consisted of the collection of crucial moments from the perspective of the participants in the innovation practice. With the interview results the researchers aimed to develop a learning history (Roth & Kleiner, 1998). According to Roth and Kleiner (1998) a learning history is a document, based on interviews with the stakeholders, that tells an organization its own story. Deliberately presented in an engaging fashion, the document is intended to create better conversations that capture and permeate an organization with learning. The stories of the innovation practices were brought together on a visually attractive poster. The aim of this poster was not only to help researchers gain insight into the innovation process, but also to encourage the organization to foster a conversation about learning and innovation. The posters were used in a workshop in which various employees from the organization in which cases 17 and 18 took place, participated.

4.1.3 Analysis

All case study reports contained a detailed within-case analysis. These analyses were the starting point for the cross-case analysis central to the meta-analysis. A case-ordered matrix (Miles & Huberman, 1994) portrayed the relevant elements of the conceptual framework.

4.2 Context and outcomes of the innovation processes

In all cases there was a clear need for innovation. There appeared to be two different contexts the cases originated from. It was either an urgent problem that occurred and needed to be solved, or it was a strategic choice to innovate in order to meet new business opportunities or to deliver better quality. Each of these two starting points led to different innovation and improvement processes.

4.2.1 Innovation practices originating from an urgent problem

Six of the innovation practices came into being after the organization they were part of, faced acute external problems. Table 4.3 shows the innovation practices for which this was the case, and the urgent problem they needed to respond to.

Table 4.3 *Innovation practices originating from an urgent problem*

Case		**Urgent problem**
2	Bintang: increasing capacity of a bottling line	Market demands could not be met
4	Shangri La: a new business model	Wholesaler network broke down
6	Hazeline snow cream: improving a moisturizer	Complaints of customers about the quality of the cream
7	Phinda: introduction of a new soap	The organization lost market share to other organizations
17	Growth contract for the maintenance of waterway corridors	Contractors did not subscribe to tenders
18	Asset management for the maintenance of main roads	The organization needed to plan many maintenance activities whereas the actual planning system didn't work

In these cases an urgent problem occurred to which the organization needed to respond. These problems couldn't be solved by applying previously developed solutions or ways of working. People involved felt the urge to develop a new product or service, or a new operating procedure.

In these cases the urgency of the external problem led to time pressure, focus, dedication and speed in the innovation process. Time and space for experimentation and exploring various paths was limited. A clear direction was chosen early in the process. The achieved changes were either improvements of existing products or ways of working (cases 2, 6, and 7) or radical innovations (cases 4, 17, and 18).

In cases 2, 6 and 7 the content consisted of expertise or experience that was already available inside the organization. For instance in case 2, learning from best practices elsewhere in the brewery appeared to be important. In case 6, knowledge of the engineering department helped to get rid of the small air bubbles that existed in the cream. In case 7 the model for the new soap line was originally developed at another site, in Brazil.

In three cases a radical new direction was chosen (case 4, 17, and 18). The participants in case 4 developed a new business model that necessitated the development of new subject matter expertise, and at the same time the professionals at the sales department needed to develop new competences in order to work according to this new model. The participants in case 17 could not use expertise that was already available in the organization. They needed to develop a tailor-made solution for this situation. In case 18 the participants of the innovation practice visited the highways agency in England. This was an important starting point for developing new subject matter expertise. The way of working as developed by the English colleagues was very inspiring for the Dutch group. However, the English way of working was not applicable right away because the English context differed from the Dutch. The participants in the innovation practice used the experience of their English colleagues as a starting point, added new perspectives, and thus developed the knowledge that was necessary to come up with an innovative solution for the problem they encountered.

4.2.2 Innovation as a strategic choice

Besides the innovation practices that originated from an urgent problem, there were innovation practices that originated from the organization's strategic choice. Several organizations saw opportunities or felt the pressure to deliver better quality (case 1), or to work more efficient (cases 3, 5, 8, 9, 10, 14 and 15). These organizations felt the necessity to improve and innovate because they identified current developments as possible threats for the near future. In cases 11, 12, 13 and 16 it was not a future threat, but rather an opportunity that caused the necessity to improve and innovate. In case 16 the board of the hospital developed a new vision that promoted a more client-centred way of working. The direction thought that this new vision offered an opportunity to the staff department of the hospital to organize their work in a different way. Cases 11, 12 and 13 show a phenomenon that Tidd, Bessant and Pavitt (2005) call 'fractures along 'fault lines''. This is a source of innovation when a long standing issue, of concern to a minority, accumulates momentum. In cases 11, 12 and 13 the long standing issue is the land use in The Netherlands. In The Netherlands there is little space for many people. It becomes increasingly important to combine different functions such as living, working and spending leisure time, in an efficient and smart way.

In the cases in which the innovation practices originated from a strategic choice, the participants had the time to explore new paths. The results of this process were mixed. In the cases in which the pressure was fairly high (in terms of time or money) and a desired solution was relatively well defined (cases 1, 3, 5, 14 and 15), the innovation practice had the characteristics of a project approach, but with the use of new methods and extended cross-functional co-operation. In the cases in which the desired output was less clear (case 8, 9, 10, 11, 12, 13 and 16), there was more experimentation and also a diverging phase in search of the kind of approach or solution that would be best. The result of this process was either a 'breakthrough' or a 'breakdown'. The 'breakdowns' occurred in cases 8, 10 and 11. In these cases the participants got stuck in the process. In the other cases participants came up with radically new approaches (sometimes after they got stuck and after they succeeded in creating a breakthrough out of this) that led to successful innovations. In cases 11, 12, 13 and 16 the external pressure was the least. This led to the development of concepts or approaches that were not directly beneficial for the regular work environment.

External pressure seems to be important for developing innovations with significant impact in daily work. However, too much pressure could stimulate working within known fields of knowledge and therefore limit innovation.

4.2.3 The ability to innovate

Besides the concrete improvements and innovations, another outcome of the innovation process may be the ability to innovate. In the innovation practices that were part of the study at hand, participants did not give explicit attention to the development of this ability.

4.3 Factors and interventions that supported the process

In the conceptual framework, besides the context and outcome of the innovation process, the learning processes and the interventions applied to stimulate that process, are visualised (see Figure 2.4). This section describes the learning processes and the interventions in the cases that were part of the meta-analysis. The seven learning functions from the corporate curriculum and three development principles to design a work environment that enables knowledge productivity were used to analyse the cases. The participants in the innovation practices did not apply these elements deliberately. However, they could be traced retrospectively.

4.3.1 Seven learning functions

Subject matter expertise

Subject matter expertise plays an important role in all the cases. Participants in the innovation practices used various sources to acquire this expertise. They used for instance books, intranet, training, internet, conferences, and excursions to other organizations or departments within the organization. The personal networks of the people involved had an important function in allocating places to find this expertise.

When innovation was triggered by an urgent problem, the opportunities for experimentation were scarce and the time pressure was high. In the cases in which this led to improvements of existing products or ways of working (cases 2, 6 and 7) participants made use of ideas and solutions that were available somewhere in the organization. In the case where participants managed to come up with a radical innovation even though time for experimenting was limited and pressure was high (cases 4, 17 and 18), participants went off the beaten track and found new concepts and ways of working. In these cases they used external sources (e.g. in case 4 participants used a business model from the fast consumer goods sector; in case 18 participants used a model from the English highways agency) as a basis to develop the knowledge to apply to the urgent problem.

Participants experienced that their subject matter expertise was one of the few certainties in a very uncertain process. This caused people to hold on to their own expertise. For six of the cases (8, 9, 10, 11, 12 and 13) this meant that it was difficult to go beyond the exchange of subject matter expertise. People in these cases found it difficult to be open to new perspectives that sometimes conflicted with their own. These participants had great difficulty breaking with their actual way of working in order to come up with radical new approaches and solutions.

Problem solving skills

Participants in the innovation practices encountered two kinds of problems. There were mere 'technical problems' such as a malfunctioning machine, and there were problems related to the process itself. Examples of the latter are people who didn't want to take part in the project whereas their involvement was necessary, or people who didn't feel taken seriously and therefore didn't want to cooperate.

It helped the participants to first analyse the problems they encountered, then think of new solutions, and then, as soon as the solution seemed promising, experiment with the new solution. Mainly three forms of problem solving were used:

- Root-cause analysis (Andersen & Fagerhaug, 2006): this is a problem solving method aimed at identifying the root causes of problems or events. Root-cause analysis is considered an iterative process that contributes to continuous improvement.
- Brainstorming (Osborn, 1963): this is a creative technique to generate a large number of ideas that could help to solve the problem.
- Research: research, being an active and systematic process of inquiry, could be used to solve problems. It is a means to either trace existing expertise (someone who encountered a similar problem and developed a solution), and to develop new knowledge (by combining different perspectives a new solutions may emerge).

Solving problems is sometimes a matter of asking a different question than you would normally do. In case 13 the facilitator asks the group how all disadvantages of the particular junction could turn into advantages. This question provided a new route for thinking that gave energy to the participants.

Reflective skills and metacognitions

The development of reflective skills and metacognitions did not get much explicit attention in the cases. Reflection was visible during group meetings. Then it was merely focused on next steps to take in the process. Swan and Bailey (2004) refer to this as instrumental reflection, a kind of reflection that is concerned with practical questions about what courses of action can best lead to the achievement of goals or solutions. There are no examples of people who reflect on their way of learning. This kind of reflection would typically lead to the development of metacognitions (e.g. by asking questions like: What are we good at? What skills have helped us throughout the process?).

Communication skills

Although there were no instances in which participants in the innovation practices paid explicit attention to the development of communicative skills, almost all respondents mentioned that they found open communication important to attain results. In the cases, these communicative skills served the following goals:

- Being able to use one's network of colleagues and acquaintances in order to trace relevant information.
- Being able to present one's own ideas and opinion in a clear and convincing way to others.
- Being able to invite others to contribute to the process. Listening and asking questions seem to be important skills in this respect.

Self-regulation skills

Personal motivation was the driving force behind most of the innovations and improvements in the cases. This motivation often originated from the problem the participants worked on. When these problems had a direct relation with their own work, participants felt motivated to find a solution. In some cases the participants were motivated because the management of their organization invited them to participate. The honour and the recognition expressed in this invitation, made them dedicated to the project. In most cases this motivation remained implicit. Although motivation to participate was present, the self-regulation of this motivation did not play an explicit role in the cases.

Peace and stability

The cases clearly show that a lack of urgency negatively influences the process. In case 16 for instance, the participants felt no urge to change. They couldn't find the energy to work on a change proposed by their management that had already been postponed for three years. As a result, these participants found it difficult to go beyond the exchange of information.

There was one example of a case in which the absence of pressure led to good results. In case 13 there was no immediate reason for innovation. The absence of time pressure arranged for the space that enabled the participants to elaborate upon new concepts. Not every idea was immediately tested for its relevance to practice. This helped to further develop unconventional ways without immediately putting them to the test of practice. This allowed people to think beyond existing frames.

Creative turmoil

Creative turmoil arose from a combination of external pressure and a strong personal motive. Sometimes there was restlessness without the creative turmoil, this was mainly caused by the fear to let go of familiar ways of thinking. However, there were instances in which participants succeeded in overcoming this phase and turned the unrest into creative turmoil. The following activities contributed to this:

- Organizing an event with external stakeholders. In case 11 people from outside the organization were invited to a workshop, which increased the pressure to come up with results.
- Organizing an excursion and go to the place where one could experience something of the problem or meet some of the stakeholders. In case 13 the participants of the innovation practice decided to meet each other at one of the regional junctions for which they were finding an innovative solution. This visit radically changed the way they thought about this junction.
- Preparing a physical product (like a particular design in case 11 or a booklet in case 17). This stimulated the participants to make ideas more explicit, to

actively combine these with the viewpoints and ideas of the others in order to make shared design decisions.
- Setting up experiments. In cases 6 and 7 the participants were stimulated by management to experiment with existing production lines. This raised a feeling of responsibility for attaining results, because existing production lines were at stake.

4.3.2 Supportive work environment

Enhancing reciprocal appeal

Most cases report that a crucial basis for reciprocal appeal was the subject matter expertise that people possess: respondents from almost all cases report that it was attractive to work with people who were more knowledgeable than they were, or who had expertise in other fields than they had. In two instances participants had left the group when they felt they could not learn enough from the others.

The cases showed that a supportive social context is characterised by input from others and their openness to new ideas, tolerance for mistakes, care, and respect. The fact that participants of most innovation practices created a work environment outside their daily functional work context made it possible to develop such a social setting. The functional work context is mostly dominated by position, hierarchical routines and avoiding loss of face.

Creating a supportive social environment was not easy for the participants in the innovation practices. Even outside the daily functional work context, teams struggled to find productive ways to cooperate. Misunderstandings and preconceptions about others were apparent. This made it often difficult to go beyond the exchange of information, and to develop new ideas. Cases 8 and 10 even got stuck because of this.

In the innovation practices two types of interventions helped the participants to create a working environment in which they could collaborate on the basis of reciprocal appeal:

- Interventions directly addressing everyone's attractiveness for the team: This was the case when participants were asked directly and personally to make explicit what they expected from others and what they thought their own contribution could be. This clearly had a positive effect in some of the cases. It made the mutual attractiveness visible and it invited people to work on the basis of reciprocal appeal instead of using their function or position as a starting point for the collaboration. Case 11 for example shows how the intervention of a facilitator directly influenced the way the people involved dealt with the reciprocal appeal in the group. In this case, the facilitator explicitly asked the participants of the innovation practice to articulate their contribution to the process. By articulating their own contribution, two of the participants involved realised that their contribution did not really add something. As a result they left the innovation practice.

- Introducing new methods of problem solving and cooperation:
  The introduction of new ways of working stimulated the creation of more attractive patterns of cooperation. In case 3 a new methodology for problem solving gave a clear perspective on the collaboration and it created a context that was from the beginning on very different from everyday work. In other cases deliberate interventions in a meeting, like playing a game in case 8, helped the participants to step out of the discussion mode into a process of listening and dialogue.

Searching for a passion

In all the cases the participants were highly committed to attain results. They all had an apparent personal interest: either in the topic (this was the case in cases 12, 13, 15 and 18), and/or in the core challenge because they personally experienced the issues the project dealt with in their daily work (this was the case in cases 4, 5 and 17). It was the intrinsic motivation of the participants that seemed to be the driving force behind the innovation practices that were part of the present study. This personal passion provided in many cases both curiosity and the determination to succeed.

Interventions that were effective in the innovation practices studied include:

- To invite participants on the basis of passion and personal interest:
  It is especially powerful when participants in an innovation practice have both a passion for the content that is central, and a stake in the solution of the problem the innovation practice aims to solve. The results indicate that a lack of curiosity and absence of a personal stake can hinder the innovation process. In case 2 the participants' curiosity with respect to the content was limited. In this case the participants didn't explore new directions and didn't develop new ideas. As a consequence, a more traditional problem solving approach prevailed. In cases in which the personal interest in the solution was less apparent or even negative, it was often difficult to keep the level of energy high (e.g. cases 8, 11 and 16).
  Not involving problem owners can slow down the process. This became clear from case 14. In this case the key players defined the ambition of the project in a way that actually hindered the process. They defined the desired outcome as a service innovation (a new diagnostic centre) whereas a definition in terms of a process innovation (new roles of GP's in the diagnostic process) would have been more productive. In this case the passion of these key players stimulated them to go very fast and to think already in terms of setting up the diagnostic centre. But because they didn't involve the prob-

lem owners (GP's and patients) in the innovation process, they forgot about an important aspect of the innovation, namely the new roles and abilities of GP's in this process.

- Special care and trust of management:
  Although the motivation concerned primarily intrinsic motivation, the cases show that pride, recognition and personal career motives are also important for the people involved. This motivation can be fed by extrinsic means such as attention or involvement of management. Management can show their trust for instance by explicitly giving participants in the innovation practice the responsibility for the work they're doing there. Cases 5, 6 and 7 show an example of this management behaviour. Management in these cases explicitly encouraged experimentation. This gave the team a feeling of responsibility and recognition.

Tempting towards knowledge productivity

Being tempted towards knowledge productivity seems to be a crucial condition for an improvement or innovation to succeed. Although innovations can't be forced, there were interventions that stimulated the innovation process. These interventions appeared to be related to the creation of a favourable social climate, and to the personal passion and motivation of the participants involved. Furthermore it became clear that interventions that stimulate active experimentation contribute to the innovation process as well. The interventions have a clear link with the previous two principles. A common characteristic of these interventions - or 'temptation strategies' - is that none of them directly manages the innovation process. They all concentrate on the creation of a setting and context for the innovation process to succeed.

Interventions to create a positive social climate include:

- Deliberately creating and foster cooperation across functions and backgrounds. This happened in almost all cases.
- Creating a new setting that invites people to use new methods of working and to develop new interaction patterns. In case 11, 12 and 13 the participants explicitly worked with a 'community of practice approach'. Indeed, this was a new approach that helped them to relinquish the conventional way of working.
- Making it a 'special event' for the participants involved in the innovation practice, e.g. by making the activities visible and recognisable for others within the organization. This contributes to a feeling of connectedness among the participants, and at the same time it makes them feel special and appreciated. Examples of interventions that aimed to turn the activities in the innovation practice into something special were found in cases 3, 5, 6 and 7.

- Facilitating the process of working on the basis of reciprocal appeal by targeted interventions or methods (cases 9 and 11).

Interventions that address passion and personal motivation include:

- Inviting participants based on personal interest and expertise instead of inviting them because of their formal position, or as representative of a functional group. In most of the cases participants were invited because of their interests and expertise and that put the message across that expertise mattered and was valued. People felt invited to use and develop their personal abilities.
- Linking the core team to others -inside and outside the organization- who have a clear stake in the results of the innovation practice (e.g. managers, clients, colleagues). This has two effects: 1) it contributes to a personally felt urge to go on since there are others waiting for results, and 2) it contributes to a feeling of being recognized as someone who does work that matters for the organization.

Intervention that stimulates participants to experiment and explore new ideas:

- Formulating the assignment in such a way that, in order to solve it, taking a new direction is inevitable. For example: in case 5 the assignment in the innovation practice was to integrate production lines of different products, and in case 4 the assignment was to change the distribution system fundamentally. Executing experiments enables participants to make the step from exchanging and discussing to doing something.

4.4 Conclusions

The meta-analysis was executed with the aim of validating and possibly extending the conceptual framework presented in chapter 2. The three research questions refer to the components of this framework.

What led to the necessity to improve and innovate?

The necessity to improve and to innovate originated either from an urgent business problem, or from a strategic choice of the organization. When innovation originates from an urgent business problem, organizations face a problem that they cannot solve by their actual way of working. It could be a problem for which they have tried already several alternative solutions that didn't work. For such a problem, an innovative solution needs to be developed. Such an urgent problem creates time pressure and dedication that contribute to the development of both improvements and innovations.

When innovation originates from a strategic choice, organizations notice opportunities to improve quality or to work more efficient. Or, instead of seeing opportunities, they might also notice developments that could become threatening to them in the future. In the cases in which innovation was a strategic choice a sense of urgency is necessary for the innovation to succeed. In all cases it was the urge felt by the people involved, that triggered the process and kept it going, even when facing difficult situations. The sense of urgency seems to be a powerful driver for improvement and innovation.

One of the assumptions made in chapter 2, based on the literature review, was that the outcome of innovation processes in terms of gradual improvements and radical innovations would depend on the organization's strategy and the kind of problems encountered by employees. In the meta-analysis no confirmation was found for this contention. The findings of the meta-analysis suggest that innovations do originate from either a strategic choice of the organization, or an urgent business problem. But no relationship was found between the kind of strategy that was pursued and the outcome of the innovation process. And no relationship was found either between the kind of problems that were encountered, and the output of the innovation process. What seems to matter most is the intention of the organizations and the employees to come up with innovative solutions. The subsequent output may then be either a gradual improvement or a radical innovation.

What was the outcome of the innovation process?

The innovation processes resulted in both gradual improvements and radical innovations. The cases that were triggered by a strategic choice of the organization either got stuck or resulted in radical innovations. A possible explanation for this could be found in the lack of time pressure. In the innovation processes triggered by a strategic choice, the influence of time pressure was limited, so participants had the time to explore new paths. However, in addition to the possibility of exploring new directions and coming up with radical innovations, this also brings on the risk of getting bogged down in exchanges of opinion or disputes between different perspectives. Faced with these hurdles, participants would feel no urge to overcome them, which could easily cause the process to get stuck.

The cases that were triggered by an urgent problem resulted in both gradual improvements and radical innovations. In these cases time pressure clearly played a role in the outcome of the process. Because time and space for experimentation and the exploration of various paths was limited, participants first traced already available solutions or directly applicable expertise to solve the problem. Instances in which expertise in their own organization was available to immediately solve the problem, this resulted in improvements of products or operating procedures. Instances in which the available knowledge was not directly applicable, led to the search for other sources of expertise, outside the organization. In these cases for instance a model or an idea from a similar organization in another country, or from a different organization in a different sector formed the starting point. Participants needed to further develop and adapt these external solutions for their own situation. In these cases radical innovation was more likely to occur.

The improvements and innovations relate to both products and processes. It became clear that product innovations and process innovations are not always clearly distinguishable. Often, the introduction of a new products necessitates a new way of working.

The ability to be innovative, which is also a yield of innovation, was not an explicit point of attention in the cases that were part of the study. The participants were mainly involved with the specific innovation or improvement they were working on. This finding could be compared to findings on reflection or the development of metacognitive skills. From a theoretical perspective, these activities are found to be crucial for learning (see Section 2.6.2). However, in practice, these are rarely exercised. Reflection for instance, often suffers from a lack of time on the part of employees (Van Lakerveld, 2005).

What factors and what interventions enhanced or inhibited the learning processes that led to the improvement or innovation?

The factors as depicted in the conceptual framework that were expected to influence the learning process (seven learning functions and three development principles) were all recognised in the cases. The participants in the cases, however, did not consciously make use of them in the innovation process. Conclusions with respect to the elements from the framework comprise:

- Creative turmoil stimulates the innovation process. The urge that participants experience to develop something new, and some form of external pressure, lead to the motivation to start the process, and to continue. At the same time, having the freedom to experiment with new ways of working and problem solving offers energy and new perspectives during the process. In several cases at various points in time the process got stuck. This happened at moments in which the exchange of opinions and information (either in a polite exchange or in an agitated discussion) took a more important place than the creation of new ideas and solutions. In these cases, organizing something, making a product, or doing an experiment, helped participants to overcome that phase.
- The substance of the innovation process is provided by the subject matter expertise. Subject matter development was at the heart of most of the studied innovation processes.

- Autonomy and responsibility took an important place. Participants in innovation practices needed the freedom to make their own choices and to decide on their own way of working. Participants needed communicative skills in order to do this successfully. It was not always self-evident for participants to possess those skills, and they needed support in order to develop them.
- In the rush of the project it was difficult for participants to find the time for reflection. And, at the same time, they did not always know how to give shape to reflection. If reflective activities were undertaken, they were often of an instrumental nature. That means, they were focused on the next steps to take in the process. The participants in the innovation practice hardly ever reflected upon their own learning process.
- The social context for knowledge productivity was provided by the cross-functional personal contacts. Care and respect for each other, and tolerance for mistakes were important for this context as well.
- For innovation it works favourable when people are passionate about the theme that is central in the innovation practice, and when they have a clear stake in the outcome. Furthermore, the drive to succeed can be fed externally. Reward and recognition from management or sponsors, have a positive effect.
- It became clear that it is not possible to directly manage the process of innovation. This can be explained from the fact that innovation is a process with an unknown outcome. Neither the participants in innovation practices nor their managers know which steps must be taken upfront. Indeed, careful planning and control is not possible in such processes. Inviting people and tempting them to engage in the process appeared to be a successful strategy.

Validation of the conceptual framework

Reflecting upon the goal of the meta-analysis -to validate and extend the conceptual framework- it could be stated that the meta-analysis of 18 case studies of innovation practices provides validation for the conceptual framework presented in chapter 2. The meta-analysis led to an illustration of the different elements of the conceptual framework and to further refinement of these elements. There were mainly three points on which the framework could be refined.

First, the nature of the subject matter expertise that is used differs throughout the innovation practices. The subject matter expertise that contributes to gradual improvements is expertise that is available within the organization and that can directly be applied. The subject matter expertise necessary for radical innovations, however, needed to be developed. The participants in these innovation practices often used the experiences of other departments or other countries as a starting point. In all cases it was necessary to further develop this expertise in order to make it applicable to the specific situation in the innovation practice.

Second, the motivation that participants felt in the innovation practices was not always an intrinsic motivation that was related to the task or subject matter at hand. Sometimes the motivation was clearly the result of personal stakes. In some of the cases career opportunities or the desire for recognition played a role. This finding is closely related to what Amabile (1996) found. Her research revealed that in creative processes the role of intrinsic motivation is crucial. Furthermore, she found evidence that extrinsic motivation does not necessarily undermine intrinsic motivation and creativity. She suggests, and this is in line with the findings in the present study, that in some cases extrinsic motivation might even contribute to the creative process.

Third, the cross-functional teams that worked in the innovation practices succeeded -at least in the successful cases- in creating a learning environment in which personal involvement played an important role. This context differed from the participants' day-to-day work context that was usually based on functions and hierarchy. The differences between the work environment that the participants designed in the innovation practice and the work environment in their day-to-day environment, is striking. This is interesting to explore further especially because in the present research project innovation is depicted as a learning process that is closely related to, or even coincides with the work itself.

5

Parallel study to trace factors that enhance learning in innovation practices

This chapter describes the study that aims to find out what factors enhance the learning processes leading to innovation. The central research question in this research phase is:

> *What factors enhance or inhibit the learning processes at moments that are crucial for the success of the innovation practice?*

The study consisted of a parallel study of 10 innovation practices. The findings were compared with literature in the fields of innovation and learning, and more specifically the problem-solving field of learning. The outcome of this study was a set of design principles. These principles were validated with facilitators and members of innovation practices.

5.1 Context of the study

The research took place in collaboration with Habiforum[1], a network organization that aims to develop innovative and sustainable forms of land use in The Netherlands. Habiforum works with innovation practices in which public and private parties, and others, collaborate in order to find suitable solutions to challenging questions. Experimentation takes an important role in these innovation practices. The participants in these innovation practices experiment with new ways of organizing planning processes. An innovation practice centres around a concrete practical problem, for which no answer is available yet. In these innovation practices stakeholders who are directly involved in the problem, or who have a motive in solving it, participate. Stakeholders include for instance officials, inhabitants or shop owners. The participants meet regularly and a facilitator from Habiforum's network is available to support them. The outcome of these innovation practices can consist of smart combinations of functions and parties or a seemingly regular plan that for the people involved, however, can be completely new because of the

[1] *For more information see the website www.habiforum.nl (in Dutch)*

way it was developed (Habiforum, 2006). The parallel study was conducted in 10 of Habiforum's innovation practices. A short description of each of the cases is given below, just as a meaningful breakthrough for each of the innovation practices.

Post-war district

This innovation practice evolved around a post-war district in the North of Holland that needed a new impulse. In this city, and particularly in this neighbourhood, the economical situation wasn't very good. The number of inhabitants decreased because the number of elderly people increased, and many youngsters left the city. The local authorities wanted to make the city attractive again and restructuring this particular neighbourhood was one of their initiatives. This neighbourhood is a post-war district that attracts disadvantaged people, mainly Antilleans. The local authorities wanted to restructure this district to make it a pleasant place to live in. The regular planning process resulted in a vision statement. Although this vision statement contained good ideas, many people wondered whether this vision statement could help the neighbourhood improve. In this innovation practice local authorities worked in collaboration with a housing foundation. Inhabitants and social institutions were also involved in the process. The innovation practice used different perspectives to look at the neighbourhood in order to find starting points to give the district a new impulse.

An important breakthrough in this innovation practice was the visit of an architect. He made a couple of different plans for the area, in which the Antilleans were no longer seen as the problem. In these proposals, the Antillean culture was seen as a unique and rich source of culture and entrepreneurship that could enrich the neighbourhood.

Rhombus

Close to a large city in The Netherlands there is an area called the 'rhombus' because of its shape, which is defined by four important highways. The area is important for the economy of the city, but it also affects the surrounding municipalities negatively with air pollution and noise. Furthermore, the rhombus works as a barrier between these municipalities and the city centre. The municipalities are affected by poverty, unemployment, and a lack of safety. In the innovation practice participants tried to find ways to use the infrastructure of the zone as an engine for economic development. The concrete starting point was a collaboration with one of the surrounding villages. Participants in this innovation practice included a facilitator, an official occupied with the planning process of one of the surrounding municipalities, another municipal official and a researcher from a national research agency.

An important breakthrough in this innovation practice was the interviews that one of the interns at the municipality did with the official and other actors. These interviews gave an overview of the different perspectives on the area.

Industrial area

The local authority of this city wanted to give the industrial area on the outskirts of the city a new impulse. In order to realise their ambition they collaborated with parties that had a vision for the area and that were involved with it. They didn't invite parties that only wanted to build in the area and then leave again. They looked for people who wanted to participate in order to bring about economic dynamism and sustainable planning. In this innovation practice people from the local authority collaborated, amongst others, with a real estate company, a construction company and a national knowledge institution. The local authorities wanted to realise an urban development that would facilitate new types of employment. To meet this goal they were even prepared to break the contracts with companies that were already settled there. The local authorities initiated an innovation practice in which they collaborated together with private parties.

An important breakthrough in the process occurred in a meeting with potential investors. The meeting began very formally. Although people felt frustrated, they didn't express this. The breakthrough was realised when the facilitator asked them: what is your stake in this project? Everyone's frustration and ambitions were put on the table. This caused the conversation to open up.

Multi-layered area

The local authorities of this city expected a shortage of places for companies to settle. The association of entrepreneurs in this municipality took the initiative to develop an innovative multi-layered industrial area. An employee of the municipality, a member of the association for entrepreneurs and a member of the chamber of commerce were involved in this innovation practice.

An important breakthrough was the one that led to the innovation practice itself. The local authorities began by asking how they could provide more space for organizations to settle in the area. One of the entrepreneurs who would play an active role in the process later on didn't feel much for this. He was afraid that the local authorities would develop an overly obvious solution that would bring nothing new to the city other than an outspread industrial area. He expected that no one would be interested in developing such an area. He then reformulated the question as follows: How could we realise an innovative and multi-layered industrial area? This created the energy that was needed to start the innovation practice.

Mounds

Inhabitants and users of a polder participated in this innovation practice that aimed to restructure the polder. The inhabitants, consisting of farmers and others, took the initiative to find a sustainable solution for the problems they were experiencing in relation to the high water of the Maas River. They thought of working with mounds (artificial hills that are made to create dry places whenever the water rises). In the innovation practice they elaborated upon this idea.

An important breakthrough in this innovation practice took place when the expertise of the farmers who were involved in the innovation practice was explicitly acknowledged by the local authorities. This broadened the involvement of the farmers in the innovation practice.

City harbour

The harbour in this city was built in the 1920s to fulfil the wish of companies for a form of water transport. However, the emergence of freight traffic on the city's roads caused the harbour to lose its original function. The area then attracted companies selling cars or storage, for instance. The area also had many monumental factories, and as the banks of the river were neglected, rare plants grew there and sometimes kingfishers could be seen.

Local authorities, inhabitants and builders all had their own ideas for the area. Some wanted to cherish this special place by strengthening the qualities of the harbour area, others wanted to cherish it by turning it into a hiking trail, or by building houses near the water. The local authorities, inhabitants and local market parties all participated in this innovation practice. They discussed the development of the entire area in order to arrive at common a common vision for the area.

At the start of this innovation practice the participants made a bike tour to an area close by. This caused an important breakthrough. In this area the local authorities had succeeded in restoring various small rivers. The participants found this an inspiring example. At the same time there was a positive effect from making a trip together and having a joint experience, instead of just talking all the time.

Hinge

Many small shops were settled in the centre of a city. These shops had limited financial resources to invest in the area and there was a risk that this lively area would become destructed. The innovation practice that operated in this area wanted to apply the innovative idea of a 'city-on-top-of-a-city' in order to halt the destruction plans. This new idea included attracting people who wanted to live above the shops. Other functions such as parking and catering were possible as well. The core group of participants in this innovation practice consisted of project developers, local authorities, and experts who developed the concept of a 'city-on-top-of-a-city'.

One of the disappointments of this innovation practice occurred when nobody came to visit a workshop organized by the participants of the innovation practice. They invited all the inhabitants of the area but nobody showed up. Although this was a disappointment for them, they used this moment to take a step back and reflect upon the process they had gone through. This breakthrough led to the development of new ideas for involving the inhabitants.

Health boulevard

This innovation practice made a concentrated effort to restructure an open and green area. Not long ago, two municipalities merged and, as a consequence, the green area that used to lay between the two municipalities now found itself right in the centre of the new town. This seemed to be the perfect chance to realise a new development in the area. The green area was very dynamic for its size (1,5 x 1,5 kilometres). Various initiatives were being discussed, for instance healthcare organizations and educational organizations wanted to collaborate with each other in the particular area. There were also plans for a new highway to cross this area. Given these different initiatives, an integral approach to design the future of this area was necessary. The innovation practice built a vision to further develop this area.

In the innovation practice an important breakthrough took place when the initiatives relating to nature were linked with those relating to healthcare. This resulted in the concept of 'health boulevard'. The new concept helped the participants develop a new perspective on the area.

Triangle

The local authorities of three large cities and three villages wanted to develop and carry out a joint vision. They had defined 30 projects (e.g. to build houses, companies and light rail) to experiment with this new vision. The innovation practice concentrated on the way in which these projects could be carried out in keeping with the vision. One question that they worked on, for instance, was: How can we best collaborate with market parties?

At a certain point in time the representatives of the municipalities who made up the innovation practice had developed a plan. They wanted to present this plan to the town councils of the six municipalities. However, they knew it wouldn't work if they presented it as a formal piece that had to be decided upon. Instead, they decided to approach ten key players to ask them what they thought about the plan. This different approach led to a breakthrough. The key players all identified with the plan, and they successfully introduced it to the local authorities.

Polder

The participants in this innovation practice concerned themselves with the future of a specific polder. This polder, which used to be a lake, was built to provide space for 'dry' agriculture. In order to keep the polder dry, millions of m3 of water must be drained yearly. Climate change combined with some local developments form a threat for the polder. It is expected that every year more water will have to be drained in order to keep the polder dry. The innovation practice focused on this question. Participants saw the situation as a threat and wanted to take advantage of it to work on sustainable development and a better spatial quality in the area.

The most important breakthrough in this innovation practice was when the participants hired a minivan and made an excursion. This breakthrough is explained in greater detail in Section 5.3.2.

5.2 Method

The parallel study consisted of explorative and inductive case study research into the innovation practices. The research was guided by the search for breakthroughs. Breakthroughs were considered the moments that are crucial for the success of innovation practices (see Section 3.4.3). The breakthroughs were derived from the observations done by the researchers and the reflections given by facilitators and participants in the innovation practices. It was up to them to qualify an occurrence as a breakthrough.

The intensity of data-gathering differed throughout the cases. Four of the innovation practices were submitted to intensive data collection. This meant attending meetings to observe what happened, interviewing the people involved, and regularly organizing reflective conversations with the main facilitators of these innovation practices. The goal was to keep track of what happened in these innovation processes and to trace moments that were qualified as breakthroughs by the people involved. For the innovation practices that were followed intensively, thick descriptions with the 'complete story' were made (see Section 3.4.4). These descriptions not only contained a description of the breakthrough moments (what happened, who were involved, what was the result), but also a description of the process the innovation practice went through in terms of important moments and decisions. As part of the validation process, the facilitators checked these descriptions. Another six of the innovation practices were followed less intensively. In these innovation practices the researchers had regular reflective conversations with the main facilitators and by means of these conversations breakthroughs were tracked down. The result was a 'thin description' per innovation practice that contained an overview of the breakthroughs that occurred. Table 5.1 presents an overview of the cases and the data-collection methods that were applied.

Additionally, the researchers joined the meetings organized for the facilitators of innovation practices. These gatherings were used to experiment with research instruments, check findings and track down breakthroughs.

The result of the analysis was a set of design principles. A validation of these design principles took place with facilitators and participants of the innovation practices.

Instruments

At the start of the research interviews were conducted with each of the facilitators. These interviews were guided by topics on how the innovation practices started, what the facilitators' expectations were, how they viewed their own role, and what questions they had at that moment. These interviews had the function of getting to know each other and to get an impression of the expectation of the facilitators with respect to the innovation practice and to learn more about their interpretation of their role. At the same time, this interview offered the researcher the opportunity to tell something about the goals of the research and the way of working.

Observations took place during meetings of the innovation practice. The observation schedules both had room for notes about the expectations of the people involved of the meeting and the yields of the meeting (with respect to content, process and people involved), and they had room for notes about what happened during the meeting. The aim of the observations was to get to know the context of the innovation practice and at the same time hold on to important situations.

The regular face-to-face and telephone interviews with the facilitators and other participants were meant to trace breakthroughs. In order to map the breakthroughs that were traced, for each breakthrough a sheet with six question was filled out: 1) the name of the innovation practice; 2) the important dates with respect to the breakthrough; 3) description of the breakthrough; 4) description of how it looked like in practice; 5) description of the leverage; 6) a note on whether follow-up was needed.

Table 5.1 *Overview of the cases and methods of data gathering*

<table>
<tr><th>Case</th><th>Description</th><th>Methods used for data gathering</th></tr>
<tr><td>Post-war district</td><td>To restructure a specific quarter in a city in the North of The Netherlands</td><td rowspan="4">Start-off face-to-face interviews with the facilitators of the innovation practices

Attending meetings of the innovation practice

Face-to-face interviews and telephone interviews with facilitators of innovation practices

Face-to-face interviews with other participants in the innovation practice</td></tr>
<tr><td>Rhombus</td><td>To abolish the barrier of this area in order to give an impulse to the social development of this part of the city</td></tr>
<tr><td>Industrial area</td><td>To restructure an industrial area in order to bring about economic dynamics and sustainable planning</td></tr>
<tr><td>Multi-layered area</td><td>To realise a multi-layered industrial area</td></tr>
<tr><td>Mounds</td><td>To develop ‘mounds’ to be safe for the rising water</td><td rowspan="6">Start-off face-to-face interview with the facilitators of the innovation practices

Regular short interviews via telephone with facilitators of the innovation practices to keep track of the process and to trace breakthroughs</td></tr>
<tr><td>City harbour</td><td>To restructure the banks of the city harbour</td></tr>
<tr><td>Hinge</td><td>To create a ‘city-on-top-of-a-city’</td></tr>
<tr><td>Health boulevard</td><td>To restructure the area between two municipalities</td></tr>
<tr><td>Triangle</td><td>Six municipalities wanted to make a joint vision and carry this out</td></tr>
<tr><td>Polder</td><td>To find a sustainable solution to keep the polder dry</td></tr>
</table>

Data analysis

The breakthroughs that occurred in the innovation practices were input for the phase of analysis. In this phase an inductive analysis (Patton, 1990) was conducted. This is a process in which categories of analysis come from the data: they emerge out of the data rather than being imposed on them prior to data collection and analysis. As Merriam (1988) describes, in an inductive analysis the search for recurring regularities within the data takes a central place. This approach resembles the grounded theory approach as developed by Glaser and Strauss (1976). An inductive analysis was used to find out what factors enhanced or inhibited the learning process in each of the breakthroughs that were tracked down. Besides the breakthroughs, moments in which the process got stuck were used in the analysis of the data. These moments contributed to a better understanding of the themes that were related to the breakthroughs. The data emerged around 12 themes. These themes were compared with literature in order to better understand and interpret them. Literature in the fields of innovation and learning, and more specifically the problem-solving field of learning was used for this purpose. The result was a description of the themes in the form of design principles for knowledge productivity. These design principles aimed to express the effective aspects underlying the breakthrough moments in the innovation practices. Each breakthrough seemed to contain more than one of these effective aspects. This means that the success of each of the breakthroughs could be explained by more than one (often two or three) design principles.

The choice for design principles as a format to present the outcomes of a descriptive study is not self-evident. Indeed, design principles are usually seen as a yield of design research (Van den Akker, 1999). The reasons to choose for design principles as the format to present the results of the analysis of the present study, are twofold. First, the choice was made in anticipation of the next research phase. In the design study (chapter 7) that follows the present study, the aim was to find out the extent to which the factors identified in the present study could help participants in innovation practices to actively design their work environment to enhance innovation. The expectation was that by formulating the outcome of this phase in design principles, it would be easier to collect at an earlier stage reactions of possible future users with respect to the design principles. Second, design principles seemed especially suitable to do justice to the variation and complexity that was found in the themes.

Van den Akker (1999, p. 9) describes design principles as heuristic statements of a format such as "If you want to design intervention X [for the purpose/function Y in context Z], then you are best advised to give that intervention the characteristics A, B and C [substantive emphasis], and to do that via procedures K, L and M [procedural emphasis], because of arguments P, Q and R.". A design principle encompasses a description of an intervention, its function and context, and it encompasses a description of the characteristics and procedures to design these characteristics. Finally, it encompasses an argumentation why to do so. However, the design principles in the present study do not fully comply with the format as prescribed by Van den Akker (1999). At this stage of the research this was not possible yet.

5.2.1 Validation of the design guidelines

A validation study was carried out to determine whether the design principles reflect the most important pillars that constitute a work environment that promotes knowledge productivity. The respondents in the validation study consisted of participants and facilitators of the innovation practices studied, as well as other innovation practices. They used the design principles to reflect on their innovation practices. With the facilitators of the innovation practices additional in-depth interviews were carried out in which they motivated their choices.

The study aimed to determine whether internal validity, the extent to which the findings are congruent with reality (Merriam, 1988), was realised. The data gathered in this validation study helped to find out whether the set was complete, and whether the design principles were clear. At the same time, in-depth interviews with some of the participants while they used the design principles to reflect on their innovation practice gave additional information about the validity of the design principles. From the differences and similarities in the way the respondents interpreted the design principles, it became clear to what extent their interpretation of the design principles was consistent. These interviews also gave insight in the way respondents worked with the principles.

Instrument

As a data-collection instrument a set of circular scales was applied (see Figure 5.1). The participants were asked to place cards labelled with design principles in the rings, indicating the degree to which these were active in their innovation practice: from very much attention for a principle (inner circle) to absence of a principle (outer circle). This instrument is based on the method of 'mapping' as described by Van der Waals (2001). The rings resemble a five-point Likert scale with the difference that people were allowed to place cards in between circles. A combination of the method of mapping and in-depth interviews gave insight into the way in which the respondents interpreted and used the design principles.

The respondents who worked with the circular scales in a face-to-face meeting were immediately interviewed about the place they assigned to the different principles, and about the breakthroughs in their innovation practices, or the absence of breakthroughs, that could illustrate their choice. Furthermore we asked them whether the principles helped them give meaning to the occurrences in their innovation practice, and whether there were important moments in their innovation practice that they couldn't describe with help of the principles.

The respondents who worked with the circular scales individually used an electronic version of the instrument. They were asked to place the principles in the rings, and for each of the principles they put on the scale, they were asked to clarify their choice.

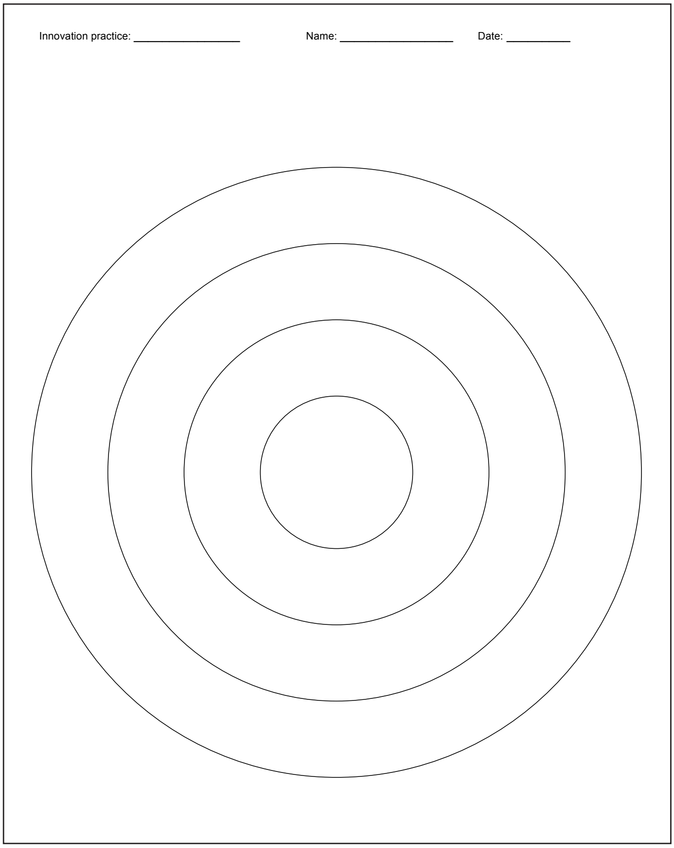


Figure 5.1.
Circular scale.

Participants

Facilitators of innovation practices (n=13) worked with the circular scales. This resulted in 11 scales that were filled out since four facilitators were co-facilitating the same innovation practice and filled out one circular scale. Another group of respondents (n=10) consisted of participants in different innovation practices.

The innovation practices the participants of this study were involved in, were in part the same as the innovation practices that were involved in the parallel study. Consequently, some of the respondents were familiar with the design principles already. This was the case for all the facilitators who participated in the validation study and for some of the other respondents.

Procedure

The goal of this research activity was to validate the design principles. The research activity was designed in such a way that it would help the respondents to reflect upon their own innovation practice. For the respondents, the opportunity for reflection was an important motivation for taking part. The data was gathered at several moments in time, in a period of eight months (May 2005-February 2006).

The facilitators filled out the circular scales while being interviewed by the researchers. The activity took them 90-120 minutes. The innovation practices' participants all filled out the scales individually. It is unknown how much time it took them. Some of the respondents elaborately filled out the clarifications that were asked for, whereas others did not clarify their choice at all.

A choice that was made during the data-gathering, was to remove design principle 10 (Generate creative turmoil) from the set of principles. The reasons for this are explained in Section 5.4.3. Four of the respondents, as can be seen in table 5.2, worked with the instrument using a set of 11 design principles, while the others all worked with the set of 12 principles.

Data analysis

The cards with design principles that the respondents had placed in the circular scales were scored according to their place: cards in the inner ring were assigned value 1, cards in the 2nd ring received value 2, cards in the 3rd ring value 3, cards in the 4th ring value 4 and cards placed outside the 4th ring received value 5. Cards that were placed in between two rings, were assigned halves (1,5, 2,5, 3,5 or 4,5). For each of the design principles, the mean and the standard deviation, to define the spread of the values, was defined.

Besides the numeric data, there were the interview results that showed how respondents gave meaning to the design principles. The differences and communalities in the way respondents gave meaning to the principles were defined, and the results of this analysis were added to the results of the analysis of the numeric data.

5.3 Design principles that enhance knowledge productivity

This section presents 12 design principles for knowledge productive work environments that emerged from the breakthroughs that were found in the innovation practices, and from the literature that was reviewed:

1. Formulate an urgent and intriguing question
2. Create a new approach

3. Work from individual motivation
4. Make unusual combinations of subject matter expertise
5. Work from mutual attractiveness
6. Build on strengths
7. Create something together
8. Entice to see new signals and to give them new meaning
9. Connect the world inside the innovation practice to the world outside
10. Generate creative turmoil
11. Pay attention to the social and communicative process
12. Actively support the development of competences

The sections below present the findings from the empirical research and the findings from the literature review. Each section describes the findings that led to the formulation of one design principle.

5.3.1 Typical questions that form the starting point for innovation

The breakthroughs in the cases showed that the formulation of the central question in the innovation practice influences the outcome. Participants in the innovation practices formulated and re-formulated the central problem. Breakthroughs occurred when they managed to formulate a question that somehow *worked*. Whether a question *worked*, was related to the extent to which it was intriguing for the people involved. In the innovation practices, questions became intriguing when:

- Participants formulated the question in terms of an appealing concept (e.g. a city-above-a-city, or a multi-layered industrial area). Unusual concepts triggered their creativity;
- Participants formulated the question in the form of a complex problem they experienced and that triggered them and that left enough space for various perspectives and directions (e.g. how can this water be stored even though the country is so full already?; how can we prevent this neighbourhood from becoming neglected?);
- Participants had questions that evoked their curiosity (e.g. an official who knew many people in a particular neighbourhood experienced that the beauty of the neighbourhood had died, and his personal involvement made him curious to find new perspectives on this problematic situation).

Besides the necessity of the question being *intriguing* for the people involved, the extent to which a question was experienced as *urgent*, seemed also relevant. In the Industrial area case the urgency of the question the innovation practice worked on, remained unclear during the whole process. In the particular innovation practice this led to long conversations, little activity in between meetings, participants who awaited developments and who asked a lot of questions. They didn't feel an urge to answer the question and that caused some slowness in the process. Instances in which the urgency was clearly there, the process got an impulse and could go on. This was the case when for instance an authoritative person with a substantive stake in the solution, set a clear deadline (e.g. in the Rhombus case).

Problem finding

Literature in the field of cognition affirms that the outcome of a problem-solving process is defined by the definition of the problem (Benjafield, 1997). Innovation can be seen as a special kind of problem solving that could also be referred to as problem finding (Getzels, 1979; Mackworth, 1965).

In many cognitive processes in which people engage, the definition of the problem, the method to solve the problem and the solution are known. For instance in arithmetic class when the teacher asks a student to calculate the area of a square with sides of three metres. The student may not know how to solve this problem initially, but will discover the correct method while working the problem. In this situation the problem is given to the student by the teacher, the method to solve the problem (the formula to calculate areas) is known, and so is the solution. The teacher presents this problem to the student with an educational purpose.

Innovation can be seen as a different kind of problem solving. In innovation the problem must be formulated, the method must be found, and the solution must be developed. This specific kind of problem solving is also referred to as problem finding (Getzels, 1979; Mackworth, 1965). The emphasis in problem finding is on the definition of a problem. As Weick (1995) said, it is never a problem that presents itself to us, it is rather a problematic situation. Getzels (1979, p.167) said that it matters how a problem is formulated: "dilemmas do not present themselves automatically as problems capable of resolution or even sensible contemplation. They must be posed and formulated in fruitful and often radical ways if they are to be moved toward solution".

The more a person explores the space of a problem prior to attempting to produce a solution, the more creative will be the result (Benjafield, 1997). In an initial problem definition our own thinking and behaviour-patterns are visible, and that can hinder the search for new solutions. A question that evokes new ways of working and that leaves room for new and uncommon perspectives must be actively developed by the people involved. The first step in creative activity involves the formulation of the problem itself (Getzels & Csikszentmihalyi, 1976).

In innovation practices in which the participants formulated a question that was both urgent and intriguing to them, it led to activity and breakthroughs. In these instances the process of problem finding appeared to be successful. This finding led to the formulation of the first design principle (see Figure 5.2).

Figure 5.2. Design principle 1.

Design Principle 1: Formulate an urgent and intriguing question

Developing an urgent and intriguing question is necessary for innovation. Such a question is not a given, it needs active development in interaction with key players and stakeholders. Urgency refers not only to a rational urge but also to the personal feeling that there is an urge. This means that the question must be formulated in such a way that the people who work on it have the feeling that the question cannot remain unanswered. An intriguing question refers to a question that entices people to develop new perspectives. A question can become intriguing when an unusual combination of concepts is made.

5.3.2 New ways of working that deviate from the traditional approach

Many breakthroughs were characterised by a new way of working. Traditional meetings with agendas were traded off against open conversations with the individual involvement as the main topic of conversation. Information was not gathered by large-scale surveys with truth-finding as the main goal but rather by small-scale excursions by the people who joined the innovation practice in order to understand the different perspectives from people involved in the area the innovation practice was occupied with.

Theoretically, this can be explained by the idea that all learning integrates thinking and doing (Senge, Scharmer, Jaworski, & Flowers, 2005). Innovative solutions often require breaking with the actual way of thinking, and adopting a new frame of reference. The cases revealed that this new way of thinking can be stimulated by new ways of doing. Some 'old ways of working' provoke 'old behaviour'. They will not lead to solutions that break with the existing way of thinking. An official meeting with a chairman, a secretary and an agenda that defines the procedure is not a setting that easily evokes new ways of thinking. The traditional hierarchy that exists in such a setting does not stimulate the innovation process. In the innovation practices these ways of working were often traded off against forms in which individuals and their perspectives played an important role. See for instance the example below, taken from the Polder case:

Example from the Polder case

The participants in this innovation practice experienced difficulties in explaining each other their interest in the innovation practice. To overcome this, they hired a minivan and with a small group of people (each belonging to one of the stakeholder groups that had an interest in the polder environment) and they made a tour through the polder. There were inhabitants, farmers, environmentalists and people who represented the group of visitors who visited the polder for recreation. Each of these stakeholders got the key of the bus for one hour. Within that hour they were free to show the others whatever they wanted. The idea was that everyone would guide the others through the polder, showing them what they found so attractive. The inhabitants for instance chose to have a coffee at a certain café in the polder where the view was exceptionally beautiful. In the afternoon they sat together and talked about the meaning of the polder to each of them. The outcome of this outing was that the various perspectives and interests became clear to everyone. This enabled them to facilitate their own process. The external facilitator was not needed as much as before.

Breaking with hindering patterns

In the literature review, not many sources were found that indicated that new ways of working are necessary for the promotion of innovation. A possible explanation for this is that a new way of working is not an end in itself. Rather, one must develop new ways of working at places where the actual way of working causes patterns that hinder the innovation process.

Path creation

What is stressed in literature on innovation is the overall way of working that promotes the innovation process. Garud and Karnøe (2003) compared in their research the emergence of wind turbines in Denmark to the emergence of wind turbines in the United States. The development of wind turbines is regarded as a form of technology entrepreneurship that requires different kinds of knowledge and the input of many actors. Denmark and the United States pursued contrasting approaches in this process, and the authors explored why actors in Denmark prevailed over those in the United States. From their study it became clear that the developers in the United States were eagerly aiming to create a major breakthrough, whereas their colleagues in Denmark, instead of pursuing an intensive R&D approach, deployed prototypes with simple engineering heuristics to engender trial-and-error learning. In the United States the goal was to create a design that had radically changed features in comparison to existing technology. In Denmark they worked in a process of emergent co-shaping in which they steadily scaled up designs, incorporating inputs of the many actors involved. Garud and Karnøe label the process that was followed in Denmark 'bricolage'. Users in Denmark continuously offered feedback, and firms learned from each other at so-called *Windmeetings*. Many actors were involved in the Danish process, including producers, users, evaluators, and regulators. Each shaped the emerging path from a particular point of view. Garud and Karnøe characterise the way of working of the Danish not as an act of discovery by alert individuals, but as the creation of a new path through the distributed efforts of many (Garud & Karnøe, 2003, p. 296). Van

Staveren (2007, p. 319) in her research on collaboration in innovation processes, refers to this approach as a developmental design. The learning environment necessary for innovation, according to her, cannot be designed in advance. It is an environment that the participants develop by constantly adapting it to the dynamics in the innovation process. Lessons learned form the basis for next steps to take. Grand and MacLean (2003), like Garud and Karnøe (2001), define the approach that could foster innovation as path creation, a process that can be recognised in the approach of the Danish wind turbine developers. Grand and MacLean see innovation not as the creation of something new that completely devalues existing ideas and structures. They studied the emergence of novelty not as an isolated and independent act, but rather as a process, temporally and socially embedded, that comes about via path creation. Path creation implies that participants in innovation processes step-by-step deviate from the path that used to be followed. The participants are seen as knowledgeable actors with the ability to proactively make sense, enact and shape opportunities.

The results from the research in the innovation practices combined with the findings from the literature review led to the formulation of the second design principle (see Figure 5.3).

Figure 5.3. Design principle 2.

Design principle 2: Create a new approach

In order to find new solutions ('thinking new'), a new way of working ('acting new') is necessary. Such a new approach can be realised by breaking with hindering structures (e.g. instead of talking about the problem in a formal meeting, making an excursion and showing each other what bothers you), and by designing an overall approach. The overall approach is characterised by a developmental approach: step-by-step designing of a process that deviates from existing routines.

5.3.3 Individual motivation as the basis for creativity

The cases reveal that individual motivation is a powerful engine for innovation. Breakthroughs in the innovation practices were often preceded by a discussion of the participants' individual motivation. When the individual interests of the people involved were discussed, participants asked each other questions such as: 'what do you dream of?'; 'what are you enthusiastic for?'; 'what is your interest in this project?'; and 'what do you want to realise?' See the example of the Industrial area case:

Example from the Industrial area case

An important milestone in this innovation practice was the moment that the facilitator asked all of the attendants in the meeting to share what their personal stake in

> the project was. This conversation offered an attractive alternative for the behaviour that hadn't helped them until now. Instead of a formal meeting it became a personal conversation that stimulated the process. Not the formal positions of the people involved determined the agenda. Rather, the personal involvement determined the conversation. This led to a breakthrough in this innovation practice.

Instances in which participants acted on behalf of the organization they worked for, or on behalf of the special interest group they represented, caused the process in the innovation practice to slow down. Apparently, it doesn't stimulate the process when people use their function or their organization's goal as a starting point instead of their own interests.

Taking a closer look at the kind of motivation or interest that participants bring up, it becomes clear that their motivation either deals with the specific content of the innovation practice, or with the desire for recognition for a specific piece of work. In literature these different aspects of innovation are referred to as intrinsic and extrinsic motivation. The next sections delve deeper into the concept of motivation in order to better understand its importance for the learning processes in innovation.

Intrinsic and extrinsic motivation

Individuals are capable of special achievements when they work from individual motivation. This is confirmed by various authors. Authors refer to this kind of personal involvement with different concepts, such as intrinsic motivation (Deci & Ryan, 1985), flow (Csikszentmihalyi, 1997), engagement (Nahapiet & Ghoshal, 1998) and passion (Amabile, 2000; Kessels, 2001b).

Amabile (1996) is one of the first researchers who directly related intrinsic motivation to creativity. She states that most familiar research on creativity focuses on brainstorming programmes consisting of sets of rules that serve as guidelines for the generation of creative solutions to problems. These researches compare ideas generated by people who had been trained in such a programme with those of people who had not. In contrast to what the authors of these researches did, Amabile examined the contribution from learning and social environment to creativity, and concluded that intrinsic motivation is closely related to creativity: "when people are primarily motivated to do some creative activity by their own interest in and enjoyment of that activity, they may be more creative than they are when primarily motivated by some goal imposed on them by others" (p.15). Interesting furthermore is the evidence she found for an 'additive model' of intrinsic and extrinsic motivation. Intrinsic motivation is defined as any motivation that arises from the individual's positive reaction to qualities of the task itself, and extrinsic motivation as any motivation that arises from sources outside of the task itself. Evidence was found that extrinsic motivation does not necessarily undermine intrinsic motivation and creativity. Indeed, it is possible that some types of extrinsic motivation may enhance creativity.

This finding relates to the findings in our case study. The personal motivation of participants in the innovation practices did not only relate to the task itself, it was also motivation that arose from sources outside the innovation practice itself, such as the recognition for finally finding a solution to a difficult question. Amabile (1993) found several extrinsic factors that can positively contribute to intrinsic motivation and thus creativity. These 'synergistic extrinsic motivators' comprise reward, recognition, and feedback that confirm competence, as well as feedback that provides important information on how to improve competence.

Being involved as an individual

Hiding behind organizational goals or acting as a representative of a group of stakeholders, does not work for innovation. That is what became clear from the innovation practices that were part of the study. This might be explained by people's need for autonomy. Christis (1992) found that as soon as task demands increase, individuals need autonomy and freedom to fill in their own work. When innovation is seen as work with high task demands, it becomes clear that people who participate in innovation practices need autonomy to fulfil their task. Following this line of reasoning, organizations that impose their own goals to participants in innovation practices, undermine this autonomy. When these organization goals are used to evaluate the results of the innovation practice, creativity is obstructed since such an evaluation system would undermine people's sense of self-determination (Amabile, 1993).

The findings from the cases were supported by the findings from literature. Altogether these findings led to the formulation of a third design principle (see Figure 5.4). This design principle stresses the individual and the individual's motivation.

Figure 5.4. Design principle 3.

Design principle 3: Work from individual motivation

Individual motivation is a powerful engine for creativity and innovation. When people have the opportunity to work on things they find important, their creativity is stimulated. Therefore, it is important, in innovation practices, to explore and use the personal incentives of all participants and to allow them to formulate a personal goal. The personal incentives can be of an intrinsic nature (e.g. a passion for a specific theme) but they may also be of an extrinsic nature (e.g. recognition).

5.3.4 Novel combinations as a trigger for innovation

According to Nahapiet and Ghoshal (1998) the creation of new knowledge occurs by two processes: combination and exchange. These two processes can be recognised in the breakthroughs that were collected in the innovation practices that were part of the study.

Combination is a process that consists of combining elements previously unconnected or developing novel ways of combining elements previously associated (Nahapiet & Ghoshal, 1998). In the innovation practices this is recognised in the act of separating the main problem or sub-problem in different themes or perspectives that each offer a different perspective on the question at hand. For instance in the Post-war district case, in which the problems in a neighbourhood in the north of The Netherlands are central, the innovation practice chose different perspectives to approach the question: economy and self-help among the inhabitants; cultural identity; social cohesion and initiatives of inhabitants. These perspectives all helped to take a different perspective on the situation. It showed that a new perspective on the situation leads to new ideas for the solution.

Exchange is a necessary process for knowledge creation when resources are held by different parties (Nahapiet & Ghoshal, 1998). The process of exchange occurs through social interaction and coactivity. This process is recognised in the innovation practices as well. In the innovation practices breakthroughs occurred when experts, invited by participants of the innovation practice, gave their perspective on the problem at hand. Often, unusual combinations of subject matter expertise were made that contributed to the breakthrough: artists or architects were invited to give their perspective. See this example from the Post-war district case:

Example from the Post-war district case:

This innovation practice is concerned with restructuring a quarter in a city in the North of The Netherlands that is mainly inhabited by citizens originating from the Antilles. The participants in this innovation practice invited an architect. This architect, who'd lived in The Netherlands Antilles, developed new ways to design the quarter. He used the Antillean culture as a starting point and came up with 12 concepts for the redesign of the quarter. He had ideas such as transforming the neighbourhood into a street theatre, making a compound and a cruise quay. He used the Antillean culture and linked elements of that culture to ways of using the neighbourhood for living, recreating and working. Normally, the homogenous group of inhabitants was seen as the main problem, but the approach of the architect used a completely different starting point. The architect's proposals inspired the participants in the innovation practice to take a new perspective on this 'problematic neighbourhood'. Participants could use this new perspective and add on their own expertise.

The process of exchange not only led to the acquisition of knowledge from outside the innovation practice, but also to the recognition of the available implicit knowledge in the innovation practice. Inviting expertise from outside, helped people inside the innovation practice to see what their own subject matter expertise consisted of. This helped the people involved to make better use of their own expertise.

The literature review showed that the processes of combination and exchange consist of both a content component, referring to the content of the innovation people are working on, and a social component, referring to the social aspects of the process leading to innovation.

Content component

With respect to the content, playing with different meanings, using language games, analogies and metaphors are important for innovation. These activities will provide the group with new terms, key words, descriptions and meanings for the concepts they begin to define together (Von Krogh et al., 2000, p. 129). Different authors stress the importance of analogies and metaphors for innovation. Using analogies helps to solve problems because they help to make the novel seem familiar by relating it to prior knowledge, and the familiar seem strange by viewing it from a new perspective (Gick & Holyoak, 1983; Holyoak, 1984). Reasoning by analogy typically implies a comparison of two concepts at the same level of abstraction. A well-known example of an analogy is that of the heart and a water pump. The analogist can note correspondences between the known problem and a new unsolved one, and on that basis an analogous potential solution derives. Especially *generative metaphors* (Schön, 1983) can stimulate innovation, invention and design. A generative metaphor is a special form of 'seeing-as' that is characterized by the carrying over of frames or perspectives from one domain to another. Schön elaborates on the example of a group of researchers in a company who were working on the improvement of a new paintbrush made with synthetic bristles. At a certain point someone observed that a paintbrush is actually a kind of pump: the paint is forced through the spaces between bristles onto the surface. The researchers experimented with natural and synthetic brushes, thinking of them as pumps. This line of thought led them to a variety of inventions. A metaphor is generative when it generates new perceptions, explanations and inventions. In the innovation practices that were included in the parallel study metaphors were used as well. The "health boulevard" used as a concept in the Health boulevard case is an example of such a generative metaphor. Developing a generative metaphor involves a developmental process. In the early stages of this process one notices or feels that X and Y are similar, without being able to say similar with respect to what. Later on, after having experimented, it becomes clearer in what aspects the similarity could help. Schön states that this way of working, modelling the unfamiliar on the familiar, helps to solve unique problems.

Social component

The processes of combination and exchange are no technical rational processes. A favourable social context affects the conditions necessary for combination and exchange to occur (Nahapiet & Ghoshal, 1998). Having a shared context and a common language plays an important role in the creation of a favourable social context. Indeed, a shared context and a common language make it easier for people to gain access to each other's knowledge. Furthermore, shared narratives are a powerful means to create, exchange, and preserve rich sets of meanings (Nahapiet & Ghoshal, 1998). Orr (1990) demonstrated that sharing stories facilitates the exchange of implicit knowledge.

In the innovation practices the processes of combination and exchange both got attention. However, the social component of these processes got more attention than the content component. The participants in the innovation practices were more frequently engaged in inviting experts and exchanging stories than in searching metaphors or analogies. The design principle that has been formulated therefore is (see Figure 5.5): Make unusual combinations of subject matter expertise.

Figure 5.5. Design principle 4.

Design principle 4: Make unusual combinations of subject matter expertise

A surprising or not obvious admixture of different kinds of knowledge can help to establish new connections between elements that were not linked before. These new connections are necessary for innovation. A fruitful way to establish new connections is by choosing new or uncommon perspectives or metaphors to look at the question at hand, or by inviting experts who have new or uncommon perspectives. In the breakthroughs that were found, the social component (e.g. inviting experts) played a more prominent role than the content component (e.g. searching for metaphors).

5.3.5 Connecting different interests

Typical for innovation practices are the different, and often opposite, interests at stake. Innovation practices evolve around difficult questions that different parties sometimes have been trying to solve for years. In order to develop an innovative solution it seems necessary to combine these opposite interests. Imagine a municipality that wants to arrange more parking spaces whereas the inhabitants wish to preserve the green park. A solution, in which these different stakes are successfully combined, is the development of an underground parking lot. The search for a solution that meets varying stakes is an important aspect of innovation.

In the innovation practices that were part of the present study, breakthroughs occurred at moments in which participants succeeded in combining different interests. For instance by collaborating with a party with which they previously didn't want to collaborate because of their competing activities. They realised that collaboration was necessary, and instead of seeing them as competitors they worked as partners.

Interestingly, combining different interests is not done by bringing the different stakes together in one common -and abstract- goal. The participants in the innovation practices rather stimulated everyone to explore his or her own motivation (as is described in section 5.3.3 and in design principle 3: Work from individual motivation) and emphasised the fact that they must work *with* each other instead of *against* each other. At a certain point in the Post-war district case, participants realised that they could not do it at their own, they realised that if they wanted something special to happen, they needed the help of others. They reached that point after everybody's personal motives were discussed. The discussion of everyone's motivation cleared the way for people to offer help and to collaborate with each other.

From the present study it became clear that Habiforum, the organization that often brought together the different parties in the innovation practices, and that facilitated the process, could act as an independent party fulfilling an important role in connecting interests.

The sections below describe the findings from the literature review on the use of different or competing personal interests instead of a common goal as a starting point for innovation. It describes the idea of working from mutual attractiveness as a principle to use and combine varying interests in innovation practices.

Using personal interests as a starting point

Pfeffer (1992) describes two strategies of 'getting things done' that are often used in organizations: hierarchical authority and the development of a strongly shared vision. He says that these strategies, although often pursued, are actually problematic. Pfeffer mentions a third strategy, the use of individual influence, as a useful alternative.

Using hierarchy as a strategy to get things done implies that the highest in rank decides the goal that is pursued. This doesn't work because for almost all work cooperation with people who do not fall within one's direct chain of command is necessary. And, a critical question that comes up with respect to this strategy, is: what happens if the person whose orders are being followed, is incorrect? These two problems that result from the use of hierarchy to get things done, are especially true for innovations. First, the innovation practices studied didn't consist of hierarchical structures in which one has the power over the others and could determine the central goal. Hierarchy as a governing mechanism does not work in the creation of a new and unknown future (Scharmer, 2007). Second, when innovation is depicted as a process in which the outcome is not known in advance, there is no-one who knows in advance what goal could best be pursued in order to make sure that the right direction is chosen.

Using a shared vision then, as a way to get things done, is also problematic. Pfeffer (1992) states that there is not always enough time to build a completely shared conception of the world. In innovation practices too, the pressure to attain results is often high. Besides, the development of a shared vision brings the risk of groupthink, a pressure to conform to the dominant view. For innovation groupthink may lead to the risk of group members becoming more committed to the status quo of the group than to the innovative performance (Angle, 2000; Tranfield, Parry, Wilson, Smith et al., 1998). The group may jointly become tunnel-visioned and get blind-sided (Van de Ven, Venkataraman, Polley, & Garud, 2000).

The use of individual influence to get things done in organizations is brought up by Pfeffer as a good alternative for the two aforementioned strategies. In this approach the emphasis is on method rather than structure. The two steps that this approach according to Pfeffer consists of, are having one's own goals clear and examining the points of view of others.

Neither a goal that is set by a powerful other, nor a shared vision, but the individual goals should be taken as a starting point to get things done in organizations. This is in line with the findings that the parallel study revealed. For the participants in the innovation practices it worked best when everyone could hold on to their own interests. The collaboration was based on a well-understood self-interest. This is also expressed in design principle 3 (Work from individual motivation).

Combining different interests

Pfeffer (1992) describes how individuals can use their influence to pursue their goals. He describes this from the point of view of one individual. The process in innovation practices, however, concerns many individuals, each having personal interests. The process of negotiation that then needs to take place is best characterised as a strategy of problem solving (Carnevale & Pruitt, 1992). Carnevale and Pruitt distinguish three strategies of negotiation. The first is concession making. In this strategy parties reduce their demands or aspirations to accommodate the other party. The second is contending. This is a strategy aimed at pushing the other party in the direction of one's wishes. Threatening is one of the tactics that could be used in this respect. The third strategy, which is the most suitable for the process of negotiation in innovation practices, is that of problem solving. In this strategy one tries to locate options that satisfy the goals of both parties. Tactics that could be used in pursuing this strategy include active listening, providing information about one's own priorities and interests, putting oneself in the other's shoes, posing a problem before stating an answer, avoiding personal attacks on the other, and brainstorming in search for solutions. The strategy of problem solving is the major route to the development of win-win solutions (Carnevale & Pruitt, 1992). Carnevale and Pruitt say that an effective use of this strategy requires that negotiators are firm about their basic interests, and maintain these aspirations long enough to determine whether they can be achieved.

The principle of reciprocal appeal or mutual attractiveness introduced by Kessels (2001b), could actually be used as a principle to design a learning environment in which participants are allowed to all pursue their own goals and interests and in which they develop a win-win solution in order to reach innovation. Reasoned from the principle of mutual attractiveness, for employees it becomes interesting to work with others and to invest in them when others in turn are able to contribute to their own ambitions. In this way both have an interest in the well-being of the other and in the success of the joint initiative (Kessels, 2001b). Creating such an environment requires specific communication skills of the people involved. Indeed, openness and genuine interest towards the ideas and contributions of others play an important role. Instead of criticising each other's contributions, participants should build upon each other (Carnevale & Pruitt, 1992; Scharmer, 2000; Von Krogh et al., 2000), only then innovation is likely to occur.

The principle of mutual attractiveness is considered to help participants in innovation practices to design a collaboration in which each of them can hold on to their own interests, and in which they use the varying interests to come up with new solutions for the problematic situation at hand. This is expressed in the fifth design principle (see Figure 5.6).

Figure 5.6.

Design principle 5.

Design principle 5: Work from mutual attractiveness

Typical for innovation is that different and often opposite interests are at stake. In order to develop an innovative solution it is necessary to combine these opposite interests. In an innovation practice the personal interests must be central, and not a general goal or an abstract organizational goal. When everybody holds on to their own interests, and when people actively seek for ways to collaborate on a basis of reciprocity, breakthroughs are likely to occur.

5.3.6 A positive approach

Breakthroughs in the innovation practices were caused by what could be called a 'positive approach'. Not failures, shortcomings or gaps were central to the breakthroughs, but rather qualities, achieved successes and positive attention. The three ways in which this 'positive approach' was recognised in the breakthroughs include:

- Using qualities as a starting point. Various innovation practices explicitly used the qualities of the area the innovation practice was working on. See for instance the example below, taken from the City harbour case:

> *Example from the City harbour case*
>
> The participants made a presentation of 'lost and found objects' from the banks of the city-harbour. The inhabitants collected beautiful pieces of nature but also some rusty objects. This made both the inhabitants and the market parties aware of how much the area actually had to offer. They realised that the area was not a blank field, but rather that there is much that is worth to protect. The perspective of the area as a 'problem' was changed into a perspective of the harbour as a promising area with various qualities. The facilitator of this innovation practice described this as a breakthrough.

- Reflection on previously achieved successes led to a lot of energy and at the same time it helped the group to learn more about their own abilities.
- Working with the qualities of the context. In various cases the qualities of the context (e.g. the rare plants growing in the old city harbour) were taken as a starting point for new developments.

Strengths-based learning

In literature this positive approach can be related to positive psychology (Seligman, 2005). Positive psychology set in in the 90s with Martin Seligman as one of its founders. Before then, psychology was mainly pointed towards pathology and curing mental illnesses. The focus of positive psychology, in contrast, lies on identifying and nurturing talent. The school of positive psychology becomes popular in various areas like organization development (Cameron, Dutton, & Quinn, 2003), evaluation research (Preskill & Coghlan, 2003) and in thinking about organizational change (Whitney & Trosten-Bloom, 2003). Although this way of thinking became popular only recently, it is built on concepts that have proven earlier to play an important role in learning processes. The focus on success for instance contributes to people's self-efficacy, people's beliefs about what they're capable of doing (Bandura, 1977). Bandura found that perceived self-efficacy is a better predictor of behaviour than past performance. Furthermore, the deliberate reflection upon achieved successes could help to acquire metacognitions that are necessary for learning (Bolhuis & Simons, 2001). Metacognition refers to people's knowledge about their own learning processes (Merriam, 1999).

The similarity between the three kinds of 'positive approaches' is that they use strengths as a starting point. The sixth design principle is based on this idea (see Figure 5.7).

Figure 5.7. Design principle 6.

Design principle 6: Build on strengths

People's talents, successes achieved by the group, and the qualities of a context provide a valuable starting point for the innovation practices. Paying attention to the strengths of individuals, the group, and the context offers an attractive starting point for reflection and for the design of follow-up steps. Furthermore it is likely to contribute to the self-efficacy of participants, which may enhance their performance.

5.3.7 Beyond a polite conversation

In the innovation practices that were part of the study, there were groups that experienced difficulties in interacting with each other in such a way that it would help them to develop new perspectives. They kept having polite conversations, agitated discussions and reflections. The kind of conversation observed in the innovation practices is related to the type of communication that Scharmer (2007) refers to as 'downloading'. Operating effectively in such conversation requires the participants to exchange polite phrases with one another, not telling one other what is really on their mind. These kinds of conversations reproduce existing rules and phrases and do not help to create something new.

In the innovation practices in which groups started to make things, for instance concrete products or prototypes, they succeeded in going beyond these polite conversations. They were then able to move from ongoing analysis and reflection to a phase of design. Instead of explaining why things are as they are, they started to inquire each other's perspectives and connected them to each other. Examples of products that were made in the innovation practices are a model, a map for the area they were working in, and a flyer that announces a gathering they organized for inhabitants in the area. See the example of the Industrial area case:

Example from the Industrial area case

The participants in this innovation practice filled out a matrix in which they presented the different variables that must play a role in the restructuring of the area: sustainability, mobility, and perception of the environment. The matrix was meant as a preparation for the next meeting for which they invited others to participate. Filling out the matrix resulted in an interesting conversation in which different perspectives were exchanged. For instance on the concept of sustainability; they discussed what they actually meant by it. It appeared that some linked this concept solely to the materials used and the influence of this on the environment, whereas others saw it as the possibility of using a house as a home office after the children have left the house. This led to a conversation about the meaning of sustainability that helped them to define what they meant by it in the context of the industrial area their innovation practice works in.

Learning by creating

In literature, support is found for the idea that a process of creation stimulates learning. The process of creation seems to contribute to learning. Wenger (1998) describes a community of practice as a group of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly. A community of practice consists of three elements: the domain (a shared domain of interest), the community (people who interact and learn together in pursuing their interest in their domain), and the practice (a shared repertoire of resources). Creating something together seems to contribute to both the community and to the shared practice. First, by creating something, people engage in a collaborate activity, which enables them to build relationships. Second, it contributes to the development of a common practice. Although the development of a practice may occur unconscious (nurses who have lunch together regularly, may not realise that their lunch discussions are one of their main sources of knowledge about how to care for patients), creating something is a means to work on this practice consciously. Ruijters (2006) states that by creating something people learn about each other's underlying knowledge and insights, they discover shortcomings and unexpected new possibilities. Scharmer (2007) explains this by the fact that concrete products help people to relate to each other in a different way than conversations do. He illustrates this with an example of a group that made sculptures and explained them to each other:

> "Each person took fifteen minutes to build a small sculpture that expressed what he or she wanted to create with his or her work. Then we had a 'gallery' tour, during which everyone explained their sculptures. The move to genuine inquiry into one's own and other's ideas allowed us to tap into another field and stream of conversational real-

> ity. The difference between this field of appreciative inquiry and the trench warfare of the prior day was palpable." (Scharmer, 2007, p. 274)

The design principle that has been formulated aims to challenge participants in innovation practices to think about products they could make. This is the seventh design principle (see Figure 5.8).

Figure 5.8. Design principle 7.

Design principle 7: Create something together

In innovation practices participants often spend quite a lot of time exchanging their points of view and discussing them. However, polite conversations or agitated discussions alone do not lead to innovation. For innovation it is necessary to examine each other's perspectives and to find out the points on which the various perspectives differ. Creating something together supports this process. Examples of products include a workshop, a photo-exhibition, a scale model or a poster.

5.3.8 Sensitivity for weak signals

In literature on learning and innovation, authors stress the necessity for a specific kind of sensitivity that enables people to give a different meaning to the world around them. Different authors make reference to this kind of awareness or sensitivity, each using different concepts and different interpretations.

Sensitivity

Walz and Bertels (1995) stress the importance of sensitivity for innovation. Traditionally, large organizations only recognise the need for change as soon as problems announce themselves. In order to stay ahead and to become aware of new opportunities people must develop a form of sensitivity. Important is, as Walz and Bertels stress, that this is not something that can be done by systematic research or computation. Organizations should encourage their employees to become sensitive for, as they call it, 'weak' and 'qualitative' information. This form of sensitivity is also referred to as sagacity (James, in: Benjafield, 1997) or mindfulness (Langer, 2005).

Sagacity

James (in: Benjafield, 1997) observed that people differ in their ability to select information that is relevant to solving problems they encounter. He refers to this sensitivity as *sagacity*, the ability to discover what is essential about a situation. This ability might be opposite to what Duncker (1972) called functionally fixedness. This is the incapacity to see that a particular object could perform the function that is needed to solve the problem.

Mindfulness

Langer (2005) speaks in this respect of mindfulness versus mindlessness. Acting mindlessness is acting as if a situation has only one possible interpretation. She explains that evaluation is central to the way we make sense of our world. Yet, Langer states, in most cases evaluation is mindless. We often find something pleasing or displeasing because we choose to see it in a particular way, whereas things 'out there' are not self-evidently good or bad. Things are either positive or negative, useful or not, depending on the context we impose on them. Mindfulness, in essence, involves the same process as creativity (Langer & Piper, 1987). In society information is often processed primarily in an unconditional way (that means we see things, and are taught to see things as one thing only) rather than conditional (that means to see things more provisionally, as is the case in: this *could be* a baby's toy). Langer and Piper found in their experiments that when objects were described conditionally, respondents were more likely to give mindful responses to problems they gave them. A conditional understanding of the world seems to prevent mindlessness, and contribute to creativity.

Sensitivity in the innovation practices that were part of the study

Sensitivity (Walz & Bertels, 1995) and sagacity (James, in Benjafield, 1997) refer to the ability to become aware of signals or information that people previously didn't see but that could offer relevant clues for the problem to solve. Mindfulness (Langer, 2005) refers to the ability to play with context and interpretation in order to change the meaning of situations, people's actions, and things. These two abilities, as became clear from literature that was reviewed, are relevant to innovation.

In the innovation practices participants used these abilities as well. Participants used and developed their sensitivity by doing interviews with people whom they would normally not have involved (e.g. interviewing a group of inhabitants). Using their genuine curiosity in an interview provided the opportunity to imagine other people's perspective. This helped them to become aware of new information or new signals. Mindfulness is also recognised in the innovation practices. Participants searched for new words and metaphors in order to play with interpretation and to switch contexts. See for instance the example from the Rhombus case:

> *Example from the Rhombus case*
>
> This innovation practice deals with restructuring a region in order to improve its social development. The region had always been labelled as 'messy'. The highway that crossed this region was seen as something that stands in the way of innovating the area. As soon as people in this innovation practice labelled the highway

> as a "gateway" they started to see new perspectives. It helped them to get ideas to organize the area in a completely new way.

The eighth design principle refers to the development of sensitivity (see Figure 5.9). This principle distinguishes the sensitivity for weak signals, also referred to as 'cues' by Weick (1995), and the act of giving new meaning to these signals or cues. Weick makes a distinction between noticing and sensemaking. Noticing refers to the "activities of filtering, classifying, and comparing, whereas sensemaking refers to interpretation and the activity of determining what the noticed cues mean" (Weick, 1995, p.51). The principle consists of these two aspects as well, furthermore it emphasises that for innovation it is necessary to give these signals new meaning.

Figure 5.9. Design principle 8.

Design principle 8: Entice to see new signals and to give them new meaning

People interpret the world around them all the time. For innovation it is necessary to reconsider existing interpretations and to develop new ones. In order to do so, people must become sensitive to new information and clues. Furthermore, playing with the interpretation of this information and these clues is necessary in order to assign new meaning to them. The use of new words and metaphors facilitates this process of playing.

5.3.9 The innovation practice versus the unit of adoption

In the innovation practices attention was paid not only to the development of new ideas and concepts, but also to the connection of them with the context for which they were developed. Several strategies of connecting the innovation practice to the context outside led to breakthroughs:

- Involving influential people by for instance letting them judge or test the developed ideas. These influential people can sometimes help the innovation practice to get a special status at the municipality (e.g. a 'front runner project' in the Mounds case) that offers them the opportunity to develop new ideas and test them without the 'old' rules and procedures that prevent them from experimenting. See the example from the Multi-layered area case:

> *Example from the Multi-layered area case*
>
> In this innovation practice the participants connected their ideas with the world outside by composing an expert group consisting of experts from outside the innovation practice. These experts were influential people within the context. They were asked to reflect on the vision the participants developed within the innovation practice. The experts were

especially interested in one of the ideas. Because of the involvement of experts in this phase, the participants in the innovation practice had the opportunity to develop this idea further.

- Another strategy was the involvement of important stakeholders that were left out before (e.g. the inhabitants or the shop owners in a certain area).
- Also, positive attention from persons with a certain status, or attention from media, helped to establish a connection with the world 'outside'. In the innovation practices articles in newspapers, a visit from the royal family and radio interviews offered the participants the opportunity to connect the two worlds.

In order to be successful, it is necessary to establish a connection between the world inside the innovation practice and the world outside. In literature the link between 'new ideas and innovations' and 'existing organizations and actual ways of working' has been discussed as well. There are several reasons why some innovations sometimes not become part of regular practice. Generally, there are three reasons why organizations, groups or individuals for whom the innovation could mean a substantial benefit (in the following sections referred to as 'unit of adoption') do actually not benefit from it: the unit of adoption doesn't know about the innovation (obliviousness); the unit of adoption doesn't want to implement the innovation (resistance); or the unit of adoption isn't able to implement the innovation (cognitive distance).

Obliviousness

The first reason why innovation is not implemented, is obliviousness. Kanter (2006) gives the example of the US charter schools. These schools were freed from some of the rules, regulations and statutes that apply to other public schools so that they could innovate. The idea behind this was that these schools could serve as models for improved education. There is little evidence, however, that charter schools have influenced changes in other schools. The problem according to Kanter here is the poor connection between the greenfield and the mainstream. Because of this poor connection, organizations miss innovation opportunities. Indeed, they just don't know about it.

Resistance

The second reason why innovative ideas are not implemented, is resistance of the unit of adoption to the innovation. Resistance could occur because of a cultural clash, as Kanter (2006) explains. This can be the case when a new innovation is launched in an existing business in which there are two classes of employees: those who have all the fun and those who make all the money. The innovators "are identified as creators of the future. They are free of rules or revenue demands and are allowed to play with ideas that don't yet work. Their colleagues are expected to follow rules, meet demands, and make money while feeling like grinds and sometimes being told they are dinosaurs whose business models will soon be obsolete." (Kanter, 2006, p.78). Another reason for resistance is put forward by Van Poucke (2005). She explains that people with new ideas are typically people who possess membership of diverse communities of practice. However, they often only act as peripheral participants (Wenger, 1998) of these communities. They have a low legitimacy of membership. Therefore it is difficult for them to import new knowledge into the community. Especially in the case of innovation the new knowledge is deviant and consequently potentially threatening for the unit of adoption. They might have resistance to accept this new way of thinking brought in by the peripheral participant. Van Poucke (2005) found in her research that it is therefore important for innovators to connect with so-called boundary spanners, who have a more central position in the community that serves as the unit of adoption. They will have more legitimacy to bring in new knowledge.

Cognitive distance

The third reason why the unit of adoption does not always benefit from innovations, is that they are not always able to implement the innovation. Jacobs (2007) states that the more radical an innovation is, the more distant it is from what the unit of adoption knows and recognises. This enlarges the risk of failure. Nooteboom (2000) explains this with the concept of cognitive distance. There is a greater or lesser cognitive distance between the innovators and the unit of adoption. A large cognitive distance has the merit of novelty, but the problem of incomprehensibility. A strategy that could help to bridge this cognitive distance is proposed by Schroeder et.al. (1989). They state that as an innovation develops, the old and the new exist concurrently, as parallel streams of activity. There is no need to substitute, transform, or replace the old with the new (Van de Ven et al., 1999). Implementation proceeds more smoothly in cases in which the 'new' overlapped with and became integrated into an existing organizational arrangement.

The ninth design principle refers to the connection that must be established between the innovation practice and the organizations, groups or individuals for whom the innovation could mean a substantial benefit (see Figure 5.10).

Figure 5.10.

Design principle 9.

Design principle 9: Connect the world inside the innovation practice to the world outside

Participants in innovation practices must establish a connection with the organizations, groups or individuals for whom the innovation they are working on could mean a substantial benefit. Indeed this supports the implementation of the proposed innovation. Such a connection can be established by involving influential people (e.g. experts) or important stakeholders (e.g. inhabitants or users) in the innovation practice.

5.3.10 Creative turmoil as the trigger for innovation

In section 5.3.1 it became clear that the central question of the innovation practice must be urgent and intriguing. Participants must feel the necessity to answer the question at hand. This urgency is related to what Kessels (1996a) refers to as 'creative turmoil'. Creative turmoil is often caused by an existential threat: a matter of winning or losing, surviving or going under, being in or out.

Kessels view is reflected in the findings of Van de Ven et al. (1999). They found that 'shocks' trigger innovation. Many innovative ideas may be generated but not acted on until some form of shock occurs. These shocks include new leadership, product failure or a budget crisis.

In the innovation practices that were part of the study it became clear that these shocks appear in many forms. In the innovation practices we see examples of a budget crisis that triggered the people involved to put an effort in collaborative action. Or, as is the case in the example below, an article in a local newspaper triggered some people to speak up for themselves:

> *Example from the Mounds case*
>
> In this innovation practice creative turmoil arises when the inhabitants of the polder read a newspaper article in which the government announces measures that concern their own area. They immediately decide to come into action and to do something themselves. They didn't want the government to decide about the future of the environment they live in.

Creative turmoil is seen in the innovation practices as something that is triggered by an external factor. Besides this, there are also innovation practices whose participants organize their own creative turmoil that arranges for the necessary action. This is done by organizing something, like a workshop that is important to all of the participants involved. Setting a deadline creates the sense of urgency that is necessary to make, do or develop something. The generation of creative turmoil, either by unexpected external developments, or by deliberate action of the participants in the innovation practice, is summarised in the tenth design principle (see Figure 5.11).

Figure 5.11. Design principle 10.

Design principle 10: Generate creative turmoil

A sense of urgency experienced by all participants of the innovation practice, is necessary for innovation. This sense of urgency can be caused by unexpected external developments such as a budget crisis or by deliberate action of the participants in the innovation practice (e.g. by defining milestones when people have to deliver certain products).

5.3.11 The innovation process as a social process

Knowledge development is a social process. Via communication people gain access to each other's knowledge networks and create a cooperative atmosphere (Kessels, 1996a). At the same time communication is necessary to help to bridge differences in cognition (Nooteboom, 2000). The social and communicative process becomes concrete in interactions between participants in innovation practices. Conversations between these participants are an important variable in the innovation process (Scharmer, 2007; Steyaert, Bouwen, & Van Looy, 1996; Von Krogh et al., 2000). Therefore, it is necessary to pay attention to the quality of the interactions. Scharmer (2007) describes an interaction pattern that he refers to as generative flow. This type of interaction enables participants to bring forth something profoundly new. Von Krogh, Ichijo, and Nonaka (2000) speak of knowledge creating conversations, and Steyaert, Bouwen, and Looy (1996) consider innovation to be a conversational event where actors engage with one another in a sense-making process.

Although from literature it becomes clear that the quality of the interactions between participants in the innovation practice matter, it is not an aspect that underlies the breakthroughs explicitly.

The facilitators do show awareness for the social and communicative process in the innovation practice. One of them said: "When participants talk a lot about the minutes, for me that is a clear sign that things are not going well. And I want things to go well. A lot of fuss about minutes means that something else is going on. Let's talk about that then". Another facilitator said: "There is a risk of losing each other while working together. Is it clear to us what we are working on? Do we still understand each other? Do we have the same problem in view? Often people go on and on whereas it is so important to stand still now and then and to reflect upon terms that are used".

The facilitators also mention interventions that they initiated with respect to the social and communicative process:

- Putting the process on hold and check: are we all talking about the same thing, do we understand each other?

- Acknowledging the input of a group of participants who did not have the feeling being taken seriously.

Interventions with respect to the social and communicative process seem to be conditional for breakthroughs, rather than directly causing breakthroughs. The social and communicative process is central in design principle 11 (see Figure 5.12).

Figure 5.12. Design priciple 11.

Design principle 11: Pay attention to the social and communicative process

Innovation is a social process. Social and communicative skills are the vehicle for this process. Therefore, it is important that participants in innovation practices pay attention to the quality of the interactions.

5.3.12 The innovation process as a learning process

In literature on innovation, learning is assigned an important role. For a long time, literature on innovation was pointed at technical innovation and considered innovation as a linear process of development and implementation, mainly focusing on the development of new products and technology (De Leede & Looise, 2005; Harkema, 2004). Movement, interaction, and feedback of knowledge and resources did not then have a prominent place in theories. Innovation was seen as something initiated by the R&D department of an organization. If knowledge was acknowledged, the emphasis was on learning from external knowledge sources (Harkema, 2004). In more recent literature innovation is seen as a cyclical interactive process in which learning plays an important role (Tidd et al., 2005). The innovation practices that were part of the study, explicitly paid attention to the learning process in two ways: by developing new competences and by reflection on the process.

Developing new competences

The facilitators in the innovation practices that were part of the study, had sometimes explicit attention for the development of competences that they needed in the innovation process. See for instance the example taken from the Hinge case:

Example from the Hinge case

In a meeting with an important politician and the director of the development company the participants of the innovation practice did not want to use a PowerPoint presentation. They were decisive to use the opportunity to start the conversation differently, unconventional. They didn't want the politician and the director to lean backwards with an attitude of 'please convince me'. This motive created the urge to learn and practice a new technique. They practiced the 2x2 technique (a way of asking questions) in advance and then they used it in the meeting. Their motive for doing it like this was their desire to organize a new kind of conversation that would have a new outcome.

At the same time, participants in the innovation practice found it difficult to facilitate their own learning and that of others. Some participants and facilitators found it easier to take over a specific activity than to help others to learn it themselves.

Reflection upon the process

Facilitators of the innovation practices often mentioned the ability to reflect. They suggest that reflection is necessary to determine their place in the process, to determine if they are still on the right track and to determine what competences they must acquire. They acknowledge that reflection is important but they experience difficulties in doing it.

The development of competences is essential for innovation. Design principles 1-11 (as described in Sections 5.3.1 – 5.3.11) are pointed towards the innovation process itself. The twelfth design principle focuses on the crucial and lasting role of learning in this process (see Figure 5.13).

Figure 5.13. Design principle 12.

Design principle 12: Actively support the development of competences

The learning processes undertaken with the intention of innovating are primarily focused on the improvements and innovations that the people involved aim to bring about. However, participants in innovation practices must pay explicit attention to the learning processes as well. They could do this by defining the competences that they need to develop and by developing approaches that stimulate learning in that direction. They should regularly reflect on these learning processes since that could enhance learning.

5.4 Validation of the design principles

This section presents the results of the study that was carried out to learn more about the validity of the design principles. Both the numeric data and the interview reports were analysed for this purpose. This section presents the results relating to the set of design principles. Appendix D presents the results relating to each of the design principles separately. The results presented in this section are threefold: the validation with respect to the content of the design principles, their application and their interrelatedness.

5.4.1 Content of the set of design principles

The respondents that were interviewed while working with the circular scales confirmed that it was possible to track down the most important breakthroughs in their innovation practices with help of the principles. Apparently, the design principles do not miss elements that are essential to characterise the breakthroughs in innovation practices. For the respondents who worked with the scales individually, with help of the electronic tool, it was more difficult to describe all the breakthroughs. For each principle they placed on the scales, they were asked to give an explanation by means of an example. Some of the respondents filled in these examples easily while others found this difficult. The nature of the instrument, an electronic instrument that they used individually, might have played a role. An electronic tool is an impersonal programme and participants might feel not invited to describe the breakthroughs in their innovation practice elaborately. There is no reason, however, to believe that participants who did not elaborately describe the breakthroughs in their innovation practice actually experienced less breakthroughs or could not use the design principles to describe them.

Ambiguous design principles (11 and 12)

Design principles 11 (Pay attention to the social and communicative process) and 12 (Actively support the development of competences) seem to be ambiguous. The interpretation of design principle 11 is not always specific. When respondents placed the design principle in the circular scale, they affirm that "communication is central" or that "we did our best to make it an open and positive atmosphere pointed at constructive contributions of the participants", but what this exactly meant, or how that contributed to a breakthrough in the process, didn't become clear. In relation to design principle 11 respondents hardly made reference to specific breakthroughs. Understanding each other, appreciating each other's contribution, and building further on each other's input instead of cutting off, are important aspects of this principle.

Principle 12 (Actively support the development of competences) is interpreted in various ways. Some respondents regard it as something that doesn't require specific attention but that is developed while working together in an innovation practice. Others see it as something that does require special attention. In this respect they refer to the 'soft skills' skills that they believe are necessary to make the innovation practice a success. They mention skills such as listening, and to be able to speak up for oneself. And they also refer to the ability of making the gains of one innovation practice available for other contexts, e.g. by organizing reflection sessions in which insights are shared with others. Respondents could not easily give concrete examples for this design principle.

Tables 5.2 en 5.3 show the Means and St. Deviation of the value that participants (Table 5.2) and facilitators (Table 5.3) assigned to the design principles (a low M-score combined with a low SD indicates that respondents placed the principle steadily in the inner rings). The data in the tables show that the respondents (both participants and facilitators of innovation practices) place design principle 12 almost without exception in the outer rings of the circular scales. Apparently, respondents do have an idea about the meaning of this principle, but they hardly recognise it in their own innovation practice.

Table 5.2

Means and St. Deviation of the places assigned to the design principles in the circular scales by the participants of innovation practices

Design Principle	**M**	**SD**	**N**
Design principle 1	2,20	1,03	10
Design principle 2	2,40	1,02	10
Design principle 3	2,75	1,09	10
Design principle 4	3,60	0,99	10
Design principle 5	3,15	1,23	10
Design principle 6	3,35	1,11	10
Design principle 7	3,20	1,51	10
Design principle 8	3,95	1,09	10
Design principle 9	3,65	0,91	10
Design principle 10	3,75	0,99	6 [a]
Design principle 11	3,45	1,36	10
Design principle 12	3,90	1,07	10

[a] 4 respondents worked with a set of 11 design principles; by the time they filled out the circular scales design principle 10 was integrated with design principle 1.

Table 5.3

Means and St. Deviation of the places assigned to the design principles in the circular scales by the facilitators of innovation practices

Design Principle	**M**	**SD**	**N**
Design principle 1	2,32	1,12	11
Design principle 2	2,09	0,92	11
Design principle 3	2,27	1,13	11
Design principle 4	2,95	1,35	11
Design principle 5	2,41	1,11	11
Design principle 6	2,68	1,31	11
Design principle 7	2,86	0,90	11
Design principle 8	2,50	1,30	11
Design principle 9	2,64	1,19	11
Design principle 10	2,82	1,17	11
Design principle 11	2,41	1,04	11
Design principle 12	3,59	1,00	11

Best recognised design principles (1, 2, 3, and 9)

Design principles 1 (Formulate an urgent and intriguing question), 2 (Create a new approach), and 3 (Work from individual motivation), were placed primarily in the inner circles (see Tables 5.2 and 5.3). Respondents found it easy to give examples of the way they recognised these principles in their own innovation practice.

Design principle 2 describes something that for the respondents lies at the core of what they're doing. Often, for them the reason to start an innovation practice was because the procedures normally used (decision groups or project groups) didn't work out for the problem they were facing. For them, design principle 2 lies at the heart of their innovation practice.

Design principle 3 was found important as well. For the respondents, the most important element of working from individual motivation, is a focus on individuals, and on 'the person behind the function'. Focussing on individuals helps to determine someone's true motivations. Respondents in their examples emphasise *tracing* individual motives. Doing this often, seems to automatically lead to *developing* or *connecting* these motives.

Design principle 9 (Connect the world inside the innovation practice with the world outside), although placed in different circles on the scale (see Tables 5.2 and 5.3), is recognised very well, and examples were easily found. Respondents stressed that they find this principle important: without the connection to the outer environment, they say, plans and products of the innovation practice will be of little meaning.

A different meaning than intended (design principles 1 and 4)

Many respondents recognised design principles 1 (Formulate an urgent and intriguing question) and 4 (Make unusual combinations of subject matter expertise). Taking a closer look at the examples respondents give, it becomes clear that the way they interpret these principles, is different from the way the principles were intended.

With respect to design principle 1 it appeared that the questions respondents formulated in their own innovation practice were not always urgent and intriguing. Although respondents acknowledged the importance of having a question that is both urgent and intriguing, most of the time they give examples of questions that are either urgent or intriguing. They called a question 'intriguing' if seemingly contradictory combinations must be made. E.g. a combination of innovative architecture and small-scale. They referred to a question as 'urgent' if:

- There was a shared ambition to restructure a region or area, which had not yet been realised. For instance, plans had been made, but the phase of implementation hadn't started. This was typically the case when the ideas in the plan originated from a compromise in which none of the stakeholders recognised their own ambition.
- The situation would escalate if no one took action. For instance, the department of town and country planning threatened to reject all plans submitted by the local authorities of a large city.

With respect to design principle 4 it is observed that particularly *utilising* subject matter expertise (either from inside or outside the innovation practice) takes an important role. Respondents did not often mention making *unusual combinations* of expertise. Two strategies used in the innovation practices were: bringing in or developing new expertise (e.g. by inviting experts from outside the innovation practice who'd bring in missing expertise about the ecology in a particular area for instance), and looking for a new perspective that would help the participants to make better use of their own expertise (e.g. by combining diverse concepts in order to acquire a new perspective on the central question).

5.4.2 Application of the set of design principles

The previous section described the extent to which respondents recognised the design principles in their innovation practice and how they interpreted them. Although none of the respondents worked deliberately with the principles, the validation study revealed some insights on how the respondents view the principles as guidelines for their action. This section shows some of the results.

'Passive' design principles (1, 5, 10, 12) versus 'active' ones

Respondents clearly distinguish design principles that are either present or not, and design principles that they could actively work with. Design principles that respondents regard as either being present or not, are principles 1 (Formulate an urgent and intriguing question), 5 (Work from mutual attractiveness), 10 (Generate creative turmoil) and 12 (Actively support the development of competences). These principles are referred to as 'passive' principles. Respondents mention their presence or absence in the innovation practice, or they mention the underpinning mechanisms. The other design principles are 'active'. Respondents find that these principles refer to aspects that can be actively developed. For these principles the respondents can easily think of examples in which they did interventions that were in line with the particular principle.

'Passive' design principles

With respect to design principle 1 (Formulate an urgent and intriguing question): respondents regard an urgent question as something that gave rise to the innovation practice, something it originated from. They do not see it as something that could be developed during the process. According to them, the fact that the innovation practice exists, is due to the fact that there was an urgent or intriguing question.

The same is true for design principle 5 (Work from mutual attractiveness), respondents find this principle important and they describe how they recognise mutual attractiveness in their innovation practices. The core element of this principle is interpreted as uncovering the different interests and making a connection between them. Respondents give examples of how they recognise this principle:

- They recognise mutual attractiveness between people in the innovation practice and people working in related fields or projects. Facilitators sometimes try to make these relationships visible.
- The extent to which the innovation practice is attractive for certain parties to participate in (this was the case when for instance a research organization saw an opportunity to develop a practical model by participating in the innovation practice).
- Mutual attractiveness among participants within the innovation practice (one participants said: "seeing the mutual attractiveness makes it easier for people to think along with others who have an ambition that seems to be opposite of their own. Simply because it is in your own interest to do so" another participant said: "because participants knew what they really did it for, they found it easier to collaborate with each other and to support initiatives of others in the group").

- Mutual attractiveness in the form of negotiation. (This was the case when one of the officers of a municipality wanted to participate in the innovation practice and was therefore prepared to slightly change her plans. But, a certain number of houses had to be built and she didn't let go of this number. The other participants in the innovation practice agreed with this because she gave in on other aspects).

There are hardly any examples of the way in which people deliberately worked on this principle. This might also have to do with the fact that the respondents have no idea how to put this principle into practice. One of the facilitator states: "This principle raises my enthusiasm but I find it hard to fill in".

With respect to design principle 10 (Generate creative turmoil) respondents mainly mention the creative turmoil that comes into being when something unexpected and threatening happens (e.g. an unexpected party suddenly comes up with a plan that gives you the idea that action should be taken quickly). Respondents do not see creative turmoil as something they can actively influence.

Design principle 12 (Actively support the development of competences) was interpreted very diverse in the first place (see Section 5.4.1). Actively influencing the development of competences is not mentioned. Respondents seem to have no idea of interventions that they could do in order to stimulate the development of competences.

'Active' design principles

With respect to design principles 2, 3, 4, 6, 7, 8 and 9 and 11 respondents mention interventions they did in the innovation practice to stimulate the mechanism behind this principle.

For design principle 2 (Create a new approach) respondents describe three ways of doing this:

- By using new ways of working and breaking with traditional routines (e.g. instead of a regular meeting with a chair, an agenda and someone who takes the minutes, the meeting is a personal conversation in which the facilitator interviews all the attendees and asks what they would like to contribute).
- By involving parties that are usually not involved in these kinds of processes or that are usually not involved in such an early stage (e.g. involving students to collaborate with, or interviewing inhabitants of the area where they want change. Other examples are asking firemen in a very early stage about the best escape routes instead of asking them to contribute after finishing the plan and then not being able to use their input effectively).
- By focussing on individuals rather than on 'representatives' representing an organization, municipality or pressure group.

Respondents refer to design principle 3 (Work from individual motives) as something that can be influenced. Respondents describe three ways in which this principle was actively used:

- Discussing what everyone finds important, what they would like to see as a result and what is needed to reach that result.
- Discussing the personal affection the participants have in relation to the region that they are working for.
- A facilitator who makes an inventory of all the personal motivations and who looks for ways of connecting them.

Examples relating to design principle 4 (Make unusual combinations of subject matter expertise) are focused on bringing in or developing expertise or finding a new perspective.

Bringing in or developing missing expertise:

- Authorities from outside the innovation practice are invited in order to bring in missing expertise (e.g. about developments in a certain region; ecology).
- Experts from different disciplines within the innovation practice collaborate and make products.

Finding a new perspective:

- Combining diverse concepts (like nature and health) in order to create a new perspective on the central question.
- Bringing in a new concept (e.g. working with culture as a central concept rather than economy. The perspective 'economy' didn't bring any new or unconventional perspectives, but the concept culture did).
- Bringing in a new perspective (e.g. an architect, an artist, an expert from outside, who doesn't see the central problem as a problem but as a chance to make something special of the district).

Design principle 6 (Build on strengths) is referred to in various ways. Respondents mention several actions that can all be seen as deliberate actions to improve the strengths of the people involved and to work with successes:

- Celebrating breakthroughs with a small treat (pie, party, etc…).
- Giving each other compliments either explicit or implicit. Some of the respondents reported that these compliments were often toned down since people are not used to receiving and giving compliments.
- Reflecting upon the obtained results by analysing the achieved successes. Often it was the facilitator who initiated this kind of interventions.

Interventions mentioned with respect to design principle 7 (Create something together) were for instance the preparations of a workshop or the making of a concrete action plan for 30 projects. The respondents recognised that the process of creation contributed to breakthrough in the process.

Design principle 8 (Entice to see new signals and to give them new meaning) is seen as a design principle that can be used actively to design interventions with. Activities that were mentioned that helped to become aware of new signals and to re-interpret the actual situation:

- Listening to a personal story. For instance in one innovation practice the participants saw the ministry of defence as an obstructing party for their plans with the city. A participant, originating from Portugal, then said that he was struck by the gloominess of the building of this ministry. He said: "we celebrate our institutions. We would link a museum to that building, a museum for peace". That story brought about a change in the way the group looked at the participation of the ministry. They wanted to be proud of these people and therefore they decided to be open for other impressions than only their first.
- Using a new approach that entices people to see a new perspective. For example in one innovation practice they used a scenario technique in order to design new perspectives for the future.
- Collaboratively give meaning to something that has happened. For instance in one innovation practice the participants had a negative experience when guests they invited from the centre for employment and income didn't want to collaborate with them. The participants in the innovation practice were very disappointed. Only after an intervention of the facilitator they were able to code this event differently. After this intervention they could think: ok, the fact that these people don't want to take initiative in this project, offers us the opportunity to take an initiating role ourselves.

These types of interventions stimulated the participants to see opportunities and possibilities, instead of threats and risks (e.g. the ministry of defence as a party that needs to be involved instead of avoided). The recurring theme in the respondents' examples, is that things, people, developments and events that were first seen as a threat or as not useful for the process, were then seen as something useful that could contribute.

Respondents recognised the following interventions with respect to design principle 9 (Connect the world inside the innovation practice to the world outside):

- Inviting an official and project managers for a meeting.
- Asking people from the local governance to participate in the innovation practice .
- Helping each other in the innovation practice to make the connection between the innovation practice and people's own work context (e.g. by

asking: 'John, does your direct manager still has confidence in your work in our group?')
- Spotting interesting developments in other places and connecting these to the process of the innovation practice.

In relation to design principle 11 (Pay attention to the social and communicative process), respondents mainly describe interventions done by the facilitator. Facilitators can stop the process during a meeting and do an intervention in order to give information, to build trust, or to give attention. Both participants and facilitators of innovation practices see this as a principle that the facilitator is responsible for.

Clear effects of the design principles (3, 4, 7)

In relation to design principle 3 (Work from individual motivation), design principle 4 (Make unusual combinations of subject matter expertise) and design principle 7 (Create something together), respondents clearly mention the effect of these principles.

Working with the third principle results in energy in the innovation practice. Respondents experience it as motivating when not the organizational stakes are central to the innovation practice but rather everyone's personal motives. One of the respondents said: "The individual motives determine the amount of energy that will be put into the process. [We used the opportunity to] check the problem definition with our own motives and to sharpen it accordingly".

When participants in innovation practices bring in new perspectives and expertise (as indicated in design principle 4) the result was that they become enthusiastic and saw more possibilities to bring in their own expertise. Respondents clearly saw that by bringing in new expertise they could better recognise and utilise each other's expertise.

At places in which design principle 7 (Create something together) was put into practice, and in which participants created things together (e.g. a workshop with a scenario, a project plan, an image of the region they were restructuring), it immediately gave an impulse to the collaboration. One respondent explains it as follows: "Together drawing a picture of the area worked really well because it forced us to make explicit what we found important, and what we found less important in the area".

Beliefs concerning how principles work

When placing a card in the outer circles of the scale, respondents explained why they didn't recognise this principle. Generally, they gave two kinds of explanations: they explained their choice by mentioning that they'd not yet paid any attention to this principle, or they explained their choice by sharing a conviction that they have in relation to the particular design principle. The following list summarises some of these assumptions:

With respect to design principle 3 (Work from individual motivation), a respondent explains: "Individual motives cannot play a role because besides the inhabitants there are five municipalities, one district, and one party that is in charge of water management". This respondent believes that when many parties are involved individual motives cannot be the focal point.

A respondent explains about design principle 6 (Build on strengths): "In this project we didn't reach any milestones, so reflecting upon the successes has not yet taken place". This respondent believes that in order to work with this design principle, visible and concrete milestones need to have taken place. There were also respondents who believed the principle could only be used after the process had been finished.

A respondent had a conviction with respect to design principle 8 (Entice to see new signals and to give them new meaning). This respondent believed that trust was a condition for enticing each other to see new signals and to give new meaning. This respondent states: "Because of mutual mistrust [in our innovation practice] mutual enticement to see new signals was out of the question".

With respect to design principle 4 (Make unusual combinations of subject matter expertise), a respondent believes that involving too many experts is dangerous for the process because they place too much emphasis on one issue.

5.4.3 Relationships between the design principles

From the examples respondents gave it became clear that the design principles are strongly interrelated. Some principles were more often linked than others. The enumeration below offers an overview of connections that became clear until now:

Design principles 2, and 3, 4, 6, 7, 8, 9 and 11

The interventions that were done to support design principles 3, 4, 6, 7, 8, 9 and 11, are often done with help of a new way of working (e.g. a new interview technique; instead of a regular meeting a walk through the neighbourhood). The examples that respondents gave with respect to design principle 2 (Create a new approach) were therefore often also linked to one of the other design principles. These interventions were more easily linked to principles 3, 4, 6, 7, 8, 9 and 11 than to principles

1, 5, 10 and 12. This can be explained by the fact that the latter group of principles was seen as 'passive' principles in the first place. These principles were not associated with new ways of working.

Design principles 10, 1 and 7

These principles were interrelated in such a way that during the validation of the principles it was decided to eliminate design principle 10 (Generate creative turmoil). There were two reasons for this decision.

First, Kessels (1996b) describes creative turmoil as something that is mainly caused by external triggers such as existential threats. In this description creative turmoil is rather conditional. In the parallel study (see section 5.3.10) and in the validation study (see Appendix D) participants did mention instances in which creative turmoil was regulated by an intervention initiated by themselves. But it was more likely that creative turmoil arose when something unexpected and threatening happened. This pointed at a mere conditional function of this design principle. Since the design principles refer to aspects that can be actively promoted by participants in innovation practice, this principle didn't fit in.

Second, looking at ways in which participants succeeded in the active promotion of creative turmoil (e.g. by setting a deadline; by defining the question in such a way that it provokes creativity), it became clear that these aspects were already 'covered' in design principles 1 (Formulate an urgent and intriguing question), and 7 (Create something together). Creating the necessary urgency that could provoke creativity can be done by formulating the question in a specific way (as design principle 1 suggests), and by setting deadlines or creating something (as design principle 7 suggests).

Design principles 4 and 8

The concepts and perspectives that were brought into play in relation with design principle 4 (Make unusual combinations of subject matter expertise) helped the respondents to see new signals and to give them new meaning (design principle 8).

5.5 Conclusions

The goal of the parallel study and the literature review was to identify the factors that enhance the learning process leading to innovation. The research question that guided this study, was:

> *What factors enhance or inhibit the learning processes at moments that are crucial for the success of the innovation practice?*

An analysis of the breakthroughs that were tracked down in the parallel study, transpired 12 recurring themes. These themes were compared with literature and as an answer to the research question 12 provisional design principles for knowledge productivity were formulated. These design principles incorporate the main factors in bringing about improvement and innovation in the case studies. During the validation study, in which participants and facilitators of innovation practices took part, one of the design principles was removed. This led to a set of 11 design principles:

1. Formulate an urgent and intriguing question
2. Create a new approach
3. Work from individual motivation
4. Make unusual combinations of subject matter expertise
5. Work from mutual attractiveness
6. Build on strengths
7. Create something together
8. Entice to see new signals and to give them new meaning
9. Connect the world inside the innovation practice to the world outside
10. Pay attention to the social and communicative process
11. Actively support the development of competences

The study that was carried out to learn more about the validity of the design principles gave more insight in the validity of the content of the design principles, their value for practice, and their interrelatedness.

Content of the design principles

The respondents in the validation study who worked with the principles individually (without a researcher interviewing them) found it more difficult to give meaning to the design principles than the people who worked with them together with a researcher, while being interviewed. Apparently, working with the design principles requires a reflective conversation that is not easily attained when working individually.

The respondents who were interviewed during the validation study confirmed that it was possible to track down the most important breakthroughs in their innovation practices with help of the principles. The validation study revealed that the design principles didn't miss essential elements that were necessary to describe the breakthroughs in innovation practices.

There were two design principles that turned out to be ambiguous, design principle 10 (Pay attention to the social and communicative process) and design principle 11 (Actively support the development of competences). Although the respondents found design principle 10 important, they didn't refer to specific breakthroughs in their innovation process with respect to this principle. This might have to do with the respondents' association with this principle. Respondents seem to link principle 10 to the innovation process in general. Indeed the innovation process is a process in which people interact and communicate in order to come to innovation. But by interpreting principle 10 like this, almost all occurrences can be related to this principle because everything happens in interaction and through communication.

Respondents placed design principle 11 almost without exception in the outer rings of the circular scales. They had an idea of the meaning of the principle, but they didn't recognise it in their own innovation practice. A possible explanation for this can be found in its name: developing competences might be linked with a shortage. In the idea of developing competences lies the premise that there actually is something that must be developed, something that is missing at the moment. For people it is more attractive to work on something that is already there, or at something they are already good at, than to work on competences they apparently lack. Another explanation for design principle 11 not being recognised in the innovation practices, might be found in its nature. The other design principles focus directly on the innovation process, whereas this principle is formulated on a meta-level. For people working in an innovation process, the innovation or improvement itself is probably the first focus.

Besides the ambiguity of principles 10 and 11, the validation study revealed that respondents recognised some principles better than others, and that respondents interpreted some principles different from the way they were intended.

Application of the design principles

With respect to the application of the design principles it became clear that respondents see some principles as 'active principles' (these may be developed using targeted interventions) and others as 'passive principles' (these are seen primarily as a characteristic of the innovation practice). Besides their assumption that some could be developed and others not, there were other personal convictions that seemed to play a role in the extent to which respondents recognised, retrospectively, the active use of design principles in their own innovation practice. These convictions were based on respondents' previous experiences and their personal preferences.

Interrelatedness of the design principles

The validation study gave insight in the relationship between the different design principles. The principles were not developed as principles that exclude one another. This is shown for instance by the fact that in almost all breakthroughs found in the parallel study, two or more design principles can be recognised. The validation study pointed to some links between principles that could be explored further.

The studies that will follow the present study go further into the content of the design principles and their application in practice. The content of the design principles will be further examined by means of an expert consultation (Chapter 6). In order to learn more about the extent to which the design principles may be deliberately applied in innovation practices a design study has been carried out (Chapter 7).

6

Expert consultation to reflect on the design principles

The parallel study in 10 ongoing innovation practices and the findings from the literature review (chapter 5) led to the definition of a set of design principles that participants and facilitators of innovation practices validated. This chapter presents the result of an expert consultation. The aim of this research activity was to formatively evaluate the design principles and critically reflect on them from different fields of expertise. Experts in the fields of learning and change, innovation, urban planning, sustainability and transition management joined the sessions. Section 6.1 further explains the method that was used in the expert consultation and the remainder of the chapter elaborates upon the results. Section 6.2 presents the experts' reflections on the design principles, Section 6.3 discusses the relationship between the various principles. Finally, Section 6.4 reflects on the critical questions that were raised.

6.1 Method

The involvement of experts in research activities can serve different goals. Experts can be involved with the purpose of evaluating the intrinsic merits of a product, obtaining new perspectives on a particular subject, or reaching consensus in a complex issue.

Evaluating the intrinsic merits of a product

Experts can be involved individually or in a panel as conductors of a formative evaluation. Formative evaluation refers to activities undertaken to furnish information that will guide improvement of the object that is evaluated (Scriven, 1991). Experts form an important group to involve in formative evaluations since their review provides different information than a review by the evaluator himself or future users of the object to be evaluated (Tessmer, 1993). The expert review is an *intrinsic* evaluation, meaning that the subject of the evaluation is evaluated in terms of intrinsic merits such as content, accuracy or technical quality.

Obtaining new perspectives

Experts can fulfil the role of 'critical friend'. In their role of critical friend experts can look critically at the work of colleagues with the aim supporting them to broaden their view. Often, critical friends are used in educational settings. Costa and Kallick (1993) refer to a critical friend as a trusted person or colleague who asks provocative questions, provides a different lens and offers critique to a person's work as a friend. Asking experts to take the role of critical friends can be used to prevent oneself from getting a tunnel vision and to get new ideas from a different perspective. Or, as Costa and Kallick (1993, p. 49) state, "if you never change the lens, you limit your vision".

Reaching consensus in a complex issue

A common way of involving experts is the Delphi study, named after the oracle of Delphi in ancient Greece. The Delphi study is a research methodology developed to reach consensus in complex issues. In this methodology the opinions of different experts are collected with respect to a complex subject about which there is no consensus yet. By giving back the answers of other experts anonymously, in several rounds one tries to reach consensus. It is used in many settings and for many purposes, including forecasting the future, exploring policy issues and planning curricula (Stritter, Tresolini, & Reeb, 1994). This method is useful when the problem can benefit from subjective judgements on a collective basis, and when the experts who must interact cannot be brought together in a face-to-face exchange because of time or cost constraints (Linstone, 1978).

Since the goal of the present study was not to reach consensus about the design principles but rather to determine their value and to obtain critical reflections, the experts were involved both as evaluators of the design principles and as critical friends. Involving them in these roles offered the freedom to use the different perspectives in a way the set of design principles would benefit from it most. The central research questions in this research phase are:

- *To what extent do experts recognise the design principles from their own area of expertise, and how would they recommend improving them?*
- *What critical questions do experts have with respect to the principles?*

Experts in the fields of learning and change, innovation, urban planning, sustainability and transition management were invited to participate in an expert meeting. The research aims to learn more about learning processes undertaken with the intention of innovating. Therefore it was obvious to invite experts knowledgeable in the fields of learning and change, and innovation. Experts in the fields of urban planning, sustainability and transition management were invited owing to their expertise on the content of the cases in the parallel study, and the kind of questions that were central in these innovation practices. Participants in the innovation practices dealt with problems related to aspects of the built and social environments of urbanised municipalities. At the same time the cases often concerned social issues for which the people involved aimed to find sustainable solutions. Since transition management deals with efforts to resolve social issues in a more sustainable way (Loeber, 2003), expertise in the field of transition management was found valuable too.

6.1.1 Participants

A total of 10 experts with expertise in the areas that were considered relevant, participated in four expert meetings. Two criteria formed the starting point for inviting experts. The first criterion refers to the different fields of expertise. The respondents needed to be researchers or former researchers in one of the selected fields of expertise. The second criterion refers to the ability to act as a critical friend. The characteristics of critical friends, as mentioned by Costa and Kallick (1993), were kept in mind when approaching experts: being able to listen well, offering value judgements only upon the request of the learner, responding to the work with integrity, and being an advocate of the success of the work. In total, 15 experts that met these criteria were invited. On the basis of their willingness and availability a selection of 10 experts was made.

In the first three meetings 3 experts participated. The fourth meeting was joined by 1 expert. This meeting was organized separately and with only 1 expert, because of logistic reasons. In the first session experts in the field of learning and change took part, in the second and fourth session experts in the field of innovation participated, and the third session consisted of three experts with different areas of expertise: urban planning, sustainability and transition management. Table 6.1 offers an overview of the number of experts per area of expertise.

Table 6.1

Number of experts per area of expertise

Area of expertise	**# Experts [a]**
Learning and change	3
Innovation	4
Urban planning	1
Sustainability	1
Transition management	1

[a] Appendix E provides a list with the names and affiliations of the experts.

6.1.2 Procedure

The experts who joined an expert meeting each got a financial compensation. The first three sessions took approximately 210 minutes, the fourth session took about half that time. A week before the actual expert meeting respondents received an elaborate description of the set of design principles both in a hard-copy version and in an electronic format. In addition, the respondents received a form that they were requested to fill out. The aim of this form was to facilitate their preparation for the session. It contained an overview of the design principles. It also offered room for making notes about the essence of the various principles and the evidence for a specific principle from theory. The meetings all followed this programme:

- Getting to know each other and sharing some first reflections on the design principles (What was your first impression? What are you curious for?).
- Discussing each principle using the following questions: What do you find the essence of this principle? How do theories from your field of expertise support or contradict this design principle? Which design principles are real principles and which ones are not?

The respondents determined the order in which the principles were discussed. In each session all principles were discussed.

Per principle the statements were noted down in a mind map. With help of a beamer this mind map was projected on the wall. Making a mind map had three functions:

- All participants could see the mind map grow. It formed a concrete product of their collaborate effort. This motivated people to contribute. Indeed, making something collaboratively is in line with design principle 7 (Create something together).
- Making a mind map in which all contributions were brought together, helped to better see communalities and differences between the respondents' statements about the design principles.
- By projecting the mind map on the wall, participants could immediately endorse their statements.

For the fourth expert session a different way of working was used since only one expert attended this session. Instead of a mind map, notes were made in a word document and the beamer was not used to project these notes on the wall.

6.1.3 Data analysis

For the remarks that were related to each of the design principles, Tessmer's (1993) indications for analysing data guided the process of analysis. First, the comments that would lead to pointless or impossible revisions were rejected. Then the comments were summarised on three aspects:

- the content of the design principles;
- the mechanisms that underlie the principles, and
- the boundaries of the principle.

Areas of agreement and disagreement were found and brought together in an overview consisting of comments per principle per aspect (see Appendix F). Since the aim was not reaching consensus amongst the experts there was the freedom to use their input selectively. Section 6.2 presents a synthesis of the comments that were found relevant.

These findings were not used to revise the design principles immediately. As Tessmer (1993) points out, revisions may be delayed until after a next step if the lack of revisions will not reduce the productivity of the next research stage. Parallel to the expert sessions another study, a design study, took place. The design study had the function of evaluating the prescriptive value of the design principles, whereas the expert sessions aimed to evaluate the content of the design principles. Therefore, it was obvious to postpone conclusions about the revision of the design principles until the results of the two studies could be compared.

Besides the remarks with respect to each of the principles, the experts made reference to the nature of the principles and to the relationships between them. They mentioned that at first sight the principles are of a different nature: some define how the innovation process should *look* like, whereas other principles state what practitioners should *do*. They recommended to define the principles all at the same aggregation level. Furthermore, they concluded that the principles are closely related to one another. This relationship, according to them, may for instance be related to the order in which to use the principles, or to their content. The experts' comments with respect to the nature of the design principles and their relationship gave rise to a re-examination of the design principles. This re-examination led to the identification of three themes: 1) the construction of new meaning, 2) collaboration in innovation practices and 3) the space required for learning. It became clear that in specific combinations the design principles may reinforce each other with respect to these themes. Section 6.2 presents the findings per design principle that helped to elaborate upon this division in themes, and Section 6.3 presents the three themes.

Finally, the experts came up with some critical questions. These questions relate to aspects that the experts missed in the design principles, furthermore they touched upon some relevant issues that refer to the development of the design principles, and lastly, some questions referred to the application of the design principles. Although none of the questions was asked by more than one expert, we considered it relevant to reflect upon all of the issues that were raised. Section 6.4 presents these critical questions and the reflections upon them.

6.2 Results with respect to each of the design principles

Design principle 1. Formulate an urgent and intriguing question

Comments made by the experts refer to the fact that the principle is formulated as if ‘urgent’ and ‘ intriguing’ were attributes of the question. Reflecting on what was said about this point in the four expert meetings, three notions come to the fore:

- The question is intriguing when two seemingly contradictory concepts must be combined (e.g. sustainability and the expansion of an industrial area), or when two seemingly opposite interests are at stake (e.g. the plan of municipality to expand the number of houses and the wish of inhabitants to keep the area green with a playground for the children).
- The question is intriguing when people involved personally find it intriguing. They must be triggered by the question and feel inspired to get started with answering the question.
- Often, the sense of urgency originates from an external source. For instance when an organization feels the urgency to innovate because going further on the same track would cause damage in the long run.

These three notions are all referred to in Section 6.3. Design principle 1 is mentioned in relation to all three themes: construction of new meaning, collaboration in innovation practices, and the space required for learning. In each of these themes a different aspect of this principle is emphasised.

Design principle 2. Create a new approach

In one of the expert meetings the creation of a new approach is seen as the creation of the space required for learning. In order to create this space, hindering routines and structures must be broken with. The experts stated that new ways of working can help to break these hindering structures. In Section 6.3 this design principle is mentioned in relation to the creation of a space required for learning.

Design principle 3. Work from individual motivation

The experts were interested in the relationship between the motivation of all the individual participants of the innovation practice and the overall goal that the innovation practice aims for. They raised the question whether it would be necessary to connect these two more strongly. For the experts it was not self-evident that working from individual motivation directly contributes to the innovation process.

At this point the experts have a perspective that is not in line with the findings from the meta-analysis (chapter 4), the parallel study and the validation study (chapter 5). All respondents in the validation study who participated in the in-depth interviews declared that paying attention to the individual motivation of the participants of the innovation practice was likely to lead to breakthroughs in the innovation practice. They gave varying examples of instances in which this was the case. Section 6.3 mentions this design principle in relation to the collaboration in innovation processes.

Design principle 4. Make unusual combinations of subject matter expertise

The experts recognise and support this design principle. In one expert meeting experts saw this principle as the generator of the creativity necessary for innovation. According to them the unusual combinations of subject matter expertise could prevent participants in innovation practices suffering from tunnel vision. In Section 6.3 design principle 4 has a prominent place in the construction of new meaning.

Design principle 5. Work from mutual attractiveness

In one expert meeting the mechanism behind this principle was referred to as to mutual dependency. Experts in the other meetings explored this notion of dependency further. They concluded that for innovation, in any case, a dependency in the form of a formal agreement would not work. They stressed the importance of open innovation (Chesbrough et al., 2006), a paradigm that assumes that organizations should use external ideas as well as internal ideas in order to be innovative. In this paradigm collaboration is likely to be fuelled by trust and reciprocity rather than by formal agreements. Section 6.3 refers to this design principle as an underlying principle for collaboration in innovation processes.

Design principle 6. Build on strengths

According to the experts this design principle consists of two aspects: using talents and abilities of individuals, and collaboratively defining successes. They regard these aspects as different from each other. According to them the first is more related to the individuals and the way in which the innovation practice enables them to use previously developed knowledge or skills. The second, they believe, refers to the group of participants in innovation practices and to the successes they have attained. The two aspects of this principle, both the individual and the collaborative, are mentioned in Section 6.3 to elaborate upon the space required for learning.

One expert doubted the relevance of this principle for innovation. This expert said that although this principle touches upon relevant issues from the perspective of learning, it is not an obvious principle from the perspective of innovation. The innovation process concentrates on the development of new products, services and processes. Letting go of the old and letting come in the new, is a key element in this process. According to this expert, these two perspectives are opposite to one another: innovation will not occur if people only keep doing what they successfully did before. New solutions will only come into existence when people are prepared to leave the beaten track, experiment, make mistakes and be open to unexpected discoveries.

Design principle 7. Create something together

The experts recognised two different mechanisms supporting this principle. First, when people make something together, they are likely to obtain new perspectives. Second, in the process of creation, conflicts are likely to occur. Conflicts bring about a necessity for action, which is likely to lead to cognitive development.

One respondent offered an interesting starting point to elaborate upon this principle. This expert wondered whether this design principle only refers to the act of creating something. According to him it might also refer to collaboratively doing something, investigating something, consulting, or solving problems. The parallel study (chapter 5) and the meta-analysis of the reconstruction studies (chapter 4) do not confirm this broader interpretation of the design principle. In the innovation practices that were part of these studies, participants interacted with each other in different ways. They were engaged in solving problems together, they did investigations, or they went out and visited the field their problem relates to. Often these new ways of working helped them to break with hindering routines or perspectives, and then they were linked to design principle 2 (Create a new approach). The instances in which participants in these innovation practices worked on tangible products -and created something-, it was the explicit way in which perspectives were confronted with each other that caused breakthroughs. And this was the reason to define a design principle that related to the act of creating something.
In Section 6.3, in relation with the theme of the construction of new meaning this design principle is referred to.

Design principle 8. Entice to see new signals and to give them new meaning

The experts enthusiastically elaborated upon the mechanisms underlying this design principle. They found this design principle very conceptual. According to them the principle shows a theoretical process: seeing new signals and giving them new meaning. The principle does not indicate how this process is taking place in practice. The experts' remarks with respect to this principle are used in Section 6.3. Indeed, this design principle is used as a starting point for one of the three themes: constructing new meaning.

Design principle 9. Connect the world inside the innovation practice to the world outside

The experts agreed on the necessity of this principle. According to them, the principle confirms the importance of the link between the innovation practice and the outside world. The experts state that, for innovation, it is not enough to invent something new. Often, people only pay attention to the first phase of innovation: invention. According to them this principle confirms the importance of the phases that follow.

The respondents also reflected on the way in which the inside world and the outside world relate to one another. They stressed that although the design principle might suggest that the outside world is the passive receiver of what the innovators develop, the outside world actually has a very active role. The people outside must not only 'adopt', 'follow' or 'implement', and the people from within the innovation practice must not see them as passive receivers. Participants in the innovation practice should follow the developments outside the innovation practice and connect to that. The experts found that this design principle refers to a process in which people from inside and outside the innovation practice collaborate with each other in a relation characterised by reciprocity in order to develop the innovation and to make it robust. This notion is used in Section 6.3. The collaboration with people from outside the innovation practice is stressed in the second theme: collaboration in innovation processes.

Design Principle 10. Pay attention to the social and communicative process

Respondents recognise two aspects that they find relevant to innovation in this design principle:

- Besides the content of the innovation there is a process
- The quality of the interaction is important

The experts in one of the expert meetings reflected critically upon this principle. They found the principle too broad. This made it for them difficult to disagree with the principle. Their comment has been used in Section 6.3. In this section design principle 10 is related to the construction of new meaning in innovation processes. In constructing new meaning the social and communicative process must focus on a specific type of conversation. Indeed, a kind of conversation that fosters the creation of new knowledge.

Design Principle 11. Actively support the development of competences

With respect to this principle experts emphasised the development of the ability to innovate. The experts concluded that innovation itself is an important condition for the development of the ability to be innovative. They also expressed that there might be more to the development of the ability to innovate. In this respect they mentioned the role of reflection. Ongoing reflection could be one of the activities that could actively support participants in innovation practice in developing their ability to innovate. This design principle forms the basis for the development of a space that is required for learning. In Section 6.3 this design principle is mentioned as a central principle in relation with this theme.

6.3 Relationships between the design principles

This section presents three themes, each inspired on one of the design principles. These themes refer to the construction of new meaning, collaboration in innovation processes, and the space required for learning. There is are obvious relationships between these themes and the design principles. Indeed, in specific combinations the design principles may reinforce each other in relation to these three themes.

6.3.1 The construction of new meaning

Innovation and learning both are processes in which the construction of meaning has an important place. Learning can be seen as the construction and reconstruction of meaning (Dixon, 1999). This is a dynamic process in which the processes that are necessary to continuously revise or create knowledge are important. In innovation, the construction of meaning is important too, especially the creation of new meaning (Steyaert et al., 1996). Design principle 8 (Entice to see new signals and to give them new meaning) refers to this process. Elements of design principles 1 (Formulate an urgent and intriguing question), 4 (Make unusual combinations of subject matter expertise), 7 (Create something together), and 10 (Pay attention to the social and communicative process) seem to reinforce this principle. These principles contribute to the construction of new meaning in different ways:

- An exploration of the field of the problem (as is depicted in principle 1) may contribute to a new problem definition that leaves more space to new solutions.
- The use of metaphors and analogies (as is referred to in principle 4) may help to develop a different perspective on the problem.
- Conflicts in collaboration are evoked when creating something (design principle 7). These conflicts may stimulate the exploration of different perspectives.
- Attention for interaction patterns (as mentioned in principle 10) may enable knowledge-creating conversations.

Exploring the field of the problem

Design principle 1 (Formulate an urgent and intriguing question) refers to an urgent and intriguing question. Whether a question is intriguing is up to the participants. Often, participants find a question intriguing when it combines two concepts that were not combined before and that might even be contradictory. Searching for a formulation of the question that could make it intriguing, requires to give new meaning to the question at hand. Getzels (1979) observed that the quality of a solution depends on the way a problem is formulated. Usually, a new problem definition is necessary to find creative solutions. Indeed, an active exploration of the field of the problem prior to attempting to produce solutions, contributes to the necessary creativity in solving the problem (Getzels & Csikszentmihalyi, 1976). In fact, the construction of new meaning starts when the problem is composed. When participants make an effort to give new meaning to the situation they experience, instead of using the first question encountered as a starting point, they are more likely to find new solutions.

Using metaphors and analogies

Design principle 4 (Make unusual combinations of subject matter expertise) explains the importance of unusual combinations of subject matter expertise. This design principle stimulates the ability of reasoning by analogy. This ability enables people to make the novel seem familiar by relating it to prior knowledge, and to make the familiar seem strange by viewing it from a new perspective (Gick & Holyoak, 1983). Analogies or metaphors provide the participants in innovation practices with new terms, key words, descriptions and meanings for the concepts they begin to define together (Von Krogh et al., 2000). Apparently, making use of analogies and metaphors supports the construction of new meaning.

Exploring the 'otherness' of others

Design principle 7 (Create something together) stimulates the activity of making something together. Research conducted by Akkerman (2006) illustrates how people most easily transform what is said by the other into what is known and familiar to one self; words and labels are often understood in own terms. This hinders people to question what is said by the other. And so, the 'otherness' of the other, providing different perspectives and different ideas, is left unexplored. Creating something together, seems to stimulate this exploration of other perspectives, since in the process of creating something together, the different perspectives easily collide. When creating a tangible product, one cannot hide behind a polite exchange of ideas. Perspectives may differ from each other and they might clash. The conflicts that may arise thus, can work as perturbations that trigger cognitive change (Von Glaserfeld, 1989).

Paying attention to interaction patterns

Design principle 10 (Pay attention to the social and communicative process) adds relevance to the social and communicative processes in the development of new knowledge for innovation. Especially the way participants in innovation practice interact with each other is essential for the success of innovation. Conversations are an important variable in the innovation process (Scharmer, 2007; Steyaert et al., 1996; Von Krogh et al., 2000). Scharmer (2007) has identified four patterns of conversational interaction: downloading, debate, dialogue and presencing. Recognising these patterns is relevant to leading innovation. When conversations have the character of a generative flow, which is related to the pattern of presencing, the conversation can enable participants to bring forth something profoundly new (Scharmer, 2007). Von Krogh, Ichijo, and Nonaka (2000) offer four guidelines for knowledge creating conversations:

- Actively encourage participation: include people with various backgrounds and knowledge, invite new people now and then, and make it easy for them to participate by making entry rituals easy to understand.
- Establish conversational etiquette: knowledge-creating conversations depend not only on what is being said, but also on how it is said. Some rules include: avoid unnecessary ambiguity, be brief, and help other participants to be brave.
- Edit conversations appropriately: as a conversation proceeds, the individual expressions should converge into one or just a few concepts that become the group's focus. This happens through agreement and understanding.
- Foster innovative language: in order to generate innovative concepts, language must be extraordinarily dynamic. Participants should allow the words they use to be playful and not always 'correct'.

6.3.2 Collaboration in innovation processes

In innovation practices, people collaborate in order to find answers to difficult questions. Collaboration takes place because the questions are often too complex to be solved by separate individuals. Taking a closer look at the kind of interdependence between participants who collaborate in an innovation practice, offers more insight in the coordination mechanisms that might improve this collaboration.

Workflow interdependencies

Thompson (in: Van de Ven, Delbecq, & Koenig, 1976) distinguished three types of workflow interdependence: pooled, sequential and reciprocal. In a pooled interdependence employees work independent from each other, in a sequential interdependence the output of one employee is the input of another, and in a reciprocal interdependence the output of one employee is the input of another in an iterative process. Van de Ven et.al. (1976) add another type of workflow interdependence, which is team interdependence. Team interdependence best characterises the collaboration process in innovation practices. In this type of workflow interdependence the interacting employees work collaboratively and at the same time. This differs from for instance sequential or reciprocal work flows in which there are temporal lapses in the flow of work between unit members (Van de Ven et al., 1976).

Coordination mechanisms

Worthwhile to note is that the coordination mechanisms that could improve work-related activities are closely related to the type of workflow interdependence. Two coordination mechanisms can be distinguished (Van den Bosch & Volberda, 2006): coordination by programming and coordination by feedback. The first strongly relies on planning and formalised roles and procedures, and the latter uses mutual adjustments as a starting point for coordinating work processes. In the case of team interdependence, which resembles the interdependence between team members in innovation practices, coordination by programming plays a limited role, and coordination by feedback is more important (Van de Ven et al., 1976). This means that the work processes in innovation practices cannot easily be planned and controlled. Rational processes of planning in advance do not work for innovation practices. Indeed, participants must adjust their actions according to the feedback they receive about the progress they make.

Design principle 5 (Work from mutual attractiveness) gives direction to the way participants relate to each other in such collaboration. In chapter 5 (Section 5.3.5) it became clear that the principle of mutual attractiveness could help participants in innovation practices to design a collaboration in which each of them can hold on to their own interests, and in which they use the varying interests to come up with new solutions for the problematic situation at hand. Formalising this way of working, won't facilitate the process, therefore participants themselves are responsible for their collaboration. It requires them to be fair to each other. Painful confrontations may belong to the feedback necessary to support the process. Mutual attractiveness is helpful in establishing a constructive and sustainable collaboration even when feedback is painful.

Design principles 1 (Formulate an urgent and intriguing question) and 3 (Work from individual motivation) reinforce this way of working. Design principle 1 shows that the question at hand must be an intriguing question for the people involved. Design principle 3 stresses the importance of working from individual motivation. Having one's own motives clear is necessary for being able to connect them to those of others. When participants know what drives them, they are more likely to invest in goals of others, if that could help them to get closer to their own goal.

Besides the collaboration within the innovation practice, there is also the collaboration with the outside world. Design principle 9 (Connect the world inside the innovation practice to the world outside) refers to that connection. It stresses the relationship that exists between the innovation practice and the world 'outside' in which the innovation will be implemented. The experts added that the relationship between 'inside' and 'outside' should also be based on reciprocity.

6.3.3 The space required for learning

In the present research, innovation is regarded as a process that consists of powerful learning processes. Design principle 11 (Actively support the development of competences) refers to the necessity of actively designing a learning environment that enables learning for innovation. Design principles 1 (Formulate an urgent and intriguing question) and 2 (Create a new approach) can contribute to the creation of such a learning environment. Design principle 6 (Build on strengths) gives direction to the learning activities that can be carried out in order to fill this environment:

- Design principle 1 (Formulate an urgent and intriguing question) shows the importance of urgency. Urgency can be considered the engine for the innovation and for the learning process, since it helps to keep it going. A sense of urgency, originating for instance from shocks like a budget crisis (Van de Ven, Angle, & Poole, 1989) can bring about the creative turmoil that is necessary for learning (Kessels, 1996a).
- Design principle 2 (Create a new approach) shows the importance of breaking with existing routines that hamper the learning process or that even may be counterproductive. Traditional meetings in which a classical

division of roles and the setting seems to predefine the outcomes of the conversation are likely to hamper innovation. At these places it is necessary to develop new ways of working that offer space for learning for the participants involved.

- Design principle 6 (Build on strengths) truly originates from a learning perspective. It stresses the importance for individuals to build on their own talents and strengths, and for groups to learn from their previous achieved successes. The reflection on one's own talents and on that of the group could help to strengthen the participants' ability to be innovative. These are learning activities that can be undertaken in innovation practices.

6.4 Critical questions and reflections

This section offers preliminary answers to the questions raised by the experts. The questions refer to the content and the application of the design principles.

6.4.1 Critical questions about the content of the design principles

I miss the concept of power in the design principles. What role does power play in innovation processes?

The organizations that initiated the innovation practices that were part of the meta-analysis (chapter 4), and the parallel study (chapter 5), often developed new structures to foster innovation. Most innovation practices were not part of the formal structure of the organizations they were related to. In these innovation practices the ability of management to use power to influence the process, was limited. Angle and Van de Ven (2000) said about such groups that they manage themselves by beating the system.

In the innovation practices that were studied, power did not seem to play a prominent role. Sometimes, managers or sponsors were actors in the innovation practice. For instance by arranging the necessary funding or by arranging that people were able to spend time in the innovation practice. However, these managers did not have a part in the breakthroughs the participants realised in the innovation practices. These findings are in line with findings of Angle and Van de Ven (2000, p. 695): "Management cannot control innovation success, only its odds". Instances in which these persons used their power and position to 'overrule' certain activities, they did not contribute to the innovation practice, but rather stopped the process.

Although power that is based on people's formal position within organizations might be the most obvious form of power, in innovation practices another form of power seems to prevail. French and Raven (1959) developed a schema of different categories of power, which reflect the different resources that power holders rely upon. They describe legitimate power, which refers to power of an individual based on his or her formal position within an organization, as the most obvious form of power. Another form of power they distinguish is expert power, which originates from the skills or expertise of employees. Toffler (1990) asserted that knowledge as a form of power becomes increasingly important in organizations that operate in a knowledge economy. This is in line with the findings in this present research. Participants in innovation practices are more knowledgeable than their formal managers with respect to the improvement or innovation at hand. This provides them with the power to make decisions and create breakthroughs.

What about leadership, this is a theme that I would expect the design principles to refer to, how come this isn't the case?

Leadership was not an explicit subject of the investigation. The parallel study focused on breakthroughs, and the analysis of the breakthroughs did not reveal leadership as an important factor.

Reflecting upon the role of leadership retrospectively, it becomes clear that participative leadership is the type of leadership that is best recognised in the cases that were studied. Manz, Bastien, Hostager and Shapiro (2000) describe three leadership perspectives that are especially appropriate for innovation: rhetorical, transactional, and participative leadership. The process of influence associated with rhetorical leadership is mostly top down, with transactional leadership it is mostly reciprocal, and with participative leadership it is mostly bottom up (Manz et al., 2000). The perspective of participative leadership prescribes a situation in which followers to a greater degree become their own source of direction and influence. Followers in this perspective can obtain increased sense of ownership of the objectives and goals being pursued. This is especially useful when leaders desire creative and intellectual input, as opposed to simply compliance in implementing the leader's ideals. The innovation practices that were studied comprise all cases in which a problematic situation or difficult question for which no answer was available yet, formed the starting point. Compliance was never a goal, simply because there was nothing to comply with yet. The way the innovation practices were organized, not as traditional project groups but rather as non-hierarchical collaborations between people with an interest in the problem or its solution, made participative leadership easier to get shape.

I miss a division between the various roles that people fulfil in different stages of the innovation process. Did you find people to fulfil different roles throughout the process?

The research of Van Poucke (2005) aimed to learn more about radical innovation in knowledge intensive service organizations. She distinguishes different roles that participants in these innovation processes fulfil in different phases of the process: Gatekeepers, Innovators and Boundary spanners. The first phase is that of idea generation. The output of this stage is a concept that forms the basis for the innovation. Gatekeepers, who give access to external networks with people who have relevant subject matter expertise, are important in this phase, just as Innovators. Innovators are essential for developing and elaborating on new ideas. The phase that follows is that of crystallization, in which a social political process is prominent. In this phase Boundary spanners are essential, they are the ones who manage to connect the innovative ideas as found and developed by the Gatekeepers and Innovators, to the actual vision in the organization. Boundary spanners are considered the early adopters of the innovation. In the last stage of the innovation process, evolution, the Boundary spanners as informal leaders direct the knowledge workers who develop incremental innovations based on the more radical first phases.

Although the present research was not conducted in a knowledge intensive service firm, the findings of Van Poucke (2005) are for a great deal applicable. In the innovation practices studied not the roles of Gatekeeper, Innovator and Boundary spanner, but the activities that people with these roles undertake can be recognised. The design principles refer to these activities.

Gatekeepers are participants in innovation practices who have access to a large network in order to involve various people with useful expertise in the innovation practice. Design principle 4 (Make unusual combinations of subject matter expertise) reflects this activity. In the innovation practices studied this role was fulfilled by more than one person. In most cases, the facilitator was someone with an extensive network who fulfilled this role.

Innovators play a role in the development of new ideas. The development of new ideas and concepts takes a prominent place in design principle 8 (Entice to see new signals and to give them new meaning). The innovation practices studied consisted of one or more participants who were good at constructing new meaning.

Boundary spanners are the persons who connect the world inside the innovation practice to the world outside. Design principle 9 (Connect the world inside the innovation practice to the world outside) depicts this. In the cases in the parallel study it were often influential people who took up this role. For instance a politician, or a manager who took part in the innovation practice but who also had a strong link with the context in which the new ideas must be implemented.

The knowledge workers, as a group of people who develop incremental innovations based on the more radical first phases, were not recognised in the present research. The research focused on breakthroughs within the innovation practices. Implementing the innovation in the sense of working with its yields, was not part of the research focus.

6.4.2 Critical questions about the application of the design principles

How should I look at the design principles, are they meant for individuals, projects or even for organizations?

The design principles are meant to be used by individuals and groups who work in innovation practices in order to find solutions for difficult questions that often cannot be solved by one person. The principles reflect the factors that were recognised in the breakthroughs in the innovation practices studied. Although the design principles are meant for individuals and groups, the content of the design principles reaches further than that. Design principle 9 (Connect the world inside the innovation practice to the world outside) for instance, describes that a connection should be made between the innovation practice and the context that it operates in. This principle stimulates a connection with people outside the innovation practice as well.

For what context are the principles meant? They seem not applicable to a 'normal organization' right away.

The principles are based on an analysis of the findings in a parallel study and a literature review (chapter 5). The cases that were included in the parallel study consisted of innovation practices in which participants worked together to realise innovation. The starting point for these practices were difficult questions for which no answer was available yet. The innovation practices all took place in the context of space use (planning processes) in The Netherlands. They did not take place within the context of one organization. Rather, different stakeholders, belonging to different organizations or stakeholder groups, took part.

Although organizations are often the first to feel the urge to solve a particular issue, the present research shows that the personal involvement of individuals is very important. Creating something that was not previously there, can only be done from a strong individual drive. Organizations should therefore look for ways of working that support this personal commitment.

Besides the individual commitment, the collaboration between different parties plays a role. The innovation practices that were included in the parallel study focused on questions that previously one organization (e.g. a municipality or a project developer) would work on in relative isolation. But because that way of working did not result in the desired effects, they developed new ways of working that often crossed organizational boundaries. For example, a collaboration could emerge between someone from the municipality who has a strong stake in a solution for the problem, someone who works with the construction company that is involved in the particular area, and some inhabitants. The studies conducted within the framework of the present research revealed that the involvement of individuals who have a stake in, or who have an interesting perspective on the solution, is promising for innovation.

For organizations it is not common to organize the work based on the personal motivation of employees. Usually, the most efficient division of work, independent of individual preferences, prevails. At the same time collaboration with other or unusual parties is not always obvious. The way in which 'normal organizations', as the experts referred to it, organize their work does not self-evidently lead to innovation. Indeed, it is possible that these organizations will change as a consequence of the knowledge economy. In such an economy the success of organizations is not so much determined by the extent to which organizations succeed in organizing the routine work, but rather by the extent to which they develop their ability to be innovative. It might be necessary for these organizations to adapt their way of working to be better equipped for this purpose.

Are the principles meant for innovation or for knowledge productivity?

Knowledge productivity refers to the learning processes that take place in order to realise innovation. The yields of this process consist of gradual improvements and radical innovations. The ability to be innovative is another, a more sustainable, outcome of this process. The interest of the present research was the process of knowledge productivity, and not innovation per se. This becomes clear for instance in the selection of cases. All cases that were part of the reconstruction studies and the parallel study consisted of innovation practices in which people who experienced the problem, participated. In this way, the learning processes that enabled the participants in the innovation practices could be investigated. The focus was not on employees who were occupied with the implementation of innovations developed elsewhere. In these cases the learning processes would have taken place elsewhere as well.

I am curious about the extent to which the design principles are applicable across sectors, subjects or types of innovation. They now give the impression that they may be applied in all these different situations.

This question refers to the generalisability of the findings. The design principles are based on the findings in the parallel study (chapter 5) that was executed in innovation practices that aimed at developing innovative solutions for land use in The Netherlands. Prior to the parallel study, a meta-analysis of different reconstruction studies was carried out (chapter 4). The cases in this study originated from various organizations and sectors, and three different countries. The innovation practices took place in for instance the context of transport, natural gas and the consumer goods sector. Up to now there are no indications that the insights as acquired in the parallel study are not applicable to the innovation practices in the reconstruction study. In the design study (chapter 7) this is further explored.

Are the design principles actual principles? Or are they rules of thumb, guidelines, design rules or conditions?

The design principles are no axioms that guarantee success when applying them. They reflect signposts that can offer people some guidance in the diffuse process of innovation. The design principles aimed to function as heuristics for people who encounter difficult situations in innovation processes. However, in further investigations it turned out that they do not unreservedly fulfil this function. Chapter 7 describes the design study that goes deeper into this matter.

The principles are formulated in words that seem to relate to people with a strong reflective capacity. To what extent does this formulation connect to the language that people in practice use and do the principles appeal to them?

It is true that the design principles are not formulated as rigid prescriptions. First, such a formulation is not considered promising for stimulating innovation. Second, in a knowledge economy work processes take on the characteristics of learning processes (Dixon, 1999; Kessels, 2004; Kessels & Van der Werff, 2002). In this kind of work reflection plays an important role (Van Lakerveld, 2005).

The design principles were validated with a group of respondents who all participated in innovation practices, both participants and facilitators. Chapter 5 describes this validation study. These respondents recognised the design principles and found them a helpful means to describe the breakthroughs they encountered in their innovation practice. The participants could very well relate to the design principles.

6.5 Conclusions

This section will reflect on the outcomes of the expert consultation by referring to the research questions that were central.

To what extent do experts recognise the design principles from their own area of expertise, and how would they recommend improving them?

The formative evaluation of the design principles revealed specific reflections upon each of the design principles. Design principles 4 (Make unusual combinations of subject matter expertise), 7 (Create something together), 9 (Connect the world inside the innovation practice to the world outside), and 10 (Pay attention to the social and communicative process) got much support from the experts.

With respect to design principle 3 (Work from individual motivation) the experts found it not self-evident that working from individual motivation directly contributes to the innovation process. The experts' opinions at this point differ from the perspective of participants in innovation practices. With respect to design principle 6 (Build on strengths) the experts noticed that this principle consists of two different aspects, an individual and a collaborative aspect. They found it not clear how these two aspects relate to one another. Some experts found design principle 10 (Pay attention to the social and communicative process) too broad.

The experts contributed to the formative evaluation from their own area of expertise. However, their different contributions were neither explicitly, nor exclusively linked to a specific area of expertise. At one point the perspectives of learning and innovation seemed to be contradictory with each other. This occurred in relation to design principle 6 (Build on strengths).

In order to improve the design principles the experts recommended to examine more closely the relationship between the principles. The critical reflections on each of the design principles were used for this purpose. This exploration led to the definition of three themes that seem to underlie the principles: the construction of new meaning, collaboration in innovation practices and the space required for learning. Design principle 8 (Entice to see new signals and to give them new meaning) seems to be most closely related to the first theme, design principle 5 (Work from mutual attractiveness) to the second, and design principle 11 (Actively support the development of competences) to the third. The other design principles, in specific combinations, seem to contribute to the development of these three themes. Design principle 1 (Formulate an urgent and intriguing question) was the only design principle that seems to reinforce all the themes. It contains different aspects that relate to the three themes.

What critical questions do experts have with respect to the principles?

The idea to invite experts who could take the role of critical friends, worked well. The experts raised critical questions, but always did that with the intention of contributing to the present research. The critical questions helped to uncover an interesting point: the difference between innovation practices and, as the experts called it, 'normal organizations'. Apparently themes such as power and leadership did not play as important a role in the innovation practices under investigation as they do in many organizations. The kind of leadership that is found in innovation practices could best be characterised as participative leadership (Manz et al., 2000). This type of leadership refers to a situation in which followers can obtain increased sense of ownership of the objectives and goals being pursued. The source of power in innovation practices does not seem to stem from participants' formal position, but rather from their knowledge and expertise (Toffler, 1990). Instead of a focus on leadership and power, working from personal motivation and mutual attractiveness seems for innovation practices more promising. It is possible that, as a consequence of the knowledge economy, organizations need to change in this respect, in order to foster innovation. The kind of collaboration that takes place in the innovation practices could serve as an example for them. It might be possible that instead of power based on hierarchy, individual motives and preferences will be the organizing principle for collaboration in organizations. The hindering structures must be broken down in order to create the space necessary for learning at the workplace.

The expert consultation, of which the findings are described in this chapter, took place in parallel with the design study reported in chapter 7. The implications for the design principles of the findings of these two studies will be elaborated on in chapter 8. That chapter integrates all findings and presents the conclusions.

7

Inquiry into the prescriptive quality of the design principles

Chapter 5 described the findings of the parallel study and a literature review. These studies resulted in a set of 11 design principles. The validation with participants and facilitators of innovation practices revealed that the design principles didn't miss essential elements to describe the breakthroughs in innovation practices. Chapter 6 presented a formative evaluation and critical review of these design principles by experts from different fields. This chapter presents the results of a design study that aimed to learn more about the prescriptive quality of each of the design principles and of the set as a whole. As the main objective of this study is to investigate the design process of suitable interventions in innovation practices, the main characteristic of this design study is creating an environment where participants become involved in designing interventions to influence the innovation process. Four types of design labs were developed for this purpose. Every type of design lab was organized several times. The design labs were conducted with the aim of answering the research question:

> *To what extent can the design principles be deliberately applied to design a work environment that promotes innovation?*

7.1 Outline of the design study

Four types of design labs were developed that engaged participants in the design of interventions for innovation practices. These labs (in this chapter referred to as design labs of type A, B, C and D) supported the participants in going through a design process in which they applied the principles to design interventions that would support the learning processes leading to innovation. Figure 7.1 shows a conceptual representation of the design process consisting of different phases.

Figure 7.1.

Model of the design process.

In reality the design process is iterative and cyclical rather than linear (Richey & Nelson, 1996). The complete design process consists of five consecutive phases. In order to use the design process to arrive at satisfactory solutions, specific design problems need to be identified (Churchman, 1971). The definition of a difficult or problematic situation is therefore the first phase of the design process. Then, in the second phase, the choice for applying one or more design principles is made. The design principles are supposed to have the function of prescriptive principles that could guide the participants in the design of an effective intervention (phase 3). And, since solving an actual field problem not only entails the design of a solution but also the realisation of the designed solution in social reality (Van Aken, 2007), the phase that follows the design of the intervention comprises the implementation of the designed intervention in practice (phase 4). The last phase (phase 5) is an evaluation in which the effects of the intervention could be measured.

Reasons for the participants to participate in a design lab were their intention to learn more about the design principles or their motivation to design interventions for their innovation practice. However, the research also served another goal. The aim of this design study was to acquire design knowledge of two types. The first type of design knowledge is related to each of the design principles, and the second type is related to working with the complete set of design principles. The sub-questions formulated in order to answer the main question refer to these two types of knowledge. The sub questions are related to the phases of the design process as shown in Figure 7.1. The questions that refer to the design principles separately are:

- Which design princip*les do respondents choose as a starting point for the design?*
- *What interventions are designed t*o promote each of the design principles?

For the set of design principles the following questions were answered:

- *What are the considerations of respondents when they choose one or more design principles to work with?*
- *How do they translate these design principles into interventions?*
- *Do respondents manage to implement the interventions in practice?*
- *To what extent do the interventions result in breakthroughs?*

7.2 Four types of design labs to study the design process

This section provides more information about the differences and communalities between the four types of design labs. For each of the design labs the procedure and the way of data gathering is explained. An overview of the design labs and the period of data gathering is presented in Appendix G.

Differences and communalities between the design labs

The design labs of type A, B, C and D all had a different goal, used different procedures and had different participants. This supported an examination of the design process in different shapes. Type A design labs engaged participants to design interventions for a fictive innovation practice. This lab took place 12 times and, in total, 39 participants took part in labs of this type. In type B design labs participants designed interventions for the innovation practice they facilitated. This type of design lab took place 9 times and, in total, 8 participants took part (one participant joined this design lab twice). Type C design labs involved the participants in a role playing game that offered an opportunity to go through the design process several times. This type of design lab took place 4 times and, in total, 32 participants joined a design lab of this type. Finally, in type D design labs emphasis was put on experimenting with different design principles to design interventions with. In total 2 design labs of this type took place, in which 32 participants took part. Table 7.1 shows the goals of each of the types of design labs and the participants. Table 7.2 presents the procedure that was followed in the labs.

The similarity between the four types of labs was that the participants all engaged in design activities with which they had the intention of creating a breakthrough in either their own, someone else's or a fictive innovation practice. In all four types of design labs participants went through (parts of) the design process as depicted in Figure 7.1.

An important difference of type C design labs in comparison to the other labs is that the interventions were implemented in a setting that resembled a role playing game. When playing a role it is possible to experiment with interventions and to observe and experience the effect. However, it is not possible to simulate the subject matter expertise and the personal involvement that employees show in the real situation. This formed an important limitation of this setting.

Focus of each of the labs in relation to the design process

Type A and D design labs focused on the first three blocks of the process as shown in Figure 7.1. In these labs participants did not implement the intervention they designed in practice. The difference between these two types of design labs was that in type A design labs participants worked with a (fictive) context that was especially constructed for them whereas in type D design labs participants brought in their own case.

Type B and C design labs focused on all five blocks of the process as shown in Figure 7.1. Participants designed interventions based on the design principles that they actually put into practice. The difference between these two types of labs is the setting in which the interventions were implemented. In type B design labs people experimented with real innovation practices and implemented the interventions in their own innovation practices. In type C design labs a role playing game formed the safe learning environment that was created in order to allow the participants to go through the design process several times and to develop new skills.

Table 7.1

Setup of the four design labs

	Type of design lab	Goal	#design labs	# participants	Group composition	Participants	Role of the researcher
A	Designing interventions for a fictive innovation practice	Getting to know the use of the design principles.	12	39	3 or 4 participants per lab	Researchers and students in the field of Human Resource Development (HRD) and Knowledge Management (KM) (n=39)	Each design lab was facilitated by one up to three researchers
B	Designing and implementing interventions for one's own innovation practice	Creating breakthroughs in an innovation practice.	9	8 [a]	1 or 2 participants per lab	Facilitators of innovation practices	Each design lab was facilitated by one researcher. Two different researchers were involved.
C	Going through the design process several times using a role playing game	Being better equipped to use the set of design principles in practice.	4	32	Two or three groups participated per lab. Each group consisted of 3 up to 5 participants	Facilitators of innovation practices (n=9), practitioners in the field of HRD (n=16), participants of innovation practices (n=7)	Each design lab was facilitated by one facilitator and one researcher. In total, two different facilitators and one researcher were involved.
D	Experimenting with different design principles to design interventions	Being better equipped to use the set of design principles in practice.	2	32	Four groups participated per lab. Each group consisted of 4 participants	Practitioners in the field of HRD	One lab was facilitated by one facilitator and one researcher. One lab was facilitated by one researcher.

[a] One participant joined this type of design lab twice.

Table 7.2

Procedure of design labs of type A, B, C and D

	Type of design lab	Procedure
A	Designing interventions for a fictive innovation practice	Since none of the participants had an innovation practice of their own, a case was purposefully constructed. Through five monologues of actors involved in this case, the innovation practice was explained. A handout introduced the principles to the participants. The participants analysed the case by using the set of design principles and a circular scale (the same instrument as was used in the parallel study, see chapter 5, Section 5.2.1). Then they were asked to think of the next step that they thought was necessary for this innovation practice. Finally, they chose one or more design principles that could help in taking this next step, and they designed interventions that could stimulate the innovation practice in going that direction.
B	Designing and implementing interventions for one's own innovation practice	In this design lab facilitators of innovation practices participated. During the design lab a participant reflected with the researcher upon the participant's innovation practice in order to define the actual design problem. Then, they chose one or more design principles from which they expected that these could help in creating a breakthrough in this innovation practice. The participant and the researcher then designed an intervention that was based on the design principles they had chosen. The participant implemented the intervention in his or her innovation practice and after the implementation an interview with the participant took place in order to evaluate the effect of the intervention.

Table 7.2 (continued)

Procedure of design labs of type A, B, C and D

Type of design lab		Procedure
C	Going through the design process several times using a role playing game	This design lab was designed as a role playing game (Demeter, 2007; Rosendale, 1989). Two groups participated in a design lab at the same time. Both groups started off with filling out a self-reflection test (see Appendix J, Figure J1) that introduced the design principles. Then, the groups brought in a difficult situation that they encountered in their work (a case). This case was a real situation from one of the participants that was relevant to the others in the group as well. Finding an appropriate case was done by making use of cards with 'mould situations'. See Appendix J for a more elaborate description of the use of these moulds. One group played the situation (they played roles as assigned to them by the other group) and the other group directed the first group in order to apply a design principle that they expected a breakthrough from. A facilitator helped them and together they reflected upon the effects. On average, a situation was played three times with different design principles and/or different interventions. After this, the groups switched and worked on another situation.
D	Experimenting with different design principles to design interventions	The groups started off with filling out a self-reflection test (see Appendix J, Figure J1) which was meant to get acquainted with the design principles. Then the groups defined a case with help of the 'moulds' that were also used in the design labs of type C. The group who brought in the case proposed a design principle that they expected to create a breakthrough in the case at hand. The other three groups designed interventions for the first group. This process was repeated for the subsequent cases. In the end there were, for every case, various interventions that each related to two or more design principles.

Data collection and analysis

Various instruments were used for two purposes: to facilitate the design process in the labs, and to learn more about the use of the separate design principles and of the set as a whole. The instruments used for the first purpose could be seen as facilitating instruments whereas the instruments used for the second purpose are data-gathering instruments. Appendixes H, I, J and K give an overview of all the instruments that were used respectively in design labs of type A, B, C and D. These appendixes also explain what data was used as input for the analysis. Table 7.3 gives an overview of the data-collection instruments.

The data was used as input to learn more about the design principles separately (first two sub questions) and to learn more about the use of the set of design principles (third until sixth sub question). Both a within-case analysis and a cross-case analysis (Eisenhardt, 1989) has been done to answer the six sub questions. The results of the within-case analysis can be found in Appendixes L, M, N and O. These appendixes present the answers to the research questions for the design labs of type A, B, C and D. Sections 7.3 and 7.4 present the results of the cross-case analysis.

Table 7.3

Overview of data-collection instruments in the design labs

Instrument	Procedure of the instrument	Data that was acquired	Type of design lab in which it was used
Circular scales to analyse an innovation practice	Every design principle was placed on a small card. Participants could position these cards on a circular scale.	Analysis of the innovation practice and design principles that the participants wanted to use as input for the design.	A
Report sheets to portray the steps of the design process and the effects	Participants filled out this sheet during the design lab.	An overview of the difficult situation, design principles that were chosen, and a description of the proposed intervention.	A
	The researcher filled out this sheet during the design lab.	An overview of the difficult situation, design principles that were chosen, a description of the proposed intervention and an evaluation of the implementation of the intervention in practice.	B
	The researcher attended the design lab and made notes that were transformed into report sheets afterwards.	Overview of all the difficult situations, the design principles that were chosen, the proposed interventions and their effect in the role playing game.	C
	The researcher attended the design lab and made notes that were transformed into report sheets afterwards.	Overview of difficult situations, design principles that were chosen and interventions that were proposed.	D
Evaluative interviews	The researcher conducted telephone interviews with the respondents to find out what they learned from the design lab.	Learning results of participants	C

7.3 Results with respect to each of the design principles

This section answers the first and second sub questions by describing the results of the cross-case analysis:

- *Which design principles do respondents choose as a starting point for the design?*
- *What interventions are designed to promote each of the design principles?*

Design principle 1. Formulate an urgent and intriguing question

Participants in type A and C design labs chose this design principle more often as a principle to work with than participants in type B and D design labs.

In type C design labs this design principle was used by four of the groups. In all of these groups participants used the principle as the first principle to work with. Then, after the situation was played for the first time, and the pattern that they wanted to change became clear, they choose different design principles to create the breakthrough. This is in line with the findings in chapter 5 (see Section 5.4.2) that show that design principle 1 was thought of as a 'passive' principle. Participants didn't see it as a principle that needs to be developed. Rather, they saw it as a principle that is either present or not.

The interventions developed by the participants with respect to this principle were often vague. These interventions rather described the problem ("what is the problem here, it is just not urgent enough for them") instead of offering a solution. An example of a more elaborate intervention that participants proposed is: "each member should define a question from their individual point of view and then the group should combine these questions into a question that defines the next goal".

Design principle 2. Create a new approach

This design principle has been used several times in design labs of type A, C and D to design interventions with. However, participants in type B design labs never chose this principle. This might have to do with the fact that in type B design labs participants designed interventions with the aim of implementing these in their own innovation practices. These innovation practices already used a very new way of working. Often, their incentive to join the design lab was to elaborate upon these new ways of working. Design principle 2 refers to that goal as a whole, whereas the other design principles offer more concrete starting points for working on that goal. In type C design labs interventions related to this principle referred without exception to the physical setting of the persons in the innovation practice. They gave them instructions such as to change the setting of the meeting by standing up. The static setting of people sitting behind a table was thus changed in a more dynamic setting.

Design principle 3. Work from individual motivation

This design principle was very popular with respondents. The respondents in the type A design labs recognised this principle best when they reflected on the innovation practice. From all the principles that were used in the design labs of type B and C, design principle 3 was by far the most frequently chosen principle to design interventions with. The interventions consisted of different ways of working. All of the interventions included a conversation about the motives, motivation, or dreams of the people involved. Either via a dialogue or by interviewing each other, participants tried to hold on to the personal motives. It seems as if this design principle touches upon something that the participants find essential for an innovation practice. At the same time they found it easy to translate this design principle in concrete interventions.

Design principle 4. Make unusual combinations of subject matter expertise

Participants in the design labs of type A, B and D used this design principle. In the interventions that they developed they proposed to invite experts or to do something that would make sure that the developed expertise within the group becomes more visible. This design principle has never been used in type C design labs. This can be explained from the fact that in type C design labs participants did a role playing game. In this game they tried to identify themselves with the characters they played. However, it is impossible to simulate the subject matter expertise that these characters possess. The use of this design principle in type C design labs was therefore not obvious.

Design principle 5. Work from mutual attractiveness

This design principle was far more popular with participants in type C design labs than with participants in the other labs. In type C design labs participants used the principle to find ways of collaboration that would be attractive for both parties. Interventions they designed resembled instructions such as “try to identify yourself with his perspective”, or: “ask questions, and start to examine. Connect these motives”. These instructions suggested either to convince someone else that something actually is mutual attractive, or they suggested to examine what the other person motivates. There were no specific interventions mentioned that could help to connect the various motives.

Design principle 6. Build on strengths

This design principle has been chosen in design labs of type A, B, C and D. Typically, participants designed two types of interventions, relating to the two aspects of this design principle: either to look for people's strengths and start working with these strengths, or to identify successes that were attained and to reflect on them.

Design principle 7. Create something together

Participants used this design principle in each of the four types of design labs to design interventions with. In none of the four types of labs this principle is extremely popular or unpopular. In type C design labs, in which people could not literally make something together -because of the setting of a role playing game-, the design principle was used metaphorically. In type D design labs the proposed interventions consisted of instructions for making a manual, making a test, and suggestions for how to work on these products.

Design principle 8. Entice to see new signals and to give them new meaning

This design principle was by far more popular with participants in type C design labs than it was with the other participants. Interventions consisted of instructions such as: "Try to have a different look at the situation" or "Ask him questions, because then new opportunities may arise to give new meaning to the situation".

Design principle 9. Connect the world inside the innovation practice to the world outside

Design principle 9 was never chosen in type B design labs and it was very popular in type A design labs. Almost all participants in type A design labs motivated their choice for this principle by saying that the process in the case they were working on -and they all worked on the same case-, was ready to start off with a new phase in which new people must be involved.

Design principle 10. Pay attention to the social and communicative process

This design principle was chosen very seldom as a design principle to work with. This is in line with the findings in the validation study (chapter 5) in which the principle was not popular either. Possibly, participants do not have much affinity with this principle or lack a clear image of associated interventions.

Design principle 11. Actively support the development of competences

Participants in type A design labs used this principle more often to work with than participants in labs of type B, C and D. For the participants in type A design labs this was actually one of the principles that was most favourite. Probably this is caused by the fact that the participants in type A design labs first were asked to make an analysis of the innovation practice. In this analysis they concluded that design principle 11 was not very active in the innovation practice. This caused them to choose the principle to design interventions with. This choice was probably more based on a rational argumentation than on their personal affinity with the principle.

Although the participants recognised new competences as important prerequisites for bringing about radical changes, the deliberate development of such competences is not regarded as a strategy to be implemented in innovation practices. It is plausible that respondents associate the development of competences with training or formal schooling. Such kind of activities is not easily put forward in the context of innovation practices. Furthermore, participants in innovation practices are primarily concerned with the particular innovation they are working on. Their focus is not their learning process and the development of competences.

7.4 Results with respect to the design principles as a set

This section presents the findings with respect to the last four sub questions:

- *What are the considerations of respondents when they choose one or more design principles to work with?*
- *How do they translate these design principles into interventions?*
- *Do respondents manage to implement the interventions in practice?*
- *To what extent do the interventions result in breakthroughs?*

Appendixes L, M, N and O show the results for the four types of design labs. This section gives an overview of the main findings per type of design lab and it shows the overall findings per research question.

7.4.1 Findings from type A design labs

When choosing principles to design an intervention in type A design labs two strategies were dominant. Participants either referred to design principles that they considered not yet active -and therefore potentially powerful- in the innovation practice they analysed, or they chose design principles that had already proven to be successful. Participants in the design labs of this type seemed to follow this strategy deliberately. A rational analysis of the innovation practice seemed to play an important role in the choice for a design principle to design interventions with. The set-up of the design labs probably contributed to this behaviour, as the participants were first asked to make an analysis of the innovation practice before choosing a design principle to work with. The other types of design labs did not explicitly encourage this behaviour. In these labs the choice for one or more design principles was often based on the participants' own preferences instead of on a rational analysis.

7.4.2 Findings from type B design labs

In type B design labs all participants succeeded in designing interventions with help of the design principles. However, the extent to which the participants succeeded in implementing the interventions in practice differed. In six of the cases participants put the intervention -in a slightly adapted version- in practice, and in four cases the participants didn't succeed in implementing the intervention. A closer look at the cases in which implementation didn't work out, results in two observations:

- These participants typically designed interventions that were quite different from their usual way of working. They did not always possess the skills needed to implement the intervention in their innovation practice.
- Often, the interventions they designed required a complete different setting than they were in. The context did not always support a careful implementation.

The participants who did implement their interventions seemed to follow a different strategy: they designed interventions they felt familiar with. At the same time their interventions were appropriate for the context they were in. They felt confident to implement the interventions in practice. And, contrary to the participants who didn't manage to put their intervention into practice, they were enthusiastic to participate in another design lab.

7.4.3 Findings from type C design labs

The analysis of the data collected in type C design labs resulted in two main findings. The first stems from the observations during the design labs, and the second from the interviews that were conducted to learn more about the lessons participants learned from the design lab.

Experimentation versus developing one's ability

Some groups were more pointed at deliberate experimentation with the design principles, with different interventions and with the setting, whereas other groups were more focused on their own ability to create breakthroughs. One group for instance that deliberately experimented did so by choosing a different principle and a different intervention for the same situation, or by choosing a different setting for the same intervention. They evaluated the effect of the specific principle or intervention in comparison to other principles or interventions. The group that focused on the development of their own ability paid more attention to the evaluation of the effect of their own behaviour and that of others. They were more focused on developing their own social and communicative skills. This difference seemed to be due partly to the focus of the facilitator, and partly to the orientation of the various groups.

Although the groups had a different focus, both groups generated valuable results. The group who deliberately engaged in experimentation was satisfied as soon as they observed the difference between two kinds of design principles, interventions or settings. The group that focused on the development of their ability to create breakthroughs was satisfied as soon as they'd experienced a *positive* difference between the 'before' and 'after' situation.

Seeing oneself as part of the system

In type C design labs participants had the opportunity to go through the steps of the design process several times by participating in a role playing game. After they attended a design lab, a telephone interview was used to investigate what they learned, and whether or not these lessons were valuable for them in their work practice. The interviews revealed that most participants learned something in the design lab. However, they did not link these lessons directly to one of the design principles. Most lessons that led to an actual change in their behaviour at work, refer to a specific ability: to focus on the other instead of to focus only on oneself or the project. Respondents report instances in their work practice in which they started to focus on someone else's interest, managed to connect different interests with one another, reflected on the other person's feelings, or asked someone else's opinion instead of being focused on defending one's own.

These findings can be linked to one of the different sources of attention from which social action can emerge as described by Scharmer (2007). Scharmer describes four different sources that each refer to a different kind of conversation:

- 'I-in-now', a source of attention that gives rise to a conversation in which downloading takes a central role. Polite routines and empty phrases prevail in this kind of conversation.
- 'I-in-you', a source of attention that gives rise to a conversation in which debate takes a central role. People tell each other what they think.
- 'I-in-it', a source of attention that gives rise to a conversation in which dialogue takes a central role. Instead of defending one's point of view, participants in this conversation start to inquire into viewpoints.
- 'I-in-me', a source of attention that gives rise to a conversation in which presencing takes a central role. This is a stage of collective creativity and flow. This source of attention is needed to bring forth something profoundly new.

The reports of the participants resemble the source of attention 'I-in-it'. They managed to move beyond a polite conversation and beyond a debate in which perspectives were exchanged. They started to gain new perspectives. In terms of Scharmer, they moved from seeing the system as something outside to seeing themselves as part of the system.

7.4.4 Findings from type D design labs

In type D design labs participants often applied more than one design principle to a case, and for every design principle they developed more than one intervention. This was all done in a restricted period of time. The time pressure and the sometimes unusual combinations of cases and design principles ('forced fits'), helped to 'stretch' the participants, and generated creativity. The result was a range of diverging interventions to create breakthroughs in the difficult situations.

7.4.5 The use of the set of design principles by participants in design labs of type A, B, C and D

What are the considerations of respondents when they choose one or more design principles to work with?

When choosing design principles to design an intervention that deliberately intends to create breakthroughs, participants in the design labs of type A followed a different strategy than the participants in the design labs of type B, C and D. The choice of participants in type A labs seemed to be primarily based on a rational analysis of the situation at hand. However, participants in the other labs seemed to decide for a specific design principle on a more intuitive or implicit basis. Three factors are likely to have contributed to this difference:

- Type A design labs explicitly encouraged the participants to make an analysis of the innovation practice first, before choosing specific design principles.
- In type A design labs researchers and students in the field of HRD and KM participated. These researchers and students had less practical experience with innovation practices than the participants in design labs of type B, C and D. It is possible that the students and researchers tend to base their choices on a rational analysis more than practitioners do.
- In type A design labs participants worked with a fictive case. The participants were not personally involved in the case this might also have contributed to a more rational rather than affective choice for design principles.

For participants in the labs of type B, C and D their personal affinity seems to plays an important role in their choice for design principles. The effects of both approaches are difficult to compare since the participants in type A labs did not implement the interventions they designed.

How do they translate these design principles into interventions?

In type C design labs the interventions consisted of an instruction that resembles the principle itself. For instance for design principle 3 (Work from individual motivation) the instruction that was given sounded like: “You have to work with their personal motives, you have to ask him questions”. In design labs of type A, B and D the interventions were more elaborate. Respondents participating in these labs designed ways of working that indicated a specific *type of activity* in a particular *context*. The design principles served as a source of inspiration to design this intervention. The design principle does not prescribe how the intervention should look like. For instance, this is shown by the diversity of interventions inspired by one design principle. Although the design principles do not describe specific ways of working, they do inspire the participants to look at the situation from a different perspective. This evokes the creativity that seems to be necessary in an insecure process in which people would typically trust on their previous experiences. In type D design labs this creativity was explicitly evoked by inviting participants to develop various interventions (each group developed one intervention) in a restricted period of time.

The group of participants in type B design labs that managed to implement their interventions in practice seemed to combine creativity with their previous experience. The interventions they designed consisted of ways of working they were experienced in.

Do the respondents manage to implement the interventions in practice?

The implementation of the developed interventions in practice was not part of design labs of type A and D. In type B labs participants aimed to implement the interventions in their own innovation practices and in type C labs participants gave the interventions, which took the form of instructions, directly to the other group who implemented them in the context of the situation that they simulated in the role playing game. In type C labs the fictive setting of a role-playing game required that participants could identify themselves with the characters to a certain extent in order to successfully implement the intervention. This was especially necessary since the kind of interventions that were developed required a certain authenticity that cannot easily be simulated.

Two factors seemed to influence a successful implementation in practice. The first factor plays a role in both type B and type C design labs. The second factor could only be observed in type B design labs.

First, the skills of the participants played an important role in a successful implementation. Instances in which the participants in type B design labs had designed interventions that required specific skills they didn't posses, implementation did not succeed. Type C design labs provided some space to experiment with different approaches. The participants could practice and immediately see the effect of their own behaviour and that of others. The reflection, which had an important place in the design labs of this type, seemed to contribute to this learning effect. When looking back upon the lessons participants learned in the design labs of type C, it turned out that many were able to better focus on the other (see Section 7.4.3). Apparently the skills that they learned by experimenting with the design principles were not so strong related to one of the principles or to working with the complete set. Rather, they learned to have a different kind of conversation, one that helped them to see new perspectives. This is an important prerequisite for innovation.

Second, a certain amount of courage is needed to do things in a different way. The interventions were developed with the intention of creating breakthroughs, and therefore were often unconventional. For instance a participant in one of the type B design labs who chose design principle 3 (Work from individual motivation) as a starting point for an intervention for the innovation practice he facilitated. The innovation practice consisted of a group of people who wanted to prevent the demolition of an old workshop that in the old days was used to repair railroad freight cars. For the next gathering this group invited entrepreneurs and officials from the municipality. The intervention consisted of a short interview with all the attendants about their dreams with respect to the old workshop and the area around. This is quite an unconventional intervention and it requires courage to start and interview the attendants instead of organizing a more conventional meeting in which everybody could possibly hide behind formal positions. However, the participant who implemented this intervention did not think of himself as courageous. His involvement and ambition with the innovation practice made it for him self-evident to implement the intervention.

A last observation concerns the role of the design labs themselves. From the group of participants that took part in type B labs there was one group -the same group as the one that succeeded in implementing the interventions in practice- that used the time in the design lab to prepare for the sessions in their innovation practice. Their motive for participating in the design lab was not a carefully implemented intervention, but the mental preparation they expected to gain from it.

To what extent do the interventions result in breakthroughs?

Participants in type B design labs who managed to implement their intervention in practice reported breakthroughs in their innovation practice. However, the extent to which the breakthroughs were an effect of the interventions that were done, was not always clear.

In the type C design labs three groups didn't succeed in creating a breakthrough. The other six groups managed to create at least one breakthrough. Whether a successfully implemented intervention led to a breakthrough was in this design lab partly determined by the extent to which the others were able to identify themselves with the role they played. Subject matter expertise is something one cannot pretend, just as a specific motivation that is felt. Because this cannot be simulated, sometimes a potentially successful intervention did not lead to the desired effect since the other participants could not authentically bring in for instance their personal motivation.

The breakthroughs that were reported in the design labs of type B and C were not self-evidently linked to the design principles the interventions were inspired on. Often, the breakthroughs could be linked to more than one principle, and frequently, these principles differed from the ones that were used when designing the intervention. The participants in the type B labs were not bothered by this. For them this was no reason to conclude that the intervention missed its goal. On the contrary, in the telephone interviews they reported about the breakthroughs and analysed the new situation again with the design principles. The design principles then served as descriptive principles to better understand the breakthrough they reported.

7.5 Factors influencing the design process

The analysis of the results of design labs of type A, B, C and D provided the answers to the sub questions that guided this design study. This section focuses on answering the main question:

> *To what extent can the design principles be deliberately applied to design a work environment that promotes innovation?*

The findings indicate that the design principles do not work as heuristic rules that prescribe the interventions that are needed to generate breakthroughs in predefined situations. The linearity of the representation of the design process (as depicted in Figure 7.1) is not consistent with our findings in the four types of design labs. Overlooking all findings of the design study six factors could be identified that influence the design process. Figure 7.2 shows the design process and the factors that were identified. At the start of the design process, when choosing a design principle, a combination of rational analysis and personal affinity seems to influence the process. Then, when designing interventions, not the principle itself indicates the intervention, but rather the use of both previous experience and creativity will help participants to design an adequate intervention. Furthermore, the results of the design labs indicate that an effective implementation of the intervention depends on the extent to which the intervention matches one's ability and the extent to which the designer has an ambition to realise something special with an innovation practice and a particular context. The ambition provides the courage to experiment with unusual interventions. The next sections elaborate on a revised design model.

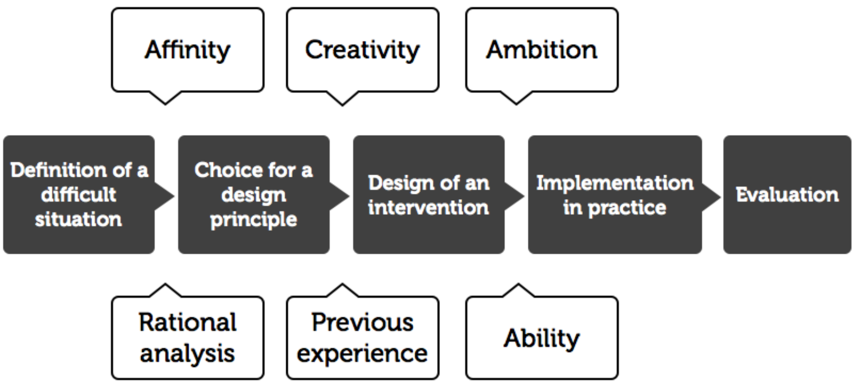


Figure 7.2.

Model of the design process and factors influencing that process.

7.5.1 Rational analysis and affinity

Thinking and feeling might sometimes seem two opposites. However, cognition and affect are in fact intertwined with each other (Zeelenberg & Aarts, 2001). Heppner and Krauskopf (1987) characterise real-life problem solving, a process that could be compared to the effort to create breakthroughs for difficult situations, as a sequence of goal directed operations that are both cognitive and affective.

In the design labs the combination of cognition and affect plays a role at the beginning of the design process. In type A design labs participants chose design principles based on a rational analysis of the innovation practice, and in design labs of type B, C and D the personal preferences of the participants mainly determined their choice. A combination of a rational analysis of the situation at hand with one's personal affinity seems to form a good basis for the design process.

7.5.2 Previous experience and creativity

In the design of interventions both the previous experience of the participants and their creativity play a role. A balanced combination of the two seems to be the most effective.

From a learning perspective it is effective to use previous experiences for the design of interventions. People have vast arrays of experiences that can be used for learning (Merriam, 1999). Research by Dochy (1992) has shown that prior knowledge is recognised as a determinant for future learning. Duncker (in: Benjafield, 1997) was especially interested in the use of previous experience in problem solving. The easiest way to deal with problems is to rely on past experiences and to ask: what did I do in similar situations in the past? The results of the design labs of type B stressed the importance of previous experience as well. Participants who managed to implement their interventions all developed interventions that required previous experience.

However, an intervention cannot solely be based on previous experiences. Previous experience might form the basis, but an adaptation for the situation at hand is required. This is especially true for innovation processes because doing what one always did will not likely lead to the desired breakthrough. New elements must be brought in, and therefore the use of previous experience needs to be combined with creativity.

Creativity is not regarded as an isolated process of generating ideas, thinking out of the box or thinking in original ways. Mumford and Gustafson (1988) stress that creativity does not only consist of the ability to behave in novel ways and to generate ideas. This kind of behaviour would not qualify as creative unless it provides some solution to a significant problem. This view is similar to that of Scardamalia and Bereiter (2003a) who state that creativity is more than a light bulb flashing in the thinker's mind. Techniques like brainstorming may help to generate many ideas in a short period of time, but that is not what it is about in the knowledge economy. According to Scardamalia and Bereiter the real challenge is sustained creativity: working with ideas and developing them into powerful and useful processes, products or theories. Coming up with the initial idea represents one small step, but creative knowledge workers are able to make something out of this first idea. These views plea for what we would call a form of 'grounded creativity', creativity that is closely linked to the problem solving process. A connection with previous experience could help to 'ground' this creativity.

In this design study creativity was stimulated in several ways:

- In labs of type A, B, C and D the design principles offered the participants new perspectives that allowed for creativity.
- In type D design labs the participants worked within a limited time frame to come up with interventions. This time pressure stimulated creativity.
- In type D design labs the participants designed interventions with a design principle that was chosen by another group. This 'forced fit' between design principle and problematic situation generated creativity as well.

7.5.3 Ability and ambition

From the design labs of type B it transpired that the implementation of the intervention not only depended on the well developed intervention but also on the skilful facilitator who could implement the intervention. The design labs of type C were then designed to offer a learning environment to develop the required abilities.

However, innovation processes do often not resemble what is known, and it is not possible to be fully prepared to what will happen by practising in a safe learning environment. At the same time the interventions are often unconventional. The ambition that someone has with the innovation practice seems to help to put an intended intervention into practice. Ambition in this case is seen as a desire that reaches above the current situation (Pettigrove, 2007).

7.5.4 A systematic and a personal approach

This section takes a closer look at the combination of the factors rational analysis, previous experience and ability, and the combination of the factors affinity, creativity and ambition. These two groups of factors may be linked to different aspects of the design process. The factors rational analysis, previous experience, and ability emphasise a systematic approach to innovation whereas the factors affinity, creativity, and ambition emphasise a more personal approach. This section examines the importance of the combination of a systematic approach and a personal approach for innovation.

Combining a systematic and a personal approach in favour of innovation

The image of innovations that come up unexpectedly, coincidentally and without too much trouble is persistent. Indeed many inventions were developed coincidentally (Alexander Fleming who coincidentally found penicillin) or after the failure of something else (Art Fry invented the post-it note using an adhesive developed by his colleague of which the adhesive was originally meant to be very strong, but instead, the glue released rather easy). And a systematic approach may at first sight seem contradictory with the free and unbridled way of working that many inventions breathe. However, Arthur (2007) points out that although the most surprising insights may come to you while taking a bath or having a shower, the thorough and systematic work that has been done before, is essential for the success. The factors rational analysis, building on previous experiences and ability, are ways to fill in the systematic side of innovation.

Although a systematic approach is important for innovation, it cannot form the starting point. Scharmer (2007, p. 422) stated that "the biggest mistake when dealing with innovation is to put the cart before the horse by first focusing on the rational mind. (...) Connecting to one's best future possibility and creating powerful breakthrough ideas requires learning to access the intelligence of the heart and the hand, not only the intelligence of the head." The design model diverts the attention not only to this systematic way of thinking that is led by the head, but also to a more personal one in which the heart (affinity and ambition) and the hands (creativity) take a central place.

This is in line with research done by Kessels (1993) in the field of curriculum design. Kessels' research showed that although the systematic approach is required to design a structured and logical curriculum, it does not guarantee success (Kessels, 1999). Although the context of the research conducted by Kessels is not design of innovation but design of curricula, the findings have a parallel with the findings in the present research. The research conducted by Kessels (1993) shows that in order to reach curriculum consistency a combination of a systematic and a relational approach must be taken into account. The systematic approach leads to a structured and logical design, and the relational approach includes activities that invite actors to get involved in the design process and implementation. The design of breakthroughs in innovation practices can, just as the design of curricula, not only be done using rational logic. There is needed something else as well. From the research in the context of curriculum design it appears that various stakeholders must be involved in early stages of the process. The present research points to a similar importance of personal involvement in the innovation practice.

7.6 Conclusions

This chapter presented the results of a design study that did inquiry into the prescriptive value of the design principles that were developed in the parallel study (chapter 5). The sections above focused on answering six sub questions. This section aims to answer the central research question:

> *To what extent can the design principles be deliberately applied to design a work environment that promotes innovation?*

The findings in the four types of design labs reveal that the prescriptive value of the design principles is limited. The design process is not as systematic as simply moving from a difficult situation to the design of an intervention with the help of the design principles, to the implementation of this intervention in practice. Six factors were identified that influence the phases of this design process: rational analysis, personal affinity, previous experience, creativity, ability and ambition.

The choice for a design principle is not determined by the difficult situation one encounters. Although a rational analysis of the situation helps to pick a design principle, personal affinity plays a role as well. Then, with respect to the design of an intervention, it transpired that the design principles do not prescribe the kind of interventions that must be done in order to generate breakthroughs. Rather a combination of previous experiences and creativity facilitates the process of designing a suitable intervention based on the chosen design principle. Moreover, the design of an intervention based on one or more design principles does not guarantee a skilful implementation of the intervention in practice. Whether participants succeeded in implementing the intervention in practice, depended on the extent to which they possessed the required abilities. Furthermore, their ambition with respect to the innovation practice seemed to play a role as well. The ambition could provide for the courage to experiment with new and unconventional ways of working.

The factors that turned out to influence the design process could be divided in factors that relate to a personal approach (affinity, creativity and ambition) and factors that relate to a systematic approach (rational analysis, previous experience and ability). It seems that a combination of a systematic and a personal approach is most fruitful for innovation practices.

The study at hand did not systematically compare instances in which participants chose one of the design principles found in the present research to design an intervention, with instances in which participants chose other design principles. This raises questions as to whether it is necessary to use the design principles in this study, and what the added value of these principles is above other principles in the process of design. The data leads to two possible answers.

First, the function of the design principles could be the different perspectives that they offer. The principles propose different angles to look at the innovation practice and the difficult situation at hand. Especially in design labs of type A, B and D this seemed to help participants to generate new ideas for interventions in the innovation practice.

Second, the findings from design lab B indicate that going through a design process in itself contributes to the successful design of interventions and the generation of breakthroughs in practice. Instances in which participants in type B design labs succeeded in generating breakthroughs in their innovation practice, the design process itself seemed to account for a large part of the success. Going deliberately through a design process seemed to help participants to think through what they wanted to realise in their innovation practice. For most participants such an elaborate mental preparation for a meeting in their innovation practice was not self-evident. It might be possible that not only the interventions, based on the design principles, accounted for the breakthroughs that were realised, but that also the mental preparation the facilitators had, played a role. This preparation might have helped the participants to think through their ambition with their innovation practice. When implementing the intervention in practice, they were able to deviate from the interventions they designed, and to adjust their actions to what was needed in the situation at hand. In this case not the skilful implementation of an intervention but the ability to adjust it to the specific events in practice, accounted for the success. These adjustments could be made thoughtfully because of the mental preparation they went through in the design lab. Then, the principles have the function of an 'advance organizer', and at the same time they are conducive to reflection on new situations that occur. Instead of prescriptive instructions the principles offer the designer a supporting framework to balance between the personal and systematic approaches required to achieve breakthroughs in complex processes.

8

Conclusion and discussion

The aim of this research project was to learn more about learning undertaken with the intention of innovating. The second chapter of this thesis explored the relationship between learning and working in a knowledge economy. From this elaboration it became clear that in a knowledge economy work processes take on the characteristics of learning processes that are focused on the development of gradual improvements and radical innovations. The concept of knowledge productivity was used to refer to these learning processes undertaken with the intention of innovating. The first main research question aimed to find out what factors matter in the learning processes leading to gradual improvements and radical innovations. Chapters 3, 4, 5 and 6 elaborated on the studies that were done in order to resolve this question. The second main research question built on this by focusing on the application of these factors in order to design a work environment that promotes breakthroughs that are necessary for the development of gradual improvements and radical innovations. Chapter 7 described the study that was done in order to answer this second question. The present chapter gives the answers to the main research questions and proposes an adjusted conceptual framework for further research on knowledge productivity. Furthermore, this chapter offers a critical reflection on four of the main concepts used throughout the research, on methodological issues that are relevant for determining the quality of this research and on the extent to which findings may be generalised to other contexts. Finally, this chapter discusses the relevance of the research findings.

8.1 Conclusions

This section answers the two main research questions, and offers an overall conclusion by proposing an adjusted conceptual framework.

First Research Question

Research question 1: What factors enhance the learning processes that lead to gradual improvements and radical innovations?

The parallel study (chapter 5) in 10 ongoing innovation practices tracked down breakthroughs. These breakthroughs were expected to represent the 'critical learning moments' of these innovation practices. The analysis of these breakthroughs led to 11 recurring themes. These themes were compared with literature in order to better understand and interpret them. Literature in the fields of innovation and learning, and more specifically the problem-solving field of learning was used for this purpose. This resulted in a description of the themes in the form of design principles for knowledge productivity. This section presents the 11 principles that express the effective aspects underlying the breakthrough moments in the innovation practices. These design principles represent the factors that were found to underlie the learning processes leading to gradual improvements and radical innovations. The design principles tended to be present in various combinations in the breakthroughs that were observed or reported by the participants.

1. Formulate an urgent and intriguing question

Developing an urgent and intriguing question is necessary for innovation. Such a question is not a given, it needs active development in interaction with key players and stakeholders. Urgency refers not only to a rational urge but also to the personal feeling that there is an urge. This means that the question must be formulated in such a way that the people who work on it have the feeling that the question cannot remain unanswered. An intriguing question refers to a question that entices people to develop new perspectives. A question can become intriguing when an unusual combination of concepts is made.

2. Create a new approach

In order to find new solutions ('thinking new'), a new way of working ('acting new') is necessary. Such a new approach can be realised by breaking with hindering structures (e.g. instead of talking about the problem in a formal meeting, making an excursion and showing each other what bothers you), and by designing an overall approach. The overall approach is characterised by a developmental approach: step-by-step designing of a process that deviates from existing routines.

3. Work from individual motivation

Individual motivation is a powerful engine for creativity and innovation. When people have the opportunity to work on things they find important, their creativity is stimulated. Therefore, it is important, in innovation practices, to explore and use the personal incentives of all participants and to allow them to formulate a personal goal. The personal incentives can be of an intrinsic nature (e.g. a passion for a specific theme) but they may also be of an extrinsic nature (e.g. recognition).

4. Make unusual combinations of subject matter expertise

A surprising or not obvious admixture of different kinds of knowledge can help to establish new connections between elements that were not linked before. These new connections are necessary for innovation. A fruitful way to establish new connections is by choosing new or uncommon perspectives or metaphors to look at the question at hand, or by inviting experts who have new or uncommon perspectives. In the breakthroughs that were found, the social component (e.g. inviting experts) played a more prominent role than the content component (e.g. searching for metaphors).

5. Work from mutual attractiveness

Typical for innovation is that different and often opposite interests are at stake. In order to develop an innovative solution it is necessary to combine these opposite interests. In an innovation practice the personal interests must be central, and not a general goal or an abstract organizational goal. When everybody holds on to their own interests, and when people actively seek for ways to collaborate on a basis of reciprocity, breakthroughs are likely to occur.

6. Build on strengths

People's talents, successes achieved by the group, and the qualities of a context provide a valuable starting point for the innovation practices. Paying attention to the strengths of individuals, the group, and the context offers an attractive starting point for reflection and for the design of follow-up steps. Furthermore it is likely to contribute to the self-efficacy of participants, which may enhance their performance.

7. Create something together

In innovation practices participants often spend quite a lot of time exchanging their points of view and discussing them. However, polite conversations or agitated discussions alone do not lead to innovation. For innovation it is necessary to examine each other's perspectives and to find out the points on which the various perspectives differ. Creating something together supports this process. Examples of products include a workshop, a photo-exhibition, a scale model or a poster.

8. Entice to see new signals and to give them new meaning

People interpret the world around them all the time. For innovation it is necessary to reconsider existing interpretations and to develop new ones. In order to do so, people must become sensitive to new information and clues. Furthermore, playing with the interpretation of this information and these clues is necessary in order to assign new meaning to them. The use of new words and metaphors facilitates this process of playing.

9. Connect the world inside the innovation practice to the world outside

Participants in innovation practices must establish a connection with the organizations, groups or individuals for whom the innovation they are working on could mean a substantial benefit. Indeed this supports the implementation of the proposed innovation. Such a connection can be established by involving influential people (e.g. experts) or important stakeholders (e.g. inhabitants or users) in the innovation practice.

10. Pay attention to the social and communicative process

Innovation is a social process. Social and communicative skills are the vehicle for this process. Therefore, it is important that participants in innovation practices pay attention to the quality of the interactions.

11. Actively support the development of competences

The learning processes undertaken with the intention of innovating are primarily focused on the improvements and innovations that the people involved aim to bring about. However, participants in innovation practices must pay explicit attention to the learning processes as well. They could do this by defining the competences that they need to develop and by developing approaches that stimulate learning in that direction. They should regularly reflect on these learning processes since that could enhance learning.

Validation of the design principles

The analysis of the findings in the parallel study, and the literature review (chapter 5) revealed these 11 themes as factors that could enhance the learning processes leading to gradual improvements and radical innovations. Facilitators and members of innovation practices have validated these themes formulated as design principles, and a group of experts was invited to execute a formative evaluation of the design principles as 'critical friends'. Finally, the principles were used by a group of practitioners who participated in design labs which helped them design work environments supporting the learning processes undertaken with the intention of innovating. These various research activities revealed that practitioners have a different perspective on the design principles than academic experts, and that people who use the design principles to reflect on their innovation practice have a different perspective on the principles than the ones who use them to design interventions.

These different perspectives became particularly clear with respect to design principles 3 (Work from individual motivation), 4 (Make unusual combinations of subject matter expertise), 5 (Work from mutual attractiveness), 8 (Entice to see new signals and to give them new meaning), 10 (Pay attention to the social and communicative process) and 11 (Actively support the development of competences).

The different perspectives on these design principles are discussed below, as are the implications for these principles. The perspectives of practitioners and experts on design principles 1 (Formulate an urgent and intriguing question), 2 (Create a new approach), 6 (Build on strengths), 7 (Create something together) and 9 (Connect the world inside the innovation practice to the world outside) were found consistent enough to justify them as separate factors.

Different perspectives on design principle 3

Design principle 3 (Work from individual motivation) is very popular with practitioners. The participants in the design labs frequently used it to design interventions, and people who reflected on their innovation practice ascribed clear effects to this principle in retrospect. The experts were critical about the connection between the individual motivation and the total innovation practice. They thought that the personal stakes and the innovation that was aimed for were far apart. They wondered how the two could be more connected. In contrast, all respondents in the validation study who participated in the in-depth interviews said that paying attention to the individual motivation of participants in the innovation practice was likely to lead to breakthroughs in the innovation practice. They gave varying examples of instances in which this was the case. Because of the particular importance practitioners attached to this principle, the decision was taken not to adjust it.

Different perspectives on design principle 4

The effect that practitioners see as resulting from design principle 4 (Make unusual combinations of subject matter expertise) differs from the effect mentioned by experts. Practitioners believe that new combinations of subject matter expertise lead to a better recognition and use of the available subject matter expertise, whereas experts say that these new combinations lead to creativity. In this case the practitioners seem to emphasise the social component of the principle, whereas experts stress its content component. Both components are part of the design principle and these findings confirm the importance of both.

Different perspectives on design principle 5

Design principle 5 (Work from mutual attractiveness) is seen by practitioners who look at the principle in retrospect as a design principle that is either present or not. They do not regard it as a principle that can be developed. However, practitioners who participated in the design labs saw mutual attractiveness as something that could indeed be developed. They frequently chose the design principle to design interventions. Apparently, the principle fulfils a function in both the process of reflection (when using the principles to give meaning to an innovation practice) and the process of design (when developing interventions for an innovation practice). It appears as though the design principle is not in and of itself 'active' or 'passive', but that other factors largely determine these characteristics. These other factors could be the situation (in a reflective action participants use the principle differently than in a design process) or the mindset of the people involved. The mindset factor is an interesting one. When participants in innovation practices believe the principle to be passive, they actually have more limited possibilities for action than when they consider it to be active. Seeing the principle as active offers participants in innovation practices more possibilities to influence the process.

Different perspectives on design principle 8

The experts find design principle 8 (Entice to see new signals and to give them new meaning) very conceptual. To them the principle represents a complicated cognitive process. This could imply that it would be difficult in practice to design interventions that support this design principle. However, the design labs showed that practitioners found it easy to think of suitable interventions to support this process. Therefore, the decision was taken not to adjust this principle.

Different perspectives on design principle 10

The experts confirmed the importance of the social and communicative process in innovation, as depicted in design principle 10 (Pay attention to the social and communicative process). However, the experts thought that the principle was not specific enough. Practitioners found it difficult to interpret this design principle unambiguously, and they seldom chose it as a principle with which to design interventions. The different reactions create the necessity to adjust this principle. A more precise formulation of this principle could focus on the conversations required for innovation, indeed, the kind of conversation that fosters the creation of new knowledge. From the literature review it became clear that conversations between participants are an important variable in innovation processes (Scharmer, 2007; Steyaert et al., 1996; Von Krogh et al., 2000). However, it takes an effort to build a context in which exciting conversations can occur, so people can learn something new about themselves or others, and find creative and novel solutions for problems (Gratton & Ghoshal, 2002). A reformulation of the design principle could be: Foster knowledge-creating conversations.

Different perspectives on design principle 11

Practitioners do not have much affinity with design principle 11 (Actively support the development of competences). They hardly recognise it in their own innovation practice. However, experts confirm that the principle does offer an important perspective when looking at innovation processes as learning processes. This design principle seems to be a meta-principle that underpins the learning nature of an innovation process. It could well be that this principle is especially interesting for researchers or experts who look at innovation from a learning perspective. Practitioners in innovation practices are primarily concerned with the specific innovation project they are working on. The conclusion with respect to this design principle, based on the evaluation by practitioners and experts, is that the principle is not recognised clearly enough to justify its existence as a separate principle.

A possible reformulation of this principle could place more emphasis on the role of reflection. This was namely an aspect stressed by the experts during the expert meetings. However, this would not self-evidently solve the problem of the different perspectives. Various scholars regard reflection as a significant aspect of learning (e.g. Kolb, 1984), an important activity for professionals who learn in the context of work (e.g. Schön, 1983), and an essential part of learning in innovation processes (e.g. Van Lakerveld, 2005). However, participants in practice tend to find it difficult to organize reflection. In the parallel study (chapter 5) participants in the innovation practices didn't know how they could give shape to reflective activities, and in the meta-analysis of the reconstruction studies (chapter 4) participants couldn't find time for reflection. Van Lakerveld (2005) describes something similar with respect to the empirical study he carried out. Reflection turned out to be important, but participants reported they couldn't find time for it. Kedde (2009) examined 20 innovation projects and this study revealed that reflection was not explicitly carried out by the participants in the innovation projects. This brings up an interesting contradiction between what is theoretically found to be important, and what is actually practiced in innovation practices with respect to reflection. A further exploration of this topic would be worthwhile.

The learning perspective versus the innovation perspective

The literature review (chapter 5) and the expert meetings (chapter 6) combined different perspectives on the findings in practice. The literature review combined the perspectives of learning and innovation. The expert consultation combined the perspectives of learning, innovation, urban planning, sustainability and transition management. The literature from various fields contributed to one another, as did the experts with their different areas of expertise. However, there was one point on which insights in the field of innovation seemed at first glance to differ from those in the field of learning, namely design principle 6 (Build on strengths). This was put forward in one of the expert meetings.

Building on strengths is a logical principle from a learning perspective. Using previous experiences (Merriam, 1999), choosing a way of working that matches your own talents instead of one that concentrates on what you find difficult and are not good at (Seligman, 2005), and the reflection on achieved successes (Swan & Bailey, 2004) are logical clues from a learning perspective.

The innovation process concentrates on the development of new products, services and operating procedures. Letting go of the old, and letting in the new, is a key element in this process. This might at first seem opposite to the learning perspective: innovation will not occur when people keep on doing (or hold on to) what they successfully did before. New solutions will only appear when people are prepared to leave the beaten track, experiment, make mistakes and be open to unexpected discoveries.

However, a further examination of these two perspectives leads to the conclusion that they can in fact strengthen each other. The use of previous experiences, abilities and previously achieved successes could contribute to the self-esteem of learners. This seems especially important in an insecure process such as innovation. Mumford and Gustafson (1988, p. 38) express this as follows: "organizational and educational systems that support autonomy or build self-esteem might increase the likelihood of innovative achievement". Furthermore, although previously developed solutions or approaches often cannot be directly used in new innovation processes, the abilities that were developed can be regarded as a more sustainable yield of innovation that can be applied in new innovation processes.

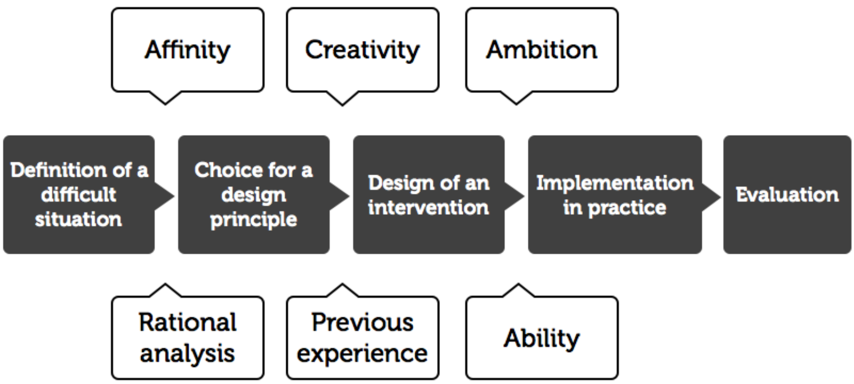
Second Research Question

> *Research question 2: To what extent can the factors identified be deliberately applied to design a work environment that promotes innovation?*

In four different types of design labs practitioners were engaged in design activities in which they used the set of design principles to create breakthroughs in innovation practices. This study revealed that the prescriptive quality of the design principles is limited. The design process is not as systematic as simply moving from a difficult situation to the design of an intervention with the help of the design principles, to the implementation of this intervention in practice. Six factors were identified that influence the phases of this design process: rational analysis, affinity, previous experience, creativity, ability and ambition. Figure 8.1 visualises the design process and shows the influencing factors.

Figure 8.1.

Model of the design process and factors influencing that process.



Six factors influencing the design process

The design study showed that the choice of a design principle is not determined by the nature of the encountered situation. Although a rational analysis of the situation helps to pick a design principle, personal affinity plays a role as well. In this phase a combination of cognition and affect (Zeelenberg & Aarts, 2001) seems to be important. In one type of design lab the rational analysis of the innovation practice was successfully stimulated by the use of circular scales (see in chapter 7 Tables 7.2 and 7.3).

The design study revealed that the design principles do not prescribe the kind of interventions that must be done in order to generate breakthroughs. Rather, a combination of people's previous experiences and their creativity facilitates the process of designing a suitable intervention. From a learning perspective the role of previous experiences (Merriam, 1999) and prior knowledge (Dochy, 1992) is self-evident. However, when new interventions for the innovation practice are solely based on previous experiences, breakthroughs are not likely to occur. Creativity and innovation are closely related (e.g. McLean, 2005). In designing interventions, participants in innovation practices must combine their previous experiences with creativity. The set of design principles seemed to help participants in the design labs to be creative. The various perspectives these principles offer help people look in a different way at the innovation practice. In this case, creativity is not meant as an isolated process of generating ideas or thinking outside the box. Scardamalia and Bereiter (2003a) point out that the real challenge in the knowledge economy is not only to develop ideas but also to develop these further into powerful and useful processes, products or theories. The use of previous experiences could help attain this form of 'grounded creativity'. With respect to the use of previous experiences, a dilemma brought up by Simons (1999, p. 580) is worth mentioning. He states that, from the perspective of the learner, one problem is knowing when to use prior knowledge actively, and when to protect oneself from its influences. Indeed, as Schuell (1988) emphasised, prior knowledge could also consist of misconceptions.

From the design labs it transpired that the design of an intervention, based on one or more of the design principles, does not guarantee a skilful implementation of the intervention in practice. Whether participants succeeded in implementing the intervention in practice depended on the extent to which they possessed the abilities required for this. However, the abilities required for a successful implementation cannot all be developed in advance. The situation in practice, especially in innovation practices, cannot be fully predicted. Apparently, people's ambition with respect to the innovation practice also influences the successful implementation of the intervention. This ambition seemed to positively influence the courage of participants to try new and unconventional interventions.

A combination of a systematic and a personal approach to innovation

Chapter 7 explored these six factors further. It became clear that the factors relate to different aspects of the innovation process (see Section 7.5.4). The factors rational analysis, previous experience, and ability emphasise a systematic approach to innovation, whereas the factors affinity, creativity, and ambition emphasise a more personal approach. For innovation a combination of a systematic and a personal approach seems to be most fruitful. When participants in innovation practices mainly pay attention to the systematic aspects, they run the risk of choosing a design principle that might rationally be the best choice, but without being appealing. In that case it will be difficult to develop an adequate intervention. Another pitfall is that an intervention completely based on their previous experience would add nothing new to the innovation practice. A third pitfall is that the intervention might never be brought in practice because participants keep on waiting until they possess the abilities required to do so.

When participants in innovation practices pay attention mainly to the personal aspects, they might develop a very unconventional and original intervention based on principles that appeal to them. However, they run the risk of it being neither grounded in reality, nor connected to their own experience and abilities. The chance that such an intervention will cause breakthroughs in the innovation practice is limited.

Function of the design principles

Based on the findings in the design study it is not possible to make statements about the effect of the design principles in practice. However, two conclusions on their function can indeed be drawn.

First, one function fulfilled by the design principles in the course of a design process is the different angles they offer for reflecting on an innovation process. One of the participants who joined a design lab was good-humoured after having found several interventions she could do in order to create a breakthrough in the difficult situation she had encountered. When asked what she had learned from the design lab she responded self-assuredly that she was confident she would never again get stuck in her innovation practice for long. She said that the design principles would help her gain a new perspective over and over again and would also offer new starting points for designing interventions. The link she lays illustrates an important function of the design principles. They propose both different perspectives and starting points for action. Therefore, they contribute to a broader view of the innovation practice, and could contribute to the development of new interventions leading to possible breakthroughs.

Second, the use of the design principles can hardly be seen separately from the design process in which they are used. It seems as if deliberate participation in a design process helps designers think through what they want to realise in their innovation practice. Such mental preparation was not self-evident for most participants in the design labs. It helped them deviate from the interventions they had designed and adjust their actions to the situation in practice. It possibly contributed to their self-confidence as well. In the design process the principles have the function of an 'advance organizer', and at the same time they are conducive to reflection on new situations that occur. Instead of prescriptive instructions the principles offer the designer a supporting framework to balance between the rational and systematic approaches required to achieve breakthroughs in complex processes.

8.1.1 An adjusted conceptual framework for knowledge productivity

The research started off with a conceptual framework in which the seven learning functions of the corporate curriculum and three development principles (Kessels, 1996a; 2001b) had an important place. This framework was the starting point for the meta-analysis of the reconstruction studies (chapter 4). The parallel study and literature review (chapter 5) resulted in 11 design principles. These consisted in part of a new arrangement of the seven learning functions and three development principles, and in part of new factors. Participants and facilitators in innovation practices validated the principles (chapter 5), experts reviewed these principles (chapter 6), and practitioners in design labs experimented with them in order to learn more about their prescriptive value (chapter 7). The design study revealed that the prescriptive value of the design principles is limited, and that other factors seem to influence the process of design. These different findings call for an overall conclusion. Looking at the complete study, innovation practices seem to lead to gradual improvements and radical innovations if attention is paid to the personal involvement of the participants, their collaboration and the process of construction of new meaning. Furthermore, participants can pay attention to the design of this learning environment in order to create breakthroughs. Figure 8.2 shows these aspects in an adjusted conceptual framework. The following sections examine the different aspects of the learning environment as depicted in this framework. An overview of the influencing factors is provided for each aspect. This overview is based on the integration of the elements of the original conceptual framework and the findings in the different studies that were part of the research project.

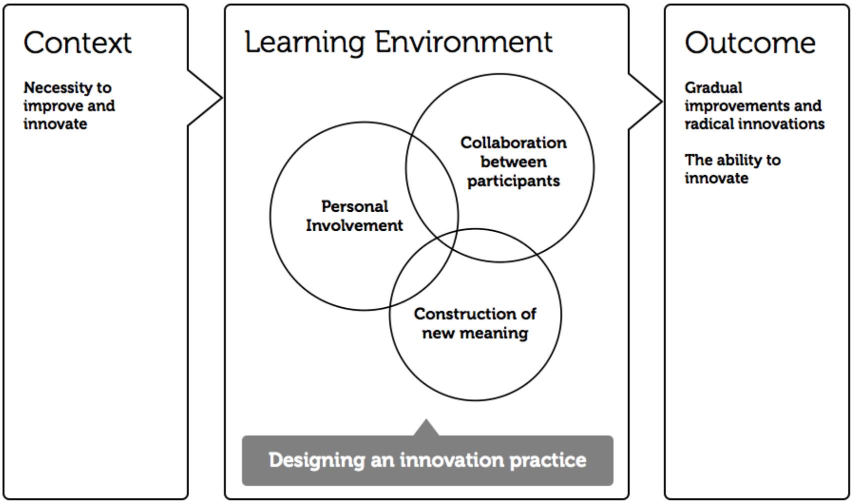


Figure 8.2.

Revised conceptual framework to study learning in innovation practices.

Personal involvement

The personal involvement of participants in an innovation practice is essential. Kessels (2001b) insisted that people cannot be smart against their will: “Discipline, loyalty and obedience may be welcome and valuable support systems for overcoming a hurdle or an impasse. Without any substantive drive, however, they will merely foster stupidity and lead to mediocrity at best” (p. 16). Therefore, Kessels suggests the search for a passion as one of the development principles for the curriculum of a knowledge-intensive organization.

The meta-analysis of the reconstruction studies in the present research recognised the role of personal involvement. The intrinsic motivation of participants in the innovation practices that were studied led to curiosity and the determination to succeed. The meta-analysis showed that the motivation of the individuals involved arose not only from the individual’s positive reaction to qualities of the task itself (intrinsic motivation), but also from sources outside the task itself (extrinsic motivation), such as recognition. The parallel study (chapter 5) showed this as well. In literature, evidence was found that some types of extrinsic motivation may indeed enhance creativity (Amabile, 1996). These ‘synergistic extrinsic motivators’ comprise reward, recognition, and feedback that confirm competence, as well as feedback that provides important information on how to improve competence. Design principle 3 (Work from individual motivation) was based on this broader interpretation of the motivation that is necessary for innovation.

The parallel study (chapter 5) showed that the different motivations of the people involved can even be opposite. There is no need to summarise these different interests in one common goal. Indeed, conflicting interests often form the core of an innovation practice. Design principle 1 (Formulate an urgent and intriguing question) expresses this. The combination of different and even opposite stakes often contributes to the definition of a question that is intriguing to the people involved.

In order to be able to use the intrinsic motivation of the participants in the innovation practice, it is important to fulfil the fifth learning function of the corporate curriculum (Kessels, 1996a): self-regulation of motivation, affection, affinity and emotions. Self-initiated motivational, behavioural and meta-cognitive processes enable participants to become controllers rather than victims of their learning experiences (Zimmerman, 1998). The meta-analysis of the reconstruction studies showed that participants did not pay explicit attention to the regulation of their affinities and motivation. However, in the parallel study it transpired that explicit attention for the motivation of the individuals involved often caused breakthroughs. Conversations in which the participants' affinity and ambition with the project were explicitly discussed, created energy and breakthroughs in the process. Taking individual motivation as an explicit topic of conversation, and letting go of the idea that participants in innovation practices are only representatives of their organization or group, made these breakthroughs possible. Figure 8.3 visualises the part of the conceptual framework referring to personal involvement.

Figure 8.3.

Personal involvement.

Collaboration between participants

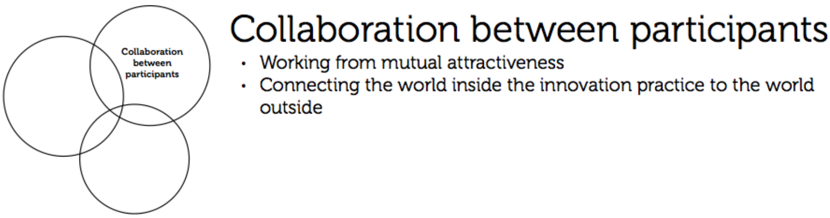
In innovation efforts, groups have more to offer than individuals in terms of the fluency of idea generation and the flexibility of developed solutions (Tidd et al., 2005). Tidd et al. also found that successful teams for innovation rarely happen by accident. Tranfield, Parry, Wilson, Smith and Foster (1998) emphasise the importance of building the appropriate team for the task at hand. They distinguish between three archetypes of teams. The archetype of self-directed team work is most adequate for generating creativity and innovation. This is also the form of collaboration that was most seen in the innovation practices studied in this research. These teams were not characterised by formal leadership, but aimed to create a culture of commitment and ownership.

One of the mechanisms that turned out to be an important principle for shaping this collaboration is mutual attractiveness. This principle was described by Kessels (1996a) as one of the development principles for the curriculum of a knowledge-intensive organization, and it was proposed as one of the design principles after the parallel study (Design principle 5: Work from mutual attractiveness). Based on the findings in the parallel study and on the review of the literature, chapter 5 argued that individual goals were the best starting point for innovation. Furthermore it was argued that a strategy characterised by concession making or contending is not the best way to deal with these different goals. Rather, it is the search for a win-win situation which characterises collaboration in innovation (Carnevale & Pruitt, 1992).

Besides the collaboration within a team working on innovation, there is also the collaboration with others outside the innovation practice: "Innovation is not the isolated enterprise of a single entrepreneur. It is a collective enterprise that centres on a network of relationships that bind together people and their organization in order to transform an abstract concept into reality" (Smith Ring & Van de Ven, 2000, p.171). The importance of the collaboration with the world 'outside' the innovation practice is formulated in design principle 9 (Connect the world inside the innovation practice to the world outside). The experts in the expert meetings (chapter 6) highlighted that this collaboration should be based on reciprocity as well. The outside world does not consist of passive receivers, and the innovation practice is not solely a bringer of innovation. Figure 8.4 shows the factors that matter in relation to the collaboration between participants.

Figure 8.4.

Collaboration between participants.



The construction of new meaning

The first two learning functions described by Kessels (1996a) are subject matter expertise and problem-solving skills. In innovation processes these learning functions have a specific meaning: making new combinations of subject matter expertise, and defining or finding the problem that needs explicit attention. These learning functions should focus on the construction of new meaning.

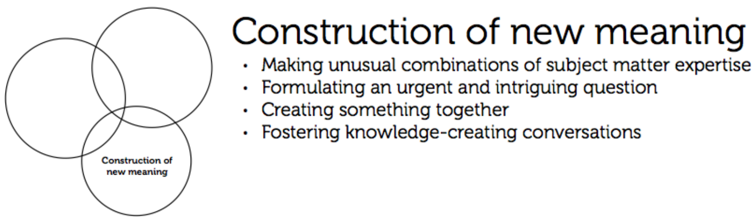
Learning can be seen as a process of constructing and reconstructing meaning (Dixon, 1999). Innovation processes are special forms of learning processes in which the construction of new meaning is especially important (Steyaert et al., 1996). Design principle 8 (Entice to see new signals and to give them new meaning) refers to the process of constructing new meaning. Elements of design principles 1 (Formulate an urgent and intriguing question), 4 (Make unusual combinations of subject matter expertise), 7 (Create something together) and 10 (Pay attention to the social and communicative process, or, in the new format: Foster knowledge-creating conversations) seem to reinforce this principle. Chapter 6 argued that these principles contribute to the construction of new meaning in different ways:

- An exploration of the field of the problem (as is called for in principle 1) may contribute to a new definition of the problem that leaves more room for new solutions.
- The use of metaphors and analogies (as referred to in principle 4) may help to develop a new perspective on the problem, as does inviting people who possess different but possibly interesting expertise.
- Conflicts appear when creating something in collaboration (design principle 7). These conflicts may stimulate the exploration of different perspectives.
- Attention for interaction patterns (as mentioned in principle 10) may enable knowledge-creating conversations. Kessels (1996a) refers to the communication skills needed for this in the fourth learning function of the corporate curriculum.

As explained in section 5.4.3, the development of an urgent question (as mentioned in principle 1) and the creation of something (as mentioned in principle 7) could provide for the creative turmoil, which is one of the learning functions that supports the process of knowledge productivity (Kessels, 1996a). The factors that could contribute to the construction of new meaning are presented in Figure 8.5.

Figure 8.5.

Construction of new meaning.



Designing an innovation practice

When innovation processes are regarded as learning processes, as is the case in this research, it becomes necessary to arrange a space for learning. Design principle 11 (Actively support the development of competences) addresses this idea. This design principle was not recognised clearly enough to justify its existence as a separate principle. It is a principle that communicates on a meta level and, apparently, a learning perspective is not the first focus for facilitators and participants of innovation practices. Their primary focus is the specific innovation at hand.

Participants in innovation practices do have attention for breaking with hindering routines. This became clear from the parallel study (chapter 5) and was expressed in the design principle 2 (Create a new approach). Breaking with hindering routines by designing new ways of working can create a space for learning.

Furthermore, facilitators and participants in innovation practices tried to enable reflection by focussing on achieved successes. The third learning function as described by Kessels (1996a) refers to the need for reflective skills. Design principle 6 (Build on strengths) gives concrete directions for giving shape to reflection. The personal talents of people involved or successes achieved by the group can form a starting point. Breaking with hindering routines, and using talents and successes as a starting point for reflection are two ways to give shape to the learning environment.

In the conceptual framework that was presented in chapter 2, interventions were depicted as one part of the learning environment. In the meta-analysis of the reconstruction studies it became clear that interventions that enhanced learning in the innovation practices never tried directly to 'manage' the innovation process. Favourable interventions concentrate on the creation of a setting and context in which the innovation process can succeed. This process of 'tempting towards knowledge productivity' is expressed by Kessels (2001b) as one of the development principles for the curriculum of a knowledge-intensive organization.

The design study (chapter 7) showed that the factors that were found to influence the learning processes leading to gradual improvements and radical innovations do not prescribe the interventions that need to be done in order to stimulate the learning processes. However, the design study did make clear that the learning environment can be actively designed. The design model provides the steps that need to be taken and the influencing factors (Figure 8.1). It transpired that designers must focus on both systematic and personal aspects.

Furthermore, the parallel study showed that the design of an approach for the innovation practice cannot be done in advance. The approach should be designed step-by-step, gradually deviating from existing routines (this is expressed in design principle 2: Create a new approach). Figure 8.6 shows the three factors that appear to matter in the design of interventions for an innovation practice.

Figure 8.6. Designing an innovation practice.

Besides the factors mentioned in Figure 8.6, 8.5, 8.4 and 8.3 one other factor might influence the learning environment that could contribute to knowledge productivity. This is the learning function 'peace and stability' as mentioned by Kessels (1996a). There are two reasons why this factor is not explicitly referred to in the adjusted conceptual framework. First, the factors mentioned in the adjusted conceptual framework are all related to what individuals and groups who participate in innovation practices can influence. Peace and stability seem rather conditional on innovation. Research carried out by Kedde (2009) in 20 innovation projects shows peace and stability as a factor that did not positively influence the success of the innovation projects. However, a lack of peace and stability, such as when during reorganizations, could negatively influence innovation. Second, 'peace and stability' is a learning function that is also related to reflective activities (e.g. Harrison & Kessels, 2004). The results of the present research indicate that practitioners in innovation practice are primarily involved with the content of the innovation itself. They do not pay explicit attention to learning and reflection.

8.2 Reflection on concepts used

This section reflects on four of the concepts that had a central role in the research project. The first is knowledge productivity, a concept that refers to the learning processes necessary for innovation. The second is the concept of innovation practice. This refers to a group of people who collaborate with the intention of innovating. The third concept is that of breakthroughs. This concept helped throughout the research to track progress in the innovation process. The fourth concept that is reflected upon is the concept of design principle. This was the format used to present the findings revealed by the parallel study and the literature review. The reflection takes into account both the theoretical and the communicative value of these concepts.

8.2.1 Knowledge productivity

In the present research the concept of knowledge productivity took a central place. Kessels (1995; 2001b) defined knowledge productivity as the process in which people trace relevant information, use this information to develop new abilities, and apply these abilities to the gradual improvement and radical innovation of products, services and work processes. In this perspective the work environment is actually the learning environment in which people develop the necessary abilities to improve and innovate products and services, and existing operating procedures. Kessels introduced the concept as a counterpart of knowledge management since the term management in relation to learning (Von Krogh et al., 2000) and in relation to innovation (Angle & Van de Ven, 2000) implies control of processes that may be inherently uncontrollable. This section reflects on three elements that make up the definition of knowledge productivity.

Gradual improvement versus radical innovation

The definition of knowledge productivity distinguishes between gradual improvements and radical innovations as results of the process of knowledge productivity. In the present research this distinction is not presented as a continuum that shows the degree of radicalness with incremental innovation on one side of the continuum and radical innovation on the other (Francis & Bessant, 2005; Tidd et al., 2005). Instead, gradual improvements and radical innovations are considered as two distinct forms of innovation that each require a different kind of learning processes. Gradual improvement is the process that elaborates on what is already present, leading to additional refinement and specialisation, and radical innovation is a process that involves breaking with the past and creating new opportunities (Walz & Bertels, 1995). The learning processes that occur in parallel with the development of gradual improvements was linked to productive learning (Ellström, 2002) (see chapter 2), and the learning processes that occur in parallel with the development of radical innovations was linked to creative learning (Ellström, 2002) (see chapter 2).

The cases that were part of the reconstruction studies (chapter 4) were classified as either gradual improvements or radical innovations. From the 18 innovation practices that were reconstructed, 3 resulted in gradual improvements. However, the analysis of the cases did not show a difference between the factors and interventions that stimulated the learning processes in the cases leading to gradual improvements and the factors and interventions that stimulated the learning processes in the cases leading to radical innovation.

In the parallel study the distinction between gradual improvements and radical innovations was not used. All the innovation practices studied had the intention to come up with innovative solutions, but the actual outcome was not part of the study. The parallel study followed ongoing innovation practices for which the outcome was yet unknown. This study focused on the breakthroughs that took place along the way. The choice not to concentrate on the outcome of the process but rather on the breakthroughs that happen along the way makes it impossible to reflect on the different learning processes that precede the development of both gradual improvements and radical innovations.

A provisional conclusion, based on the findings in the meta-analysis is that the intention to find a solution for a difficult question accounts for the characteristics of the learning process more than the intention to develop either a gradual improvement or a radical innovation. In all cases the intention was to come up with an innovative solution for an intricate question or a long-standing issue. Participants never deliberately aimed at developing gradual improvements. The difference between the learning processes that parallel the development of gradual improvements and radical innovations seems to be the availability of the content that was needed to develop a solution. When the content could be found within the context in which the innovation practice was active, it led to gradual improvements. When the content was not directly available it needed to be found elsewhere and adjusted to the situation at hand, or else newly developed. In these cases radical innovation was more likely to occur.

The ability to innovate as an outcome of knowledge productivity

Concrete improvements and innovations are a valuable outcome of the innovation process. Another outcome is the ability of individuals and groups to be knowledge productive (Keursten et al., 2006). The present research had the aim to learn more about the learning processes undertaken with the intention of innovating. This resulted in a set of design principles. The prescriptive value of these principles appeared to be limited. Apparently, the ability to innovate cannot be easily translated into a set of principles to design the process. The findings in the design study (chapter 7) led to a model of the design process. The model shows the different steps to take, and it shows that a combination of a personal and a systematic approach is necessary to create breakthroughs. This model could be seen as a visualisation of a possible way to develop the ability of practitioners to be innovative. However, the present research did not measure if and to what extent deliberate use of this model increases the ability of participants to improve and innovate.

Innovation processes as powerful learning processes

In line with the definition of knowledge productivity, the present research considered the innovation process as consisting of powerful learning processes. This perspective led to the development of a conceptual framework (chapter 2), and was the starting point for the meta-analysis (chapter 4) and the parallel study (chapter 5). An analysis of the breakthrough moments ('critical learning incidents') in the cases included in the parallel study, together with a review of literature on innovation, learning and problem solving, led to the development of a set of 11 design principles. A validation study showed that these principles help participants in innovation practices to describe the most important breakthroughs in their innovation practice. Experts from various fields, including learning and innovation, recognised the principles. Together, these findings support the idea that regarding innovation processes as learning processes is a worthwhile perspective.

8.2.2 Innovation practice

Innovation practice is the concept that, within the context of the present research, indicates a group of people who work together in order to find an innovative solution to a difficult question. In both the reconstruction study (chapter 4) and the parallel study (chapter 5), innovation practice referred to the cases that were part of the study. The word *practice* refers to a shared concern, or a passion for something which this group of people do (Wenger, 1998). The word *innovation* refers to the intention of this group. They feel the urge to come up with an innovative solution. In fact, an innovation practice is an innovation practice even when it does not come up with innovative solutions in the end.

People's intention of coming up with innovative solutions was chosen as a starting point for the present research for two reasons. First, there was no alternative in the parallel study. The groups had just started with their work and the only certainty was their intention to come up with innovative solutions; no outcomes were visible yet. In order to select cases that were worth examining, the intention of the people involved to come up with innovative solutions was used as starting point.

Second, the reconstruction studies made it clear that even though these innovation processes were already in an advanced stage, it was difficult to differentiate between successful, unsuccessful, and not yet successful processes. The outcome of innovation processes is not known beforehand, so it is not always possible to know if and when one has reached the finish. What at first seems to be an end-result, might later appear to be a preliminary yield. Processes that get stuck might even become successful later on. The denomination of 'innovation practice' was therefore used to indicate the cases that were studied. This concept emphasises people's intention in their collaboration, and not the output.

The use of people's intention to come up with an innovative solution, worked well in communicating with practitioners. Practitioners easily associate with someone who cooperates with others with the aim of finding a solution for a difficult question or a problematic situation for which 'more of the same' will not work. This description appeals to them more than the idea of being an 'innovator' or being involved in 'innovation'. One possible explanation for this is that working on difficult questions for which no answer is available yet is easily associated with people's daily work, whereas 'innovation' is still linked to technical innovations that are done by technicians and R&D departments. However, this is rather a one-sided view, since most gains with respect to innovation can be expected from organizations which include process innovations in their definition (Volberda & Van den Bosch, 2004), and which regard all departments as possible contributors to this process (Kanter, 2006).

One question that this choice of an intentional perspective evokes, however, is related to the answer to the first main research question of the present research. Did the present research project actually addressed that question? This first main research question wanted to learn more about factors that influence the learning processes leading to gradual improvements and radical innovations. The fact that some of the innovation practices that were studied got stuck along the way did not influence the results. And neither did the fact that not all of the innovation practices came up with innovative solutions by the time the phase of data-gathering had finished. Strictly speaking, the findings of this research project offer insight into the factors that matter in the learning processes *intending* to bring about gradual improvements and radical innovations.

8.2.3 Breakthroughs

The parallel study concentrated on ongoing innovation practices. This offered the opportunity to observe innovation processes as they occurred and to immediately hold on to important moments. These important moments were referred to as 'breakthroughs'. Breakthroughs refer to a change in both 'thinking' and 'acting' leading to a step forward in the innovation practice (see chapter 3, Section 3.4.3) of participants in an innovation practice. A change in thinking was conceptualised as a change of governing variables (Argyris & Schön, 1978), mental models (Senge, 2000) or frames of reference (Hedberg & Wolff, 2001). For innovation this change in thinking must be combined with a change in behaviour. One must act based on these new ways of thinking (Hedberg & Wolff, 2001).

These breakthroughs were expected to indicate the critical learning incidents of the innovation practice. Whether a breakthrough took place was left up to the judgment of the participants. Looking back upon the choice to use breakthrough as a central concept to understand learning processes in innovation processes, two comments can be made.

First, respondents who took part in the parallel study easily grasped 'breakthrough' as a concept. It seemed to make a claim on their intuition, and they could easily point at breakthroughs that occurred in their innovation practice. Besides the concept of breakthrough, respondents used other words such as 'magical moment', 'turning point', or 'critical moment'. They seemed to use these words interchangeably to indicate important moments in their innovation practice. The extent to which the collected breakthroughs indicate a change in existing ways of thinking and doing, and thus relate to learning, was not always clear.

Second, the conceptual relationship between breakthroughs and innovation has not been elaborated upon extensively. Although it is conceptually clear that innovations are likely to be preceded by breakthroughs, we did not do further inquiry into the exact relationship. The research did not indicate, either conceptually or empirically, the kind of breakthroughs or the sequence of breakthroughs that are likely to lead to innovation.

It would be worthwhile to develop a framework to collect and classify breakthroughs in the context of innovation. Are 'magical moments', 'turning points', 'critical moments' and 'breakthroughs' the same? How do these moments relate to the change in thinking and the change in acting that is supposed to underlie all innovation processes? And how do these moments relate to the final outcome of the innovation process? Answers to these questions could help develop such a framework.

8.2.4 Design Principles

The concept of design principle refers to the format that was chosen to present the findings of the parallel study combined with the findings from the literature review (chapter 5). The design principles reflect the patterns that could be recognised in the breakthroughs collected in the parallel study. In fact it is not common to use the format of design principles for this purpose. Usually, design principles are used as a format to reflect findings in a design research (Kali, in press; Linn, Bell, & Davis, 2004; Van den Akker, 1999). However, in the present research the design principles formed the input of the design research. This made it possible to collect at an earlier stage reactions of possible future users with respect to the design principles. Another reason for choosing design principles as a format in this phase was that design principles seemed especially suitable to do justice to the variation and complexity that was found in the themes. However, looking at the use of the concept of design principle retrospectively, two problems become clear.

First, the communicative value of the concept is limited. Design principles, design guidelines, or design patterns are commonly used in the context of the design of physical or virtual environments such as architecture (Alexander, Ishikawa, & Silverstein, 1977), software design (Gamma, Helm, Johnson, & Vlissides, 1995), or distance learning (Verdonschot & Kwakman, 2004). In the present research the term design principle indicated factors that could be used for the design of a work environment that promotes learning for innovation. The principles did not indicate how the physical work environment should be designed. Rather, they gave directions for designing learning interventions in this work environment. This is a more abstract application of the concept, and many participants in the research project, as well as fellow researchers found the term 'design principle' difficult to grasp.

Second, the design principles turned out not to have a powerful prescriptive function. This makes it difficult to justify the use of the 'design principle' concept. According to Van den Akker (1999) a design principle is a heuristic statement that describes an intervention and its purpose, the characteristics of the intervention, the procedures through which to reach it, and the arguments that explain why things must be done this way. After the parallel study and the literature review (chapter 5) there was not yet enough information to use this format. But after the expert review (chapter 6) and the design study (chapter 7) it was not obvious to use this format either, because the design principles appeared not to act as prescriptive rules, but rather as different perspectives that could be supportive in the design of interventions.

8.3 Reflection on methodology

This section reflects upon the research approach, starting with the reliability of the data obtained through self-reports in both the parallel study and the design study. Second, the reflection concentrates on the internal validity of the research approach that consisted of various building blocks brought together by means of multiple-method bricolage (Kincheloe & Berry, 2004). The last section concerns the generalisability of the findings.

8.3.1 Reliability of self-reports as measurement method

Reliability refers to the extent to which a repetition of the same study will yield the same results. It is a term that is usually linked to the instruments used, and whether these can be trusted, measurement after measurement, to deliver a reliable outcome (Swanborn, 1987).When a table is measured with a tape measure that indicates its height, the reliability of the tape measure can be determined by measuring various tables one or two times. If the measurements correlate, the tape measure is a reliable instrument to measure the table's height. However, reliability is problematic in the social sciences because human behaviour is never static (Merriam, 1988). So applying the instrument various times might lead to different results not because the instrument is not reliable, but because human behaviour is not static as the height of a table. Reliability is based on the assumption that there is a single reality which, if studied repeatedly with a reliable instrument, will give the same results (Merriam, 1988). In this research our stance is that the world around us is not to be discovered but rather constructed (Wardekker, 1999). This was one of the reasons to trace breakthroughs in the case study research (chapter 5) and breakthroughs and learning effects in the design study (chapter 7) mainly by asking the participants to judge whether a breakthrough had taken place or whether they experienced learning effects.

It is worthwhile to discuss this method from the perspective of reliability. Reliability in this respect does not mean the extent to which the interview instrument would measure the same breakthroughs or learning effects if it were applied repeatedly. Rather, it means the extent to which the information acquired by means of self-reports is accurate. How likely is it that the participants are able to reflect upon the changes they have gone through? How reliable are the statements about breakthroughs that primarily rely on self-reports?

Biases could occur because respondents tend to report what they believe the researcher expects to see (T. D. Cook & Campbell, 1979), through forms of distortion in the way our memory works (Schacter, 1999), and because of implicit theories about how one has changed (Ross, 1989). Since self-reports are used throughout the research, it is worthwhile to reflect upon the reliability of the participants' statements. Self-reports were used for two purposes:

- As a method to trace breakthroughs in innovation practices: this was the case in the parallel study (chapter 5), and in type B design labs in the design study (chapter 7).
- As a method in type C design labs in the design study (chapter 7) to find out what people learned from the role playing game.

The answers of the participants who were asked to reflect on their innovation practice in order to trace breakthroughs might be biased by an effect that T. D. Cook and Campbell (1979) refer to as the tendency to report what reflects positively on participants' abilities, knowledge, beliefs, and opinions, and what Ross (1989) calls self-presentation.

The participants were all facilitators of innovation practices who design interventions and bring these into practice. They all aim to facilitate the process of the innovation practice in order to reach an innovative solution. The majority of the respondents in type B design labs, and all participants in the parallel study, always reported one or more breakthroughs. The tendency of participants to report their experiences in a way that makes them look competent in the eyes of the researcher, might have influenced the reports of participants in the present research. Their image of competent facilitators as people who are able to create breakthroughs might have caused them to look for breakthroughs even when there were no obvious breakthroughs to report. This would explain the fact that the collected breakthroughs were very different from each other: some seemed rather insignificant whereas others appeared to have had a high impact. In the analysis of the data no distinction was made between the different forms of breakthroughs. The formulation of criteria that a breakthrough needs to meet in order to be classified as such would have helped to trace breakthroughs more precisely. It still would have been possible to leave it up to the participants to judge whether the situation meets the criteria, and the criteria could also have served as a guideline for deciding what is, or is not, a breakthrough.

The learning results of the participants who joined type C design labs were measured with self-reports as well. Many participants reported that they didn't learn anything new, but that the design lab helped refresh some things or sharpened an insight they had had earlier. This was remarkable since they often did report changes in their behaviour at work. The fact that participants were thrifty in reporting newly acquired insights or skills might be explained by people's tendency towards consistency over time (Schacter, 1999). Schacter explains that people tend to overestimate the consistency between their past and present attitudes, beliefs, and feelings. Even though they might have gained new insights during the design lab -as indicated by the way they reported about changes they implemented in their work environment- they say that they have not learned anything new, because they tend to overestimate their own consistency over time. Even though this bias might have been present, it probably did not influence the final results of the design study. The question about learning gains was used at the very beginning of the interview. The aim was to find out the extent to which the design lab led to a change of behaviour in the work environment of participants. The expectation was that participants would find it easier to reflect upon the change of behaviour at work when the first question was directly related to learning gains that respondents took away from the design lab, and the following questions to an application of this insight to the work environment. However, it appeared that this stepping stone was not necessary. The word 'new' in particular (in the question: 'Did you learn anything *new*?') seemed to trigger the participants, and seduced them to overestimate their own consistency over time.

8.3.2 Internal validity of the research approach

One important way to strengthen a study's design is through triangulation, or the combination of methodologies in the study of the same phenomenon (Patton, 1990). Denzin (1978) differentiates between data triangulation, investigator triangulation, theory triangulation, and methodological triangulation. The last form, the use of multiple methods to study a single problem, is especially well employed in the building block research approach that was developed in a process that Kincheloe and Berry (2004) refer to as multiple-method bricolage. For this kind of research approach all the blocks must build on one another logically. The present research has at least one salient transition that is worth reflecting on. This is the shift from research of a descriptive nature that aimed to hold on to the factors influencing the learning processes in innovation practices, to a prescriptive research approach that served the goal of finding out the extent to which these factors could be used to deliberately influence this process. This bridge between description and prescription needs to be taken carefully. Lowyck (1995) suggests that researchers too often deem that a description of reality is sufficient to optimize that reality. 'Knowing that' is too often directly linked to 'knowing how' whereas this transition shows the need for a design science. Burkhardt and Schoenfeld (2003) refer to design research as 'engineering science', and they find this type of research essential to building strong linkages between research-based insights and improved practice. They claim that the link between research-based development and robust well-tested models of large scale change are weak and often even nonexistent: "Although good insight-focused research identifies problems and suggests possibilities for progress, it does not itself generate possibilities for progress, it does not itself generate reliable solutions that can be directly implemented on a large scale" (Burkhardt & Schoenfeld, 2003, p. 5). In the past decades several scholars have advocated this research approach. For instance it has been further developed in the field of education (Gravemeijer, 1999; Richey & Nelson, 1996; Van den Akker, 1999), management (Van Aken, 2004) and organizational research (Romme & Damen, 2007). Below, two aspects are critically reflected on in order to define the rigor with which the descriptive study that identified design principles was linked to a design study that tested the prescriptive quality of these principles: the transition from the descriptive to the prescriptive research phase and the quality of the design study itself.

Transition from a descriptive to prescriptive research phase

Burkhardt and Schoenfeld (2003) describe six types of effective models that are common to what they call successful research-based fields of practice such as medicine. One of these best reflects the approach in the research at hand. It takes as a starting point a "reasonably stable theoretical base, with a minimum of faddishness and a clear view of the reliable range of each aspect of the theory" (Burkhardt & Schoenfeld, 2003, p. 6). According to them such a theory base allows for a clear focus and provides the necessary guidance for the design phase.

The basis for the theory used in the design study was laid some fifteen years ago. In 1993 Drucker realised that if knowledge was the most important factor in the knowledge economy, the main responsibility of organizations would be to make knowledge productive (Drucker, 1993). He states that the most valuable resource for 21st-century organizations will not be production equipment but knowledge workers and their productivity (Drucker, 1999). Kessels introduced the concept of knowledge productivity (Kessels, 1995), and presented the corporate curriculum (Kessels, 1996a). The corporate curriculum, consisting of seven related learning functions (Kessels, 1996a, 2001a) and three developmental principles (Kessels, 2001b, 2004) forms a method that organizations could use to turn their work environment into a learning environment that stimulates this process of knowledge creation. Van Lakerveld (2005) has shown that the learning functions of the corporate curriculum form a coherent set. Stam (2007) built further on this work and showed that the learning functions can be measured reliably. The present research used the elements of the corporate curriculum as a starting point and found 11 design principles that are closely related to the elements of the corporate curriculum. Confirmation of the importance of a personal approach in the innovation process -in addition to the result of the present research- is found in the research of Van der Waals (2001), who concluded that an employee-driven approach works best to foster knowledge productivity. There is a strong interrelatedness between the 11 design principles that were used as input for the design research and the elements of the corporate curriculum (see section 8.1.1). Furthermore the validation of the design principles with participants and facilitators of innovation practices, and the expert consultation, contributed to the basis underpinning the design study. These successive research activities and the connection with previous research on knowledge productivity over the last 15 years provided a stable base for the current design study.

Quality of the design study

The way in which the results of design study were reported contributes to the quality of the study. The report of the results of this study complies with the aspects mentioned by Collins, Joseph and Bielaczyc (2004). They indicate five crucial elements in the reports of design study: the goals and elements of the design, settings where implemented, a description of each phase, the outcomes found, and the lessons learned. All these aspects have been described for the design study:

- The goals for each of the types of design labs are described in Table 7.1. The elements that make up the design labs of type A, B, C and D and the procedure that was followed, are presented respectively in Appendixes H, I, J and K.
- The design labs were not implemented in a specific setting, but Table 7.1 characterises the groups of participants that took part.
- Appendixes L, M, N and O present the outcomes per type of design lab. This is the result of the within-case analysis.
- Section 7.3 shows the findings for each of the design principles. Section 7.4 presents the main findings per type of design lab as well as the outcomes of the cross-case analysis that was done of all the design labs together.
- Section 7.5 answers the central research question. The section returns to the initial model of the design process and adds several factors that seem to influence this process.

8.3.3 Generalisability of the results

The results of the present study are not simply generalisable to all organizations since the cases that were studied were not part of a random selection. However, the case studies took place in various organizations, sectors and countries. The 18 case studies that were part of the reconstruction studies took place in innovation practices in different sectors in The Netherlands, China and Indonesia. The 10 case studies that were included in the parallel study took place in innovation practices which were initiated by a Dutch organization that promotes innovative urban planning processes in The Netherlands. Different people, related to both public and private organizations, took part in these innovation practices. In the design study facilitators from innovation practices, practitioners from the field of Human Resource Development (HRD), students and researchers in the field of HRD and Knowledge Management took part. They belonged to different organizations. The reconstruction study, the parallel study and the design study included a variety of cases. This approach promotes validity of the results in other contexts than those that were studied (Merriam, 1988; Yin, 1984).

Looking at the variety of cases it is credible that the findings may be valid for all forms of innovation organized as innovation practices. The findings could be applied in a context in which the following three elements are present: 1) an intricate question, problematic situation or long-standing issue that requires an innovative solution, 2) a group of people from one or more organizations, all of whom are committed to solving the problem, and 3) a concrete manifestation of the problem that is dealt with.

Situations in which the findings of the present research are not applicable include situations in which individuals did not choose to participate, situations in which individuals have no interest in solving the problem at hand, and also situations in which the group that aims to find an innovative solution does not have the freedom to experiment with new approaches. If groups need to comply with the rigid structures and procedures that organizations often deploy, the findings from the present research will not be easy to apply.

8.4 Reflection on the relevance of the research findings

Chapter 1 presented the relevance of the present research for theory building, practice and society. This section reflects on these three contributions.

Scientific relevance

The present research aimed to contribute to existing theory by better understanding learning processes undertaken with the intention of innovating at the workplace. This was done by considering the innovation process as a learning process. The studies included in the research project resulted in a set of design principles which reflect the factors that matter in the learning processes leading to innovation. Furthermore the research resulted in a model that offers more insight in the way these design principles could be used to design a learning environment leading to innovation. Finally, it led to a revised conceptual framework to examine learning with the intention of innovating.

Practical relevance

The present research aimed to contribute to practice by providing guidelines which could help organizations in the design of learning environments that support employees in the process of learning with the intention of innovating. The results of the research are useful for practitioners in three ways.

First, the design principles clarify the factors that matter in the creation of breakthroughs in innovation practices. These principles might be used in daily practice as a means to reflect upon or analyse an innovation practice. Furthermore the cases studied provide examples of interventions that were carried out by participants in innovation practices, and that contributed to the creation of breakthroughs. Although these principles and the concrete examples do not tell people exactly what they need to do, they do contribute to practice by showing underlying principles that can serve as examples (Wardekker, 1999). This can be helpful for participants in innovation practices.

Second, the design study resulted in a model that represents the design process that can lead to breakthroughs in innovation practices as well as the factors that need to be taken into account. Although the design study did not result in cut-and-dried solution concepts, the model that emerged from it can be useful for practitioners to guide their design process.

Third, the design study used four types of design labs that facilitated practitioners in the design of interventions to create breakthroughs. These labs provide useful ways of working that can be seen as a by-product of this research project. With help of the protocols that were given, these four types of labs provide four ways of working that could help practitioners to create breakthroughs in their innovation practice.

Furthermore, many practitioners became involved in the course of the research project. They participated in research activities that served as reflective activities or design activities. In total, 23 practitioners took part in the validation study in which participants used the design principles to reflect on their own innovation practice. And 111 participants took part in the design study, in which participants designed interventions for difficult situations in innovation practices. In this way, the research project aimed to contribute directly to practice.

Relevance to society

The present research aimed to contribute to developments in society by gaining insight into the learning processes undertaken with the intention of innovating, in which individuals collaborate across organizations, sectors and countries. The cases that were part of the parallel study consisted of innovation practices in which individuals from different organizations and across sectors collaborated with each other. Individuals who did not belong to an organization often participated in these innovation practices. These included, for instance, inhabitants of the area that was central in the innovation practice. The research clearly showed that in order to develop innovative solutions for long standing issues it is necessary to include individuals who commit themselves to solving a problem, a concrete place in which the problem manifests itself, and an urgency to reach a breakthrough in this issue.

The participants in the research project consisted for a large part of people who joined one of Habiforum's innovation practices. They aimed to find innovative solutions for questions relating to the limited space in The Netherlands. Participants in these innovation practices took part in the parallel study, in the validation study and in the design study. These research activities did not only focus on the answers to the central research questions, but also on the development of the innovation practices. The data collection comprised reflective activities and design activities. In this way the research project aimed to contribute directly to innovation practices that work on long-standing issues that are relevant to society.

Summary

Learning to Innovate

A series of studies to explore and enable learning in innovation practices

Chapter 1

Chapter 1 lays out the reasons for this investigation, the central research questions and the relevance of the research for science, practice and society. Our economy has changed from an industrial economy to a knowledge economy (Drucker, 1993). This thesis investigates learning and working in such a knowledge economy. In an industrial economy productivity was an important determinant for the success of organizations. However, in a knowledge economy advantage is not so much gained from the ability to produce more products but from the ability to innovate. In a knowledge economy the success of organizations is determined by the extent to which they succeed in developing new knowledge and in applying that knowledge for the gradual improvement and radical innovation of their products, services and operating procedures. Developing improvements and innovations is not an activity restricted to R&D departments and solely focused on the development of new products. Indeed, in a knowledge economy all members of an organization contribute to the process of improvement and innovation. It is actually process innovation that is especially promising. The development of the knowledge economy influences the way in which learning in the context of work takes place. In order to be successful in a knowledge economy learning with the intention of innovating becomes increasingly important. It is this form of learning that is central to this thesis. The first research question aims to trace factors that enhance the learning processes leading to gradual improvements and radical innovations. The second research question examines the extent to which these factors could be deliberately applied to design a work environment that promotes innovation.

Chapter 2

Chapter 2 explores the characteristics of learning processes that occur in parallel with innovation. Subsequently, a conceptual framework is presented that will form the starting point for the studies to be carried out.

Learning with the intention of innovating is a special form of learning. For a long time, learning in the context of work was organized serially: first learning, and then the application of this learning at the workplace. However, the effects of these training programmes in terms of the transfer of what had been learned to the workplace was disappointing (see Baldwin & Ford, 1988; Burke & Baldwin, 1999).

This was one of the reasons why the focus shifted from a training orientation to a learning orientation (Marsick & Watkins, 1990). Notions such as work-based learning, work-related learning and workplace learning emerged. Many of the learning processes that take place at work focus on helping employees to become better at their work. For instance, by observing a more experienced colleague at work, one can learn the intricacies of the profession. However, learning with the intention of innovating refers to another form of learning. This form of learning is not so much initiated from the perspective of learning (how can I become better at this task?), but rather from the perspective of work (how could we solve this problem?). This is the kind of learning that takes place when a difficult question or problematic situation arises which has occurred before and for which no solution has been found, in spite of a number of attempts in that direction. When solving these questions learning and working coincide; then, the work environment can be seen as a rich learning environment (Kessels & Van der Werff, 2002). Learning is in this case not seen as a means to support the work, but rather as something which itself adds value to the work by improving and innovating it. The concept of knowledge productivity (Kessels, 2001b) integrates the notions of learning and innovating. Knowledge productivity refers to the processes through which new knowledge is developed, contributing to the gradual improvements and radical innovations of products, services and operating procedures. In the conceptual framework this concept is further defined with the help of literature. The framework consists of the context from which the innovation process originates, the learning environment that is required for the development of innovations and the outcomes of the innovation process. The learning environment is operationalised with the learning functions of the corporate curriculum (Kessels, 1996a, 2001a) and the development principles for designing a work environment that promotes knowledge productivity (Kessels, 2001b, 2004). The outcome of innovation does not only consist of the concrete improvements and innovations but also of the ability of the people involved to develop these improvements and innovations.

Chapter 3

Chapter 3 offers a description of the method used to answer the research questions. The method consists of a series of studies that all answer different questions. The findings from one study together with developments in the practice in which the research took place determined the approach in the subsequent study. Central to the research is the study of innovation practices. An innovation practice is a group of people that is motivated to collaboratively find an innovative solution for a difficult problem for which the answer is yet unknown.

In the first study a meta-analysis was conducted of 18 reconstruction studies of completed innovation practices. The analysis led to the confirmation and refinement of the elements of the conceptual framework. It turned out to be difficult, in a reconstruction study, to hold on to the learning processes. Respondents encountered difficulties reflecting upon the learning process in their innovation practice. This was one of the reasons why we decided to closely monitor some ongoing innovation practices. This would offer the possibility to immediately hold on to important moments and also see where the process got stuck. This is why a parallel study was conducted in the following research phase.

The parallel study was combined with a literature review. In the parallel study we monitored 10 innovation practices. In doing this we put the original framework aside, for two reasons. First, we wanted to avoid detecting automatic confirmation of the elements of the framework, at the expense of new aspects. Second, we wanted to follow the learning processes more rigorously. Tracing concrete moments in the form of 'critical learning moments' brought us closer to the participants in the innovation process and their work, than if we had used the terms from the conceptual framework as a starting point for data collection. Indeed, these terms originate for a large part from the world of learning rather than that of work. The analysis of the findings in the innovation practices combined with the literature review resulted in a set of 11 provisional design principles which reflect the factors that appear to matter in learning in innovation practices. These factors were validated with participants and facilitators from innovation practices.

Following the parallel study two other studies were carried out simultaneously. First, an expert consultation was carried out in which 10 experts with different fields of expertise took on the role of 'critical friend' and as such participated in a formative evaluation of the design principles. Second, a design study was conducted in which participants used the design principles in different ways in order to examine their prescriptive quality. We wanted to find out the extent to which the principles, which until now were validated as descriptive factors, could facilitate the design of a work environment that promotes innovation. The design study included four types of design labs that were each performed several times. In total, 111 respondents took part in the design labs.

Chapter 4

Chapter 4 presents the approach and results of the first study. This study consisted of a meta-analysis of 18 reconstruction studies of innovation practices. The cases consisted of successful and less successful innovations that took place in different organizations in The Netherlands, China and Indonesia. Examples of cases include the introduction of a new soap product line, the development of a beer dispensing system for small volume outlets, and the combination of two production lines.

The conclusions in this chapter delve deeper into the elements of the conceptual framework. The learning functions from the corporate curriculum and the development principles for work environments that stimulate knowledge productivity were clearly recognised in the cases. The framework could be refined on three points. In addition, we concluded that the innovation processes in the cases at hand arose from either an urgent problem or a strategic choice of the organization. If an urgent problem was the reason, employees in the organization experienced a concrete problem for which previous attempts hadn't led to a solution and for which they aimed to find an innovative solution. Such concrete problems often generated the time pressure and the dedication that contributed to solving the problem. The solutions in these cases were either gradual improvements or radical innovations. Because of the time pressure people could work in a focused manner. Usually, they first looked for existing solution concepts. If these were readily available, they were adapted to the situation at hand. This often led to gradual improvements. When no solution was readily available, something new had to be developed. This was often done based on examples elsewhere. These examples had to be customised for the new situation. Often, this led to radical innovations.

Innovation was employed as a strategic choice when an organization saw possibilities to work more efficiently or to improve quality. Innovation processes that originated from a strategic choice either led to radical innovations or else got stuck along the way. A possible explanation for this could be the relative lack of time pressure in these cases. This meant that participants in these innovation practices often had the time and space to discover new paths. If they succeeded, then it led to radical innovations. However, if the process got stuck in a dispute between people with different perspectives and there was no significant pressure to reach results, there was a danger that the process might get stuck and that participants might give up. Another effect of the limited time pressure was that it sometimes led to solutions in the form of concepts that were not directly applicable in the work environment.

Chapter 5

Chapter 5 presents the parallel study and the additional literature review. The innovation practices that were monitored in the parallel study all focused on questions in the field of planning processes in The Netherlands. These innovation practices were initiated by Habiforum, a network organization that promotes innovative and sustainable land use in the country. In these innovation practices people connected to public and private parties worked together in a joint effort to find innovative solutions for intricate questions. Examples of cases are the restructuring of a problem district, the restructuring of an industrial area, and the development of a multi-layered industrial area.

By means of observations and interviews the developments in four of these innovation practices were followed closely. Another six innovation practices were followed from a greater distance. Data collection focused on tracing breakthroughs. Breakthroughs were seen as the 'critical learning moments' of the innovation practice that refer to a change in both thinking and acting leading to a step forward in the innovation practice. The assumption was that each successful innovation was preceded by successive breakthroughs. The analysis of the breakthroughs was combined with a literature review in the fields of innovation, learning, and more specifically the problem-solving field of learning. The analysis resulted in 12 themes. These themes were formulated as design principles. After a validation of these principles by participants and facilitators of innovation practices the set was restructured into a set of 11 principles:

11 Design Principles

1. Formulate an urgent and intriguing question
2. Create a new approach
3. Work from individual motivation
4. Make unusual combinations of subject matter expertise
5. Work from mutual attractiveness
6. Build on strengths
7. Create something together
8. Entice to see new signals and to give them new meaning
9. Connect the world inside the innovation practice to the world outside
10. Pay attention to the social and communicative process
11. Actively support the development of competences

The respondents who participated in the validation study could describe the most important breakthroughs in their innovation practice with the help of the principles. Furthermore, the validation study revealed that the set of principles didn't miss elements that were necessary to describe the breakthroughs. Two principles turned out to be ambiguous: principle 10 and principle 11. Although respondents found principle 10 important, they didn't use it often to describe breakthroughs that occurred. A possible explanation could be that respondents associate the principle with the whole innovation process. Innovation processes consist of a group of collaborating participants who interact continuously. Seen in this light all occurrences could be related to the social and communicative process. Principle 11 was not recognised by respondents in their own innovation practice. This might be due to the formulation of the principle; the development of competences could easily be related to eliminating shortcomings, which might not be seen as an attractive perspective. But it might also be due to the nature of the principle. The other principles are all directly related to the innovation process whereas this principle could be seen as a 'meta principle' because it refers to the innovation process as a whole. Furthermore the validation study led to insight into the application of the design principles and their interrelatedness.

Chapter 6

Chapter 6 presents the results of the expert consultation. Three experts in the field of learning and change and four experts in the field of innovation took part in these expert meetings. Another three experts were invited owing to their expertise on the content of the cases in the parallel study, i.e., urban planning, sustainability and transition management.

The experts reflected on each of the principles. They discussed the content of the design principles, the mechanisms that underlie the principles, and the boundaries of the principles. Principles 4, 7 and 9 were broadly agreed upon. The experts were most critical about principles 3, 6 and 10. In order to improve the principles the experts recommended investigating the interrelatedness between the principles. This recommendation inspired an exploration of underlying themes. This led to three themes: the construction of new meaning, collaboration in innovation practices and the space required for learning. Design principle 8 is closely related to the first theme, principle 5 to the second theme and principle 11 to the third. The other principles, in specific combinations, appear to contribute to the developments of these themes.

In their role of 'critical friend' the experts asked critical questions. This chapter reflects on these questions. One interesting question was the extent to which the principles could be applied in 'normal organizations'. Themes such as power and leadership seem to have a different role in innovation practices than in the daily practice of many organizations. Leadership in innovation practices resembles participative leadership (Manz et al., 2000). This type of leadership refers to a situation in which followers can acquire an increased sense of ownership of the goals that are being pursued. Power in innovation practices is not determined by hierarchical positions but rather by the knowledge and expertise of the people involved (Toffler, 1990). It is conceivable that organizations will change as a consequence of the knowledge economy. The kind of collaboration that takes place in innovation practices could serve as an example. Individual motives and preferences might prevail over rigid structures. And power based on knowledge could become increasingly important, at the expense of influence based on someone's formal position.

Chapter 7

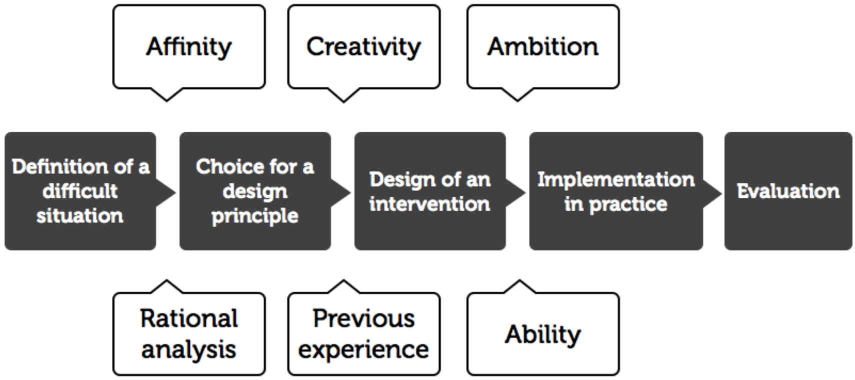
Chapter 7 presents the design study that was conducted to explore the prescriptive value of the design principles. Each of the four types of design labs helped participants design interventions based on design principles with the aim of achieving breakthroughs in an innovation practice. By developing four different types of design labs we had the opportunity to study the design process in various shapes.

In type A design labs participants analysed a fictive innovation practice and used the design principles to design interventions. In type B labs participants developed interventions for their own innovation practice based on one or more design principles. They put the intervention into practice and its effect was subsequently evaluated. In type C design labs participants took part in a role playing game. This game gave them the opportunity to go through a design cycle multiple times, so as to experiment with various principles and acquire the skills of putting the interventions into practice. Type D design labs challenged participants to experiment with the set of design principles. They designed various interventions for difficult situations. Putting these into practice was not part of the design labs of this type. The design labs provided information on each of the principles and on the set.

The results revealed that the prescriptive value of the design principles is limited. The design process is not as systematic as simply defining a difficult situation, choosing a design principle, designing an intervention, and implementing the intervention in practice. Six factors were identified that influence the phases of the design process: rational analysis, previous experiences, ability, affinity, creativity and ambition (see Figure 1).

Figure 1.

Model of the design process and factors influencing that process.



The choice for the most viable principle as the basis for a design is not only informed by the nature of the difficult situation. Although a rational analysis of the situation helps to choose a principle, personal affinity also plays a role. With respect to the design of the intervention it became clear that the principles do not prescribe the interventions required to achieve a breakthrough. A combination of previous experiences and creativity supports the process of designing a suitable intervention. However, the design of an intervention based on one or more of the design principles does not guarantee a skilful implementation in practice. Whether the participants succeeded in implementing the intervention in practice depended on the abilities of those who put it in practice, and their overall ambition with respect to the innovation practice. Personal ambition can provide the necessary courage to experiment with new and unconventional interventions.

Rational analysis, previous experiences and ability are factors that point to a systematic approach to the design process. Affinity, creativity and ambition are factors that point to a personal approach. In order to create breakthroughs in innovation processes a combination of a systematic approach and a personal approach seems most viable.

Chapter 8

Chapter 8 provides an answer to the two main questions of the research project. Furthermore, it offers a reflection. The first main question is:

> *What factors enhance the learning processes that lead to gradual improvements and radical innovations?*

The second main question is:

> *To what extent can the factors identified be deliberately applied to design a work environment that promotes innovation?*

In answer to the first main question this chapter presents an overview of the 11 design principles which reflect the factors that enhance learning in innovation practices. Participants and facilitators of innovation practices validated these principles, while experts from different fields performed a formative evaluation. In the design labs a large number of people applied the principles in practice. It transpired that practitioners have a different perspective on the design principles than academic experts. Furthermore people who use the design principles to reflect on their innovation practice were shown to have a different perspective than people who use the principle in the course of a design process. The most salient differences between these perspectives involve principles 3, 4, 5, 8, 10 and 11. These different perspectives are discussed in this chapter. For design principle 10 an alternative formulation was proposed. We suggested renaming this principle as: 'Foster knowledge-creating conversations'. Principle 11 was not recognised clearly enough to justify its existence as a separate principle. Although the principle was found theoretically important (this was confirmed both in the expert meetings and in the literature review), it is not recognisable for people in practice. Their attention is mainly focused on the innovation process itself, and not explicitly on the underlying learning processes.

In answer to the second research question we conclude that the design principles do not have a prescriptive function. The application of the principles in order to design interventions for innovation practices is influenced by six other factors as depicted in the model (Figure 1). A combination of a systematic and personal approach seems the most viable for innovation. The design principles present various perspectives that offer the designer starting points for the design of interventions. There were also indications that designing itself contributed to the achievement of breakthroughs. Going through a design process offers a mental preparation that increases self-esteem, and provides concrete clues to hold on to or to deviate from during the innovation process. In the design process the principles have the function of an 'advance organizer', and at the same time they are conducive to reflection on new situations that occur. Instead of prescriptive instructions the principles offer the designer a supporting framework to balance between the rational and systematic approaches required to achieve breakthroughs in complex processes.

The research started with a conceptual framework in which the learning functions from the corporate curriculum and the development principles for knowledge productive work environments had a prominent place. The parallel study led to a set of 11 design principles. These consisted in part of a new arrangement of the seven learning functions and three development principles, and in part of new factors. The design study revealed six factors that turned out to influence the design process that people go through when they apply the principles. These different findings call for an overall conclusion. This chapter presents this conclusion in the form of an adjusted conceptual framework. The framework does not give a prominent place to the learning functions and development principles as such. The core elements of the learning environment are defined as personal involvement, collaboration between participants, the construction of new meaning and the design of an innovation practice.

The last part of chapter 8 reflects on the theoretical and communicative value of several concepts that were central to this thesis. Furthermore, a reflection is given on methodological issues that are important to determine the quality of the research project, such as the reliability of the self-reports used throughout the research, and internal validity. Subsequently the generalisability of the results is elaborated upon. We suppose that the findings of the research project will be applicable to forms of innovation organized as innovation practices. This means that there must be an intricate question or a problematic situation, a group of people who are motivated and committed to finding a solution, and a concrete manifestation of the problem at a specific place. The results will be not applicable to situations in which individuals did not choose to participate in an innovation practice, or do not have an interest in solving the problem at hand. Moreover, groups need to have the freedom to experiment with new approaches.

Finally, this last chapter provides a reflection on the relevance of the findings for science, practice and society.

Samenvatting

Leren om te Innoveren

Een reeks studies om het leren in innovatiepraktijken te verkennen en versterken

Hoofdstuk 1

Hoofdstuk 1 beschrijft de aanleiding, de centrale vragen en de relevantie van het onderzoek voor wetenschap, praktijk en samenleving. Onze economie is veranderd in een kenniseconomie (Drucker, 1993). Dit proefschrift gaat over leren en werken in een kenniseconomie. In een industriële economie was het vooral de mate van productiviteit die het succes van organisaties bepaalde. In een kenniseconomie daarentegen, is niet zozeer het sneller produceren maar het slimmer werken iets dat organisaties voordeel kan opleveren. In een kenniseconomie wordt het succes van organisaties bepaald door de mate waarin zij in staat zijn nieuwe kennis te ontwikkelen en die toe te passen op het verbeteren en vernieuwen van hun producten, diensten en processen. Het gaat hier niet enkel om innovatie die plaatsvindt in R&D-afdelingen en die gericht is op productontwikkeling. In een kenniseconomie dragen alle leden van een organisatie bij aan het proces van verbeteren en vernieuwen. Juist van procesinnovaties -verbeteringen en vernieuwingen in de manier van werken- valt veel te verwachten.

De zich verder ontwikkelende kenniseconomie heeft invloed op de manier waarop leren in de context van het werk plaatsvindt. Om succesvol te zijn in een kenniseconomie is het leren met de intentie om te verbeteren en vernieuwen van belang. Het is deze vorm van leren die centraal staat in dit proefschrift.
De eerste onderzoeksvraag richt zich op het opsporen van factoren die leerprocessen bevorderen die leiden tot verbeteringen en vernieuwingen. De tweede onderzoeksvraag heeft als doel erachter te komen of we deze factoren zouden kunnen gebruiken om een leeromgeving te ontwerpen die innovatie kan ondersteunen.

Hoofdstuk 2

Hoofdstuk 2 gaat dieper in op de kenmerken van leerprocessen die samengaan met innovatie. Tevens wordt een conceptueel raamwerk ontwikkeld dat het startpunt zal zijn voor de studies die volgen.

Leren dat plaatsvindt met de intentie om te innoveren is een bijzonder soort leren. Lange tijd werd leren in de context van het werk met name serieel georganiseerd: eerst leren, en dan toepassen in het werk. Dit gebeurde bijvoorbeeld in de vorm van trainingen. Een lastig punt met deze vorm van leren was de transfer van de leersituatie naar de werksituatie. Die viel vaak tegen (zie Baldwin & Ford, 1988; Burke & Baldwin, 1999). Onder andere door deze tegenvallende resultaten verschoof de aandacht van opleiden naar leren (Marsick & Watkins, 1990) en speelt werkplekleren een steeds belangrijkere rol; het leren wordt georganiseerd in het werk. Veel van het leren dat plaatsvindt in het werk is erop gericht mensen te ondersteunen om beter te worden in hun werk. Door mee te lopen met een meer ervaren collega bijvoorbeeld kun je de kneepjes van het vak afkijken. Leren met de intentie om tot innovatie te komen verwijst echter naar een nog andere vorm van leren. Dit soort leren is niet zozeer geïnitieerd vanuit het perspectief van leren (hoe kan ik beter worden in deze taak?) maar vanuit het perspectief van het werk (hoe kunnen we dit probleem oplossen?). Dit soort leren vindt plaats zodra er een lastig vraagstuk voorligt of een problematische situatie die al langer speelt en waarvoor eerdere pogingen het op te lossen niet succesvol waren. Bij het oplossen van dat soort vragen vallen leren en werken in feite samen. Je kunt het werk in zo'n geval zien als een rijke leeromgeving (Kessels & Van der Werff, 2002). Het werk is niet gericht op het leren, maar het leren zelf voegt waarde toe aan het werk door het te verbeteren en te vernieuwen. Het begrip kennisproductiviteit (Kessels, 2001b) brengt de noties van leren en innoveren samen. Kennisproductiviteit is het proces waarlangs nieuwe kennis ontwikkeld wordt die bijdraagt aan stapsgewijze verbetering en radicale vernieuwing van producten, diensten en werkprocessen. In het conceptueel kader wordt dit begrip verder geoperationaliseerd met behulp van literatuur. Dit kader bestaat uit de context waaruit innovatie voortkomt, de leeromgeving die nodig is voor het ontwikkelen van innovaties, en de uitkomsten van het innovatieproces. De leeromgeving wordt geoperationaliseerd met de leerfuncties uit het corporate curriculum (Kessels, 1996a) en de ontwikkelprincipes voor het vormgeven van een werkomgeving die kennisproductiviteit bevordert (Kessels, 2001b). De opbrengst van innovatie bestaat niet alleen uit de concrete verbeteringen en vernieuwingen maar ook uit het vermogen dat mensen ontwikkeld hebben om deze tot stand te brengen.

Hoofdstuk 3

Hoofdstuk 3 beschrijft de methode die gebruikt is voor het beantwoorden van de onderzoeksvragen. De methode bestaat uit een reeks van studies die elk andere vragen beantwoorden. De bevindingen uit de ene studie tezamen met de ontwikkelingen in de praktijk waar het onderzoek plaatsvond, bepaalden steeds de aanpak in de erop volgende studie. Centraal in het onderzoek staan innovatiepraktijken. Een innovatiepraktijk is een groep mensen die gemotiveerd is om samen te werken aan een lastig vraagstuk waarvoor de oplossing nog onbekend is. Zij hebben de intentie te komen tot een innovatieve oplossing voor dit vraagstuk.

In de eerste studie analyseerden we 18 reconstructiestudies van afgeronde innovatiepraktijken. De analyse van deze reconstructiestudies leidde tot een bevestiging en verfijning van het conceptueel raamwerk. Het bleek in een reconstructiestudie lastig om grip te krijgen op de leerprocessen. De respondenten hadden er moeite mee om in termen van leren terug te kijken op hun innovatiepraktijk. Hierdoor ontstond de behoefte om enkele nog lopende innovatieprojecten van nabij te volgen. Zo zouden we belangrijke momenten direct kunnen vasthouden en ook kunnen zien waar het proces vastloopt. Hiervoor hebben we in de volgende fase van het onderzoek een parallelstudie opgezet.

De parallelstudie werd gecombineerd met een aanvullend literatuuronderzoek. In de parallelstudie werden 10 innovatiepraktijken van nabij gevolgd. Hierbij legden we het oorspronkelijke conceptuele raamwerk terzijde. Dit had twee redenen. Ten eerste wilden we voorkomen dat we steeds bevestiging zouden vinden voor de elementen uit dat raamwerk en gevoeligheid zouden verliezen voor nieuwe aspecten. Ten tweede wilden we de leerprocessen nauwkeurig volgen. Door concrete situaties in de vorm van 'kritieke leermomenten' op te sporen konden we beter aansluiten bij de belevingswereld van de betrokkenen dan door te werken met de termen uit het conceptueel raamwerk, die voor een deel hun oorsprong vinden in de wereld van leren. De analyse van de bevindingen in de innovatiepraktijken gecombineerd met het literatuuronderzoek leverde een set van 11 ontwerpprincipes op die de factoren weergeven die van belang bleken te zijn bij het leren in innovatiepraktijken. Deze factoren zijn gevalideerd met deelnemers en facilitatoren van innovatiepraktijken.

Na de parallelstudie vonden twee studies gelijktijdig plaats. Ten eerste de expertconsultatie waarin 10 experts uit diverse domeinen in de rol van 'critical friend' meewerkten aan een formatieve evaluatie van de ontwerpprincipes. Ten tweede de ontwerpstudie waarin deelnemers op verschillende manieren werkten met de ontwerpprincipes om zo de prescriptieve waarde van de principes te kunnen onderzoeken. We wilden weten in hoeverre de principes die tot nu toe steeds gevalideerd waren als beschrijvende factoren, ook konden helpen bij het bewust ontwerpen van een werkomgeving die innovatie bevordert. De ontwerpstudie bestond uit vier typen ontwerplaboratoria die elk diverse keren zijn uitgevoerd. In totaal namen 111 respondenten deel aan de ontwerplabs.

Hoofdstuk 4

Hoofdstuk 4 presenteert de opzet en resultaten van de eerste studie. Er is een meta-analyse gedaan van 18 reconstructiestudies van innovatiepraktijken. De cases bestonden uit succesvolle en minder succesvolle vernieuwingen die plaatsvonden in diverse organisaties in Nederland, China en Indonesië. Voorbeelden van cases zijn de introductie van een nieuwe zeeplijn, de ontwikkeling van een tapsysteem voor kleine volumes bier en het samenbrengen van twee productielijnen.

De conclusies van dit hoofdstuk gaan in op de onderdelen van het conceptueel raamwerk. De leerfuncties uit het corporate curriculum en de ontwikkelprincipes voor een werkomgeving die kennisproductiviteit stimuleert, werden duidelijk herkend in de cases. Op drie punten kon het raamwerk verfijnd worden.

Daarnaast concludeerden we dat de aanleiding voor innovatie werd gevormd door ofwel een urgent probleem ofwel een bewuste strategische keuze. Als een urgent probleem de aanleiding was, ervoeren medewerkers in de organisatie een concreet probleem waar al meerdere dingen voor waren geprobeerd en waarvoor men op zoek was naar een innovatieve oplossing. Zo'n concreet probleem zorgde vaak voor de druk en de toewijding die nodig was om tot een oplossing te komen. De oplossingen waren ofwel stapsgewijze verbeteringen ofwel radicale vernieuwingen. Door de tijdsdruk werd gefocust gewerkt. Allereerst werden bestaande oplossingen opgespoord. Als die voorhanden waren, werden ze aangepast aan de situatie waar men mee te maken had. Dit leidde vaak tot verbeteringen. Als er geen oplossing beschikbaar was, moest er iets nieuws ontwikkeld worden. Dit werd vaak gedaan op basis van werkwijzen elders. Deze werkwijzen moesten vervolgens op maat gemaakt worden voor de eigen situatie. Dit leidde meestal tot radicale vernieuwingen.

Innovatie werd ingezet als strategische keuze als een organisatie mogelijkheden zag om efficiënter te werken of de kwaliteit te vergroten. Innovatieprocessen die voortkwamen uit een strategische keuze resulteerden ofwel in radicale vernieuwingen, ofwel liepen vast. Dit heeft mogelijk te maken met een gebrek aan tijdsdruk in deze cases. Door de lage druk hadden deelnemers in deze innovatiepraktijken tijd en ruimte om nieuwe wegen te ontdekken. Als dat lukte, leverde het radicale vernieuwingen op. Echter, als het proces vastliep in een discussie tussen mensen met verschillende perspectieven en er geen druk werd gevoeld om tot resultaten te komen, ontstond het gevaar dat het proces vastliep en de deelnemers afhaakten. Een ander effect van de lage tijdsdruk was dat het soms leidde tot oplossingen in de vorm van concepten die (nog) niet direct toepasbaar waren in het werk.

Hoofdstuk 5

Hoofdstuk 5 beschrijft de parallelstudie en de aanvullende literatuurstudie. De innovatiepraktijken die gevolgd werden in de parallelstudie hielden zich alle bezig met vraagstukken op het gebied van ruimtelijke ordening in Nederland. Het waren zogenaamde 'proeftuinen' geïnitieerd door Habiforum, een netwerk ter bevordering van innovatief en duurzaam ruimtegebruik in Nederland. In deze innovatiepraktijken werken mensen, verbonden aan publieke en private partijen, samen aan vernieuwende oplossingen voor weerbarstige vraagstukken. Voorbeelden van cases zijn de herstructurering van een probleemwijk, de herstructurering van een bedrijventerrein en de ontwikkeling van een meerlagig bedrijventerrein.

Door observaties en interviews werden de ontwikkelingen in vier van die innovatiepraktijken van nabij gevolgd. Zes andere innovatiepraktijken volgden we van een grotere afstand. De dataverzameling was erop gericht doorbraken op te sporen. Doorbraken worden in dit onderzoek gezien als de 'kritische leermomenten' van een innovatiepraktijk; het zijn veranderingen in het denken en in het handelen van de betrokkenen die leidden tot een stap voorwaarts in de innovatiepraktijk. De veronderstelling was dat elke innovatie tot stand is gekomen door een opeenvolging van doorbraken. De analyse van de doorbraken combineerden we met een literatuurstudie op de terreinen innovatie, leren en meer specifiek het domein van probleem-oplossen. De analyse leverde 12 thema's op. Deze thema's werden verwoord als ontwerpprincipes. Na een validering van deze principes met deelnemers en facilitatoren van innovatiepraktijken werd het een set van 11 principes:

11 Ontwerp-principes

1. Formuleer een urgent en intrigerend vraagstuk
2. Ontwerp een nieuwe aanpak
3. Werk vanuit individuele drijfveren
4. Maak ongewone combinaties van materiedeskundigheid
5. Werk vanuit wederzijdse aantrekkelijkheid
6. Werk vanuit kracht
7. Creëer samen iets
8. Verleid tot het zien van nieuwe signalen en het geven van nieuwe betekenissen
9. Verbind de wereld binnen de innovatiepraktijk met de wereld daarbuiten
10. Besteed aandacht aan het sociaal communicatieve proces
11. Ondersteun actief de ontwikkeling van bekwaamheden

De respondenten die meededen in de valideringsstudie bleken in staat de belangrijkste doorbraken in hun innovatiepraktijk te beschrijven aan de hand van de principes. Het werd ook duidelijk dat de set principes geen elementen miste die nodig waren om de doorbraken te beschrijven. Twee principes bleken niet eenduidig te zijn: principe 10 en principe 11. Hoewel respondenten principe 10 belangrijk vonden, gebruikten ze het niet om doorbraken die zich voordeden in hun innovatiepraktijk te beschrijven. Dit zou kunnen komen doordat respondenten dit principe vaak associëren met het gehele innovatieproces. Het innovatieproces bestaat uit een groep samenwerkende deelnemers die voortdurend interacteren. In dat licht bezien, hebben alle gebeurtenissen met het sociaal communicatieve proces te maken. Principe 11 werd door respondenten niet herkend in hun eigen innovatiepraktijk. Dit zou te maken kunnen hebben met de formulering van dit principe. Het ontwikkelen van competenties wordt misschien geassocieerd met het wegwerken van tekortkomingen. Dat is geen aantrekkelijk perspectief. Het zou ook kunnen komen door de aard van het principe. Waar de andere principes direct betrekking hebben op het innovatieproces, is dit in feite een 'meta-principe' omdat het naar het totale innovatieproces verwijst. De valideringsstudie leidde ook tot een beter zicht op de toepassing van de principes en de onderlinge samenhang.

Hoofdstuk 6

Hoofdstuk 6 beschrijft de resultaten van de expertconsultatie. Aan deze expert meetings namen drie experts op het gebied van leren en veranderen deel, en vier experts op het gebied van innovatie. Voorts waren er nog drie experts uitgenodigd vanwege hun kennis met betrekking tot de inhoud van de cases in de parallelstudie. Dit waren experts op het gebied van stedelijke planning, duurzaamheid en transitiemanagement.

De experts reflecteerden op de inhoud van elk van de principes, de onderliggende mechanismen en de grenzen van de principes. Principes 4, 7, 9 en 10 kregen veel ondersteuning. Het meest kritisch waren de experts over principes 3, 6 en 10. Om de principes te verbeteren raadden de experts aan de samenhang tussen de principes verder te onderzoeken. Deze aanbeveling gaf aanleiding voor een verkenning van de onderliggende thema's. Dit leidde tot drie thema's: het geven van nieuwe betekenis, samenwerken in innovatiepraktijken, en het zorgen voor een leerruimte. Ontwerpprincipe 8 is nauw verbonden aan het eerste thema, principe 5 aan het tweede en principe 11 aan het derde thema. De andere principes lijken in bepaalde combinaties bij te kunnen dragen aan de ontwikkeling van deze thema's.

In de rol van 'critical friend' stelden de experts tevens kritische vragen. In hoofdstuk 6 wordt op deze vragen gereflecteerd. Interessant was de vraag in hoeverre de principes ook toepasbaar zijn in 'normale organisaties'. De thema's macht en leiderschap lijken in innovatiepraktijken een heel andere rol te hebben dan in de dagelijkse praktijk van veel organisaties. Het soort leiderschap in innovatiepraktijken is het best te omschrijven als participatief leiderschap (Manz et al., 2000). Dit is een vorm van leiderschap waarin de 'volgers' zeggenschap hebben over de doelen die worden nagestreefd. Macht in innovatiepraktijken wordt niet bepaald door hiërarchische posities maar door de kennis en expertise van betrokkenen (Toffler, 1990). Het is denkbaar dat organisaties onder invloed van een zich verder ontwikkelende kenniseconomie zullen gaan veranderen. De vorm van samenwerking in innovatiepraktijken zou best kunnen werken als voorbeeld voor organisaties. In plaats van rigide structuren zullen individuele motieven en voorkeuren een belangrijk organiserend principe zijn. En in plaats van invloed gebaseerd op formele posities zal macht op basis van kennis steeds belangrijker worden.

Hoofdstuk 7

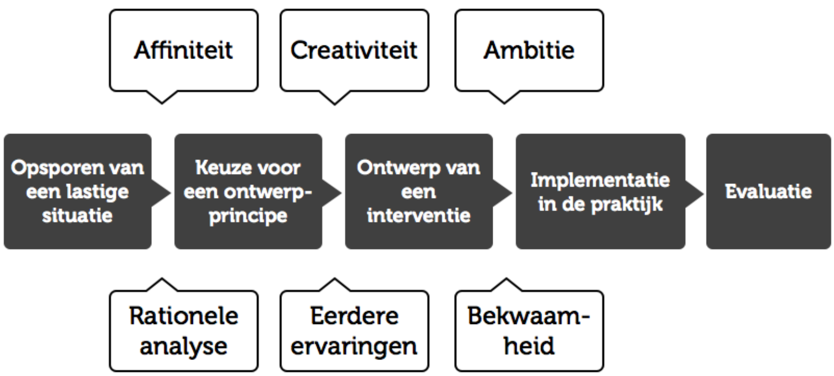
Hoofdstuk 7 presenteert de ontwerpstudie naar de prescriptieve waarde van de ontwerpprincipes, uitgevoerd in vier verschillende typen van ontwerplaboratoria. In elk van de vier typen ontwerplabs worden deelnemers in een omgeving gebracht die ze ondersteunt in het ontwerpen van interventies op basis van de ontwerpprincipes met de bedoeling doorbraken te bereiken in een innovatiepraktijk. De verschillende soorten ontwerplabs boden de mogelijkheid het ontwerpproces in verschillende gedaanten te bestuderen.

In ontwerplabs van type A analyseerden deelnemers een fictieve innovatiepraktijk en ontwierpen ze interventies op basis van de ontwerpprincipes. In labs van type B hebben de deelnemers op basis van een of meerdere ontwerpprincipes een interventie voor hun eigen innovatiepraktijk ontworpen. Deze interventie brachten ze in praktijk en naderhand evalueerden we het effect. In ontwerplabs van type C namen deelnemers deel aan een rollenspel. Dit rollenspel bood ze de kans een ontwerpproces meerdere keren te doorlopen, te experimenteren met diverse principes en zich te bekwamen in het in praktijk brengen van de interventies. Ontwerplabs van type D daagden deelnemers uit te experimenteren met de hele set ontwerpprincipes. Deelnemers ontwierpen diverse interventies voor een lastige situatie. Het in praktijk brengen ervan maakte geen deel uit van ontwerplabs van dit type. De ontwerplabs leverden informatie op met betrekking tot elk van de principes en met betrekking tot de gehele set.

Uit de resultaten blijkt dat de prescriptieve waarde van de ontwerpprincipes beperkt is. Het ontwerpproces blijkt niet zo systematisch te zijn als het vaststellen van een lastige situatie, het kiezen van een ontwerpprincipe, het ontwerpen van een interventie en het implementeren van die interventie in de praktijk. Zes factoren blijken van invloed te zijn op dit ontwerpproces: een rationele analyse, eerdere ervaringen, de aanwezige bekwaamheid, persoonlijke affiniteit, creativiteit, en ambitie (zie Figuur 1).

Figuur 1.

Model van het ontwerpproces en de factoren die het beïnvloeden.



Het meest kansrijke ontwerpprincipe als basis voor een ontwerp wordt niet enkel ingegeven door de aard van de lastige situatie. Hoewel een rationele analyse van de situatie helpt bij het kiezen van een principe, speelt persoonlijke affiniteit ook een belangrijke rol. Als het gaat om het ontwerpen van een interventie werd duidelijk dat de principes zelf geen interventies voorschrijven die nodig zijn om een doorbraak te realiseren. Een combinatie van eerdere ervaring en creativiteit van de gebruiker van het model ondersteunt het proces van ontwerp van een geschikte interventie. Vervolgens bleek dat een goed ontworpen interventie nog geen garantie is voor een succesvolle implementatie. Hierop zijn de bekwaamheden en de ambitie van de persoon die de interventie implementeert van invloed. De persoonlijke ambitie die hij of zij met de innovatiepraktijk heeft, zorgt voor de moed om onconventionele interventies ook echt in praktijk te brengen.

De rationele analyse, eerdere ervaringen, en bekwaamheid zijn factoren die verwijzen naar een systematische aanpak van het ontwerpproces terwijl affiniteit, creativiteit, en ambitie factoren zijn die verwijzen naar een meer persoonlijke aanpak. Om tot doorbraken te komen in innovatiepraktijken lijkt een combinatie van deze twee aanpakken het meest kansrijk.

Hoofdstuk 8

Hoofdstuk 8 beantwoordt de twee hoofdvragen van het onderzoek. Tevens bestaat dit hoofdstuk uit een reflectie. De eerste onderzoeksvraag luidt:

> *Welke factoren bevorderen de leerprocessen die leiden tot verbeteringen en vernieuwingen?*

De tweede vraag luidt:

> *In hoeverre kunnen de opgespoorde factoren doelbewust ingezet worden om een leeromgeving te ontwerpen die innovatie kan ondersteunen?*

Als antwoord op de eerste hoofdvraag geven we in dit hoofdstuk een overzicht van de 11 ontwerpprincipes die de factoren weergeven die leren in innovatiepraktijken bevorderen. Deze 11 principes zijn gevalideerd door deelnemers en facilitatoren van innovatiepraktijken, ze zijn geëvalueerd door experts uit verschillende velden en in de ontwerplabs heeft een groot aantal mensen ermee gewerkt. Er kwam naar voren dat mensen uit de praktijk een ander perspectief op de principes hebben dan academische experts. Tevens bleek dat mensen die de principes gebruiken om te reflecteren op hun innovatiepraktijk anders naar de principes kijken dan mensen die ze gebruiken om interventies mee te ontwerpen. De belangrijkste verschillen tussen deze manieren van kijken komen naar voren bij de principes 3, 4, 5, 8, 10 en 11. De verschillen worden in dit hoofdstuk besproken. Voor principe 10 wordt een herformulering voorgesteld. We stellen voor dit principe te formuleren als: ‘Bevorder gesprekken die bijdragen aan kenniscreatie’. Principe 11 wordt niet duidelijk genoeg herkend om als apart principe te handhaven. Hoewel het principe theoretisch van belang wordt geacht (dit werd bevestigd in de expertsessies en in de literatuurstudie) is het voor mensen in de praktijk niet herkenbaar. Hun aandacht gaat met name uit naar het innovatieproces zelf. Zij zijn niet expliciet gericht op de onderliggende leerprocessen.

Als antwoord op de tweede onderzoeksvraag concluderen we dat de ontwerpprincipes geen voorschrijvende functie hebben. Het gebruik van de principes om interventies in innovatiepraktijken te ontwerpen wordt beïnvloed door zes andere factoren zoals afgebeeld in het model (Figuur 1). Een combinatie van een systematische en persoonlijke aanpak lijkt het meest kansrijk voor innovatie. De ontwerpprincipes hebben hierin de functie van verschillende perspectieven die de ontwerper diverse aanknopingspunten geven voor het ontwerpen van interventies. Er zijn ook aanwijzingen dat het ontwerpen zelf bijdraagt aan het creëren van doorbraken. Het doorlopen van een ontwerpproces biedt een mentale voorbereiding die enerzijds zelfvertrouwen geeft en anderzijds concrete handreikingen oplevert om tijdens het innovatieproces aan vast te houden of juist van af te wijken. In dit ontwerpproces vervullen de principes de functie van een 'advance organizer' en helpen ze bij het reflecteren op nieuwe situaties die zich voordoen in de praktijk. In plaats van prescriptieve instructies vormen de principes de ondersteuning voor de ontwerper om te balanceren tussen een rationele aanpak en een persoonlijke aanpak die beide nodig zijn om tot doorbraken te komen in weerbarstige processen.

Het onderzoek startte met een conceptueel raamwerk waarin de leerfuncties uit het corporate curriculum en de ontwikkelprincipes voor kennisproductieve werkomgevingen een centrale plaats hadden. De parallelstudie leverde een set van 11 principes op. Dit was deels een herordening van de leerfuncties en ontwikkelprincipes en bevatte deels nieuwe elementen. In het ontwerponderzoek bleek dat er zes factoren van invloed zijn op het ontwerpproces dat mensen doorlopen in het toepassen van de principes. Deze veelheid aan factoren vraagt om een overkoepelende conclusie. Die wordt in dit hoofdstuk gepresenteerd in de vorm van een aangepast conceptueel kader. De belangrijkste aanpassing betreft het onderdeel van de leeromgeving. Hierin staan niet langer de leerfuncties en de ontwikkelprincipes centraal. De kernelementen van de leeromgeving zijn gedefinieerd als persoonlijke betrokkenheid, samenwerking tussen deelnemers, geven van nieuwe betekenis, en het ontwerp van een innovatiepraktijk.

In het laatste deel van dit hoofdstuk wordt een reflectie gegeven op de theoretische en communicatieve waarde van enkele concepten die in dit proefschrift centraal staan. Daarnaast vindt een reflectie plaats op enkele methodologische kwesties die van belang zijn voor het bepalen van de kwaliteit van dit onderzoek, zoals de betrouwbaarheid van de zelfrapportages die gedurende het onderzoek gebruikt zijn en de interne validiteit. Ook wordt de generaliseerbaarheid van de resultaten aan de orde gesteld. We veronderstellen dat de bevindingen uit het onderzoek toepasbaar zullen zijn voor vormen van innovatie die georganiseerd zijn als innovatieprakijken. Dat betekent dat er een lastige vraag of problematische situatie moet zijn, een groep mensen die graag een oplossing voor het vraagstuk wil vinden en een concrete manifestatie van het probleem op een bepaalde plaats. De resultaten zullen niet toepasbaar zijn in situaties waarin individuen niet zelf gekozen hebben voor deelname in zo'n innovatiepraktijk of als ze weinig belang hebben bij de oplossing van het vraagstuk. Daarnaast moeten de groepen de vrijheid hebben om te experimenteren met nieuwe aanpakken.

Ten slotte reflecteren we op de relevantie van de bevindingen voor wetenschap, praktijk en maatschappij.

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Appendix A – Format used for the thick descriptions

Thick description of [name innovation practice]

Description by [name of researcher]
Updated until [date]
Based on the following documents:

Date	What	By whom	Meant for whom
	[e.g. Logbook notes]		
	[e.g. Personal notes]	[e.g. name facilitator]	[e.g. name facilita-tor]
	[e.g. Preliminary interview]	[e.g. name researcher]	[e.g. purpose of research]
	[e.g. Description of breakthrough]		
	[e.g. Invitation for the first meeting of the innovation practice]		
	[e.g. Telephone interview prior to the first meeting]		
	[e.g. Observations]		
	[e.g. Telephone interview to reflect on the meeting]		

Problem

[Description of the central problem in this innovation practice]

History of this innovation practice

[Description of the developments that led to this innovation practice]

Participants in this innovation practice

[Enumeration of participants in the innovation practice]

Events	**Reflections of participants in the innovation practice**
[Factual description of events]	[Reflection on this event of participants of the innovation practice]
[Description of breakthrough using the format for thin descriptions (see Appendix B)]	

Appendix B – Format used for the thin descriptions

Innovation practice:	
Who described this breakthrough:	
Date:	
Report by:	
What led to this breakthrough:	
Description of the breakthrough (what happened, who were involved):	
Effect of the breakthrough (for the people involved, the process, the innovation):	
What were the most important aspects of this breakthrough:	
What meaning could we give to what happened:	
What questions does it evoke:	
What are next steps:	

Appendix C – Interview questions used in the reconstruction studies

The questions below were used to construct interview guides which were used in the reconstruction studies that were part of the meta-analysis.

1 .Building the story

Key questions to get an overview of the case:

- What is the innovation that was achieved? Was it a product or process innovation, or was it an innovation of the way of working?
- Is it best characterised as an improvement (achieved by building on what was already present) or as an innovation (radically breaking with the past and deviating from tradition)?
- What makes this innovation/improvement important to the organization? (e.g. in terms of value, outcomes, process)
- Who was involved and in what role (e.g. initiator, coordinator, developer, client, user, inspirer, …)? Who were the key players?
- What was the reason the process got started? Who made the first step?
- How did it get started?
- Looking back upon the process: are there main staged or phases that can be identified? What were these?
- What were the most critical situations and events that took place?
- What was the role of learning in the various stages of the process?

2. Going in-depth

Outcomes for the organization

- What are the effects of the innovation/improvement for the people involved, for the organization, and for the clients of the organization? How is this noticeable?
- What are the significant characteristics of the innovation/improvement?
- What and for whom are the short-term and long-term profits of the innovation/improvement?

Knowledge and learning processes that were crucial for creating this outcome

Knowledge needed:
- Which knowledge and which competences were crucial to realise the change? How and when did you find out which knowledge was crucial?
- Were there people in your organization who had this knowledge? How did you find out if this was the case?
- Which expertise did you get from outside?

Identifying, gathering and interpreting information:
- What did the people involved do to find and acquire relevant information and to process this information?
- How did the people involved inform each other about relevant information? How did they make their knowledge and information accessible for others?
- What tools and instruments were used to track down relevant information? Which tools worked well and which didn't?

Using this information to develop new competences:

- What are you/the group/the company able to do now, that you weren't able to before?
- Which methods and tools were used to create new knowledge?
- What helped the process of knowledge creation and what hindered this process?

Applying new skills to improve or innovate:
- How was the newly created knowledge applied in the process? How did this help the innovation/improvement?
- Which measures were taken to support the use of the new knowledge in day-to-day practice?
- What tools and instruments were used to track down relevant information? Which tools worked well and which didn't?

3. Corporate curriculum

Subject matter expertise:
- What subject matter expertise played a role in the process?

- When did you find out what expertise was needed, and how did you involve people with this expertise?
- How did you know what expertise was available in the group of people involved, and what expertise needed to be developed?
- How did you make use of available expertise?
- How did you develop the expertise that was not available from the beginning?

Problem-solving skills:

- Which problems and challenges did you encounter during the process?
- How did you deal with these problems?
- Did you solve the problems that you encountered individually or collaboratively?
- Did you experiment with new ways of dealing with problems?
- How was experimentation stimulated?

Reflective skills and metacognitions:

- Were there, during the process, moments to stand still and reflect? How were they organized?
- What methods did you use to reflect? What were the results of the different methods?
- What was the subject of reflection (e.g. the content, the way of working, the learning process)?
- What methods did you use for the development of knowledge and competences? What did these methods result in?
- Did you experience enough attention for each other and safety to give and to receive feedback?

Communication skills:

- What was the role of communication in realising the innovation/improvement? What aspects of communication were strongly developed? Which difficulties occurred in the communication? How did this influence the process?
- Which social and communication skills were crucial in the change process? How were they developed and used?
- How did you gain access to each other's knowledge? What were the most fruitful moments and methods for exchanging knowledge?
- How were you stimulated to bring in your knowledge and ideas?
- How did you involve stakeholders outside the project team?

Self-regulation skills:

- Who was very motivated to take part in the change process? How did you notice? Why were they so interested?

- When were there moments in which there was much energy in the process? What had generated this energy?
- When were there moments of stagnation? What was the reason for this? How did you deal with this?
- Which factors have stimulated or inhibited your motivation?
- Did you have influence on your own contribution to the innovation practice (e.g. on your role or task)? What were the possibilities to align your contribution with your personal interests?
- What caused you to continue when you experienced difficulties? What prevented you from stopping or quitting?

Peace and stability:

- Was there enough time to deepen the understanding of the important questions and issues during the process? How did you create the time to do this? What has helped you in doing this and what has hindered you?
- Was there enough time during the process for you to stand still and reflect on the process? How did you create the time for this?
- Did you take the time to incorporate new ideas and insights in a structural way into processes, products and services?

Creative turmoil:

- What has helped you to let go of the existing approaches and solutions?
- What were the risks involved? Who would have felt the consequences?
- Why was the innovation/improvement important for you? What would have been the implications for you if it wouldn't succeed? Did you realise this during the process?
- Were you stimulated and invited to bring in new ideas and approaches? What stimulated this?
- Did you work on questions that needed creative solutions? Where did these questions come from?

The extent to which the work environment supports knowledge productivity

How did the work environment support co-operation based on reciprocal appeal?

- Which characteristics of the organization stimulated learning from and with each other? What characteristics hindered the this?
- Which opportunities did you have to influence their work and contribution in this process? How did you use these opportunities?
- Did you experience the process as one in which there was reciprocal appeal? Why? What stimulated this and what hindered this?

How did the work environment encourage people to find and develop their passion?

- Where did your drive to participate come from?
- Were there setbacks in the process? How did you deal with these setbacks, and what helped you to overcome them?

How did the work environment tempt workers to exploit the possibilities to be knowledge productive?

- How did the organization invite and stimulate you to be active in this change process?

4. Context and interventions

Which measures and interventions influenced the innovation/improvement?

- What were the most important interventions and measures in the change process? What was the nature of these interventions? What effect did they have?
- Who was initiating interventions and why? Who else was involved in doing interventions?
- Which approach was taken in designing and implementing interventions? How did this work out?
- What helped and what hindered the implementation of the interventions?

Which characteristics of the work environment influenced the realisation of the desired change?

- To what extent did the following characteristics of the work environment influence the process? What helped and what hindered? How important was this for realising the innovation/improvement?
- structure of the organization
- culture of the organization and the country
- management style and the way of decision making
- the way the work is organized (work processes, tasks, responsibilities, information flow, …)
- available resources
- formal and informal sources of power and influence

Where did the necessity to invest in the change come from?

- What instigated the desire and actions to change? (e.g. drive, threats, strengths, weaknesses, opportunities,…)

- Did this come from internal and/or external developments?
- Who were the first to address this and draw attention to this?
- What caused the process to get started?

Appendix D – Overview of the design principles and the way respondents in the validation study gave meaning to them

1. Formulate an urgent and intriguing question

Respondents refer to questions that are either urgent or intriguing. They called a question 'intriguing' if seemingly contradictory combinations must be made. E.g. Combining innovative architecture and small-scale. They called a question 'urgent' if:

- There is a shared ambition to restructure a region or area that is not yet realized. It could happen for instance that despite the plans that were made, the phase of implementation isn't started. This was typically the case when the ideas the plan consisted of originated from a compromise in which none of the people involved could recognise their own ambition.
- The situation would escalate if no one takes action. E.g. The department of town and country planning threatened to reject all the plans submitted by the local authority of a large city.

2. Create a new approach

Design principle 2 describes something that for the respondents lies at the core of what they're doing. Often, for them the reason to start an innovation practice was because the procedures normally used (decision groups or project groups) didn't work out for the problem they were facing. For them, design principle 2 lies at the heart of their innovation practice. Respondents describe three ways of creating a new approach:

- By using new ways of working and breaking with traditional routines (e.g. instead of a regular meeting with a chair, an agenda and someone who takes the minutes, the meeting is a personal conversation in which the facilitator interviews all the attendees and asks what they would like to contribute).
- By involving parties that are usually not involved in these kinds of processes or that are usually not involved in such an early stage (e.g. involving students to collaborate with, or interviewing inhabitants of the area where they want change. Other examples are asking firemen in a very early stage about the best escape routes instead of asking them to contribute after finishing the plan and then not being able to use their input effectively).

- By focussing on individuals rather than on 'officers' representing an organization, municipality or pressure group.

The respondents emphasise mainly concrete ways of working they used. In only one innovation practice participants developed an overall approach: they made a distinction between four phases in the process. Phase 1: Collecting a group of people who were motivated to work on the central issue of restructuring this particular district. This phase continues even when the next phase will start. Phase 2: Working from four themes which are related to the content of the central issue in order to explore everybody's ambitions. Phase 3: Meetings that consisted of personal conversations. These conversations concerned everybody's individual motives and the way their own patterns of behaviour hampered progress in realising their ambitions. Phase 4: Going back to the issue of the district in order to take action.

3. Work from individual motivation

For the respondents the most important element of this principle consists of a focus on individuals, on persons behind the functions. Focussing on individuals helps to determine someone's true motivations. Respondents put more emphasis on tracing individual motives than on developing or connecting them. Respondents work on these individual motives in mainly three ways:

- Discussing what everyone finds important, what they would like to see as a result and what is needed to reach that result.
- Discussing the personal affection the participants have with the region that they are working for.
- A facilitator who makes an inventory of all the personal motivations and who looks for ways of connecting them.

4. Make unusual combinations of subject matter expertise

Examples relating to design principle 4 (Make unusual combinations of subject matter expertise) are focused on bringing in or developing expertise or finding a new perspective.

Bringing in or developing missing expertise:

- People from outside the innovation practice are invited in order to bring in missing expertise (e.g. about developments in a certain region; ecology).
- People from different disciplines within the innovation practice collaborate and make products.

Finding a new perspective:

- Combining diverse concepts (like nature and health) in order to have a new perspective on the central question.
- Bringing in a new concept (e.g. working with culture as a central concept rather than economy. The perspective 'economy' didn't bring any new or unconventional perspectives, but the concept culture did).
- Bringing in a new perspective (e.g. an architect, an artist, an expert from outside, who doesn't see the central problem as a problem but as a chance to make something special of the district).

5. Work from mutual attractiveness

The core element of this principle is interpreted as uncovering the different interests and making a connection between them. Respondents give examples of how they recognise this principle:

- They recognise mutual attractiveness between people in the innovation practice and people working in relating fields or projects. Facilitators sometimes try to make these relationships visible.
- The extent to which the innovation practice is attractive for certain parties to participate in (this was the case when for instance a research organization saw an opportunity to develop a practical model by participating in the innovation practice).
- Mutual attractiveness among participants within the innovation practice (one participants said: "seeing the mutual attractiveness makes it easier for people to think along with others who have an ambition that seems to be opposite of their own. Simply because it is in your own interest to do so" another participant said: "because people knew what they really did it for, they found it easier to collaborate with each other and to support initiatives of others in the group").
- Mutual attractiveness in the form of negotiation. (this was the case when one of the officers of a municipality wanted to participate in the innovation practice and was therefore prepared to slightly change her plans. But, a certain number of houses had to be built and she didn't let go of this number. The other participants in the innovation practice agreed with this because she gave in on other aspects).

6. Build on strengths

Design principle 6 (Build on strengths) is referred to in various ways. Respondents mention several actions that can all be seen, reflecting on them with hindsight, as deliberate actions to improve the strengths of the people involved and to work with successes:

- Celebrating breakthroughs with a small treat (pie, party, etc…).

- Giving each other compliments either explicit or implicit. Some of the respondents reported that these compliments were often toned down since people are not used to receiving and giving each other compliments.
- Reflecting upon the obtained results by analysing the achieved successes. The facilitator often initiated this kind of interventions.

7. Create something together

This principle is always taken literally: respondents interpret it as getting something done together: a product, a plan, a paper. In doing this, people experience an impulse for collaboration and something to hold on to. One of the respondents describes creating something as antithetical to a consumerist attitude: “The project team of the municipality became creators instead of consumers. They made sketches in which they took into account all the aspects (green areas, infrastructure, recreation, etc…), this helped to work in collaboration instead of in competition”.

- In innovation practices in which participants created things together, like a workshop with a scenario, a project plan or an image of the region they were restructuring, it immediately gave an impulse to the collaboration.
- In innovation practices in which participants were not ready for creating something together (e.g. because it was not yet a real group that could do something together), participants created things individually.

8. Entice to see new signals and to give them new meaning

Starting to think from opportunities and possibilities, instead of threats and risks is what most people take from this principle. Things that were mentioned that helped to become aware of new signals and to re-interpret the actual situation:

- Listening to a personal story. For instance in one innovation practice the participants saw the ministry of defence as an obstructing party for their plans with the city. A participant from Portugal then said that he was struck by the gloominess of the building of this ministry. He said: “we celebrate our institutions. We would link a museum to that building, a museum for peace”. That story brought about a change in the way the group looked at the participation of the ministry. They wanted to be proud of these people and therefore they decided to be open for other impressions than only their first.
- Using a new approach that entices people to see a new perspective. For example in one innovation practice they used a scenario technique in order to design new perspectives for the future.
- Collaboratively give meaning to something that has happened. For instance in one innovation practice the participants had a negative experience when

guests they invited from the centre for employment and income didn't want to collaborate with them. The participants in the innovation practice were very disappointed. Only after an intervention of the facilitator they were able to code this event differently. After this intervention they could think: ok, the fact that these people don't want to take initiative in this project, offers us the opportunity to take an initiating role.

9. Connect the world inside the innovation practice to the world outside

Respondents find this principle important: without the connection to the outer environment, the plans and product developed in the innovation practice will have less meaning. In order to connect activities inside the innovation practice to the regular planning process outside the innovation practice, the following actions can be used:

- Inviting officials and project managers for a meeting.
- Asking people from the local governance to participate in the innovation practice .
- Helping each other in the innovation practice to make the connection between the innovation practice and people's own work context (e.g. by asking: "John, does your direct manager still has confidence in your work in our group?")
- Spotting interesting developments in other places and connect these to the process of the innovation practice.

10. Generate creative turmoil

Respondents most often mention creative turmoil that comes into being when something unexpected and threatening happens (e.g. an unexpected party suddenly comes up with a plan that must be reacted upon quickly). Sometimes, respondents mention creative turmoil that is regulated by their own action (e.g. after having set a deadline).

11. Pay attention to the social and communicative process

Respondents mention this principle in very different ways, such as: "Communication is central", and "We worked to make it an open and positive atmosphere pointed at constructive contributions of the participants". Respondents describe interventions done by the facilitator as an important aspect of this design principle. Facilitators can stop the process during a meeting and do an intervention in order to give information, to build trust, or to give attention.

12. Actively support the development of competences

Respondents refer to this design principle as:

- Something that is needed to make the gains of this innovation practice available for other contexts. E.g. by organizing reflection sessions in which insights are shared with others.
- Something that doesn't need specific attention but that is developed while working together in an innovation practice.

Respondents found it difficult to give concrete examples from their own innovation practice. Respondents who had a clear picture of this design principle saw the competences either as something that must be developed and owned by the people working in the innovation practice, or as the outcome of an innovation practice that must be transferred to others.

Appendix E – Experts that took part in the expert meetings

Area of expertise	Expert	Affiliation	Moment of consultation
Learning and change	Prof. Dr. P.R.J. Simons	Utrecht University	April 2007
	Prof. dr. F.A.J. Korthagen	Utrecht University	
	Dr. M.J.J. Coenders	Leerarchitectuur	
Innovation	Dr. A.B.M. van Poucke	DBC Onderhoud	May 2007
	Prof. Dr. M.H. Huysman	Free University of Amsterdam	
	Dr. S.J.M. Harkema	The Hague University of applied sciences	
	Prof. Dr. J.C.Looise	University of Twente	July 2007
Urban planning	Prof. Dr. G.P.M.R. Dewulf	University of Twente	June 2007
Sustainability	Dr. N.G. Faber	University of Groningen	June 2007
Transition management	Dr. A.M.C. Loeber	University of Amsterdam	June 2007

Appendix F – Findings per design principle that the expert consultation revealed

This Appendix contains an overview of the findings per design principle that the expert consultation revealed. These findings refer to the content of the design principles, the mechanisms that underlie the design principles and the boundaries of the design principles. For some design principles the experts also gave tips for working with them in practice. Lastly, for each of the design principles the questions that were asked are presented.

1. Formulate an urgent and intriguing question

Comments with respect to content:

- The principle is formulated as if urgent and intriguing were attributes of a question. Couldn't it differ per person whether a question is found urgent or intriguing. It could be a combination of the question itself (different and opposite interests at stake), personally felt involvement and a kind of pressure or urgency that stems from the organization (an existential threat, the idea that going further on the same track would cause damage).

Comments with respect to underlying mechanisms:

- Creating creative turmoil can also stop the process (see also: Argyris on defence mechanisms).
- The self-determination theory (see also: Deci & Ryan) refers to competence, autonomy and relatedness. If one of these factors doesn't function well, a process of creation begins. Could that be the start of creative turmoil?
- See also Dorothy Leonard on creative tension.

Boundaries:

- Is it necessary for *all participants* to feel some sort of restlessness in order to be innovative?

Tips:

- Don't put too much emphasis on the goals that were set in advance, but focus on a subject that invites people to join the process.
- It works well to translate the goal into questions that appeals to the people you want to involve (see also: Grin).

- In order to develop a question that could form the starting point for innovation, it could work to start with an organization-wide 'scan'.

2. Create a new approach

Comments with respect to content:

- This principle is about breaking with hindering structures, thinking frames and routines.
- The principle says that you design the new approach along the way. That sounds as if one doesn't think about it. It can't be meant like that.

Comments with respect to underlying mechanisms:

- The principle refers to the design of a space for learning.
- The design of a new approach is an iterative process. It is not a linear but rather a cumulative process. See also Gary Cooper who described innovation in five phases.
- See also methods of software development (e.g. extreme programming, prototyping, rapid application development).
- It is not possible to separate thinking and doing (See also: Schön on reflection in action)

Boundaries:

- Should the way of working always be renewed? One shouldn't design a new way of working, only for the sake of its newness. One should reflect on the existing approach and break with hindering structures.
- Maybe this principle is especially important in the field of urban planning and space use (the context in which the innovation practices that were studied took place).

Tips:

- What could help is to develop a simulation game that people could play at the beginning of the process. This can help them to think through what could happen along the way.
- Involve a panel and market parties in the development of the approach (see also: Buys).

Questions:

- Does this principle refer to organizing coincidences and facilitating serendipity? (see also: Latour).

3. Work from individual motivation

Comments with respect to content:

- What is meant with motives? Are motives and motivation similar to the concept passion?

Comments with respect to underlying mechanisms:

- Individual motivation is in itself not enough to realise a change in the system.
- The link between individual commitment and the goal of the innovation practice is very important.

4. Make unusual combinations of subject matter expertise

Comments with respect to underlying mechanisms:

- By combining elements that are usually not combined, the necessary creativity comes out.
- This principle helps to break through existing patterns to prevent from a tunnel vision and to connect different knowledge domains (and thus people).

Boundaries:

- The risk of metaphors is that they easily take on a life of their own.

Tips:

- Start with the craftsmanship that is present in the innovation practice.
- Work on boundary practices. Legitimate peripheral participation is only one form (see also: Wenger).
- Work in multidisciplinary teams.

5. Work from mutual attractiveness

Comments with respect to content:

- The design principle refers to:
    - mutual dependency,
    - reciprocal relations,
    - relations
- Trust is needed to realise innovation. Creating too many formal agreements will not promote innovation.

- One needs both a motive to collaborate (relational) and a win-win situation (the transaction).

Comments with respect to underlying mechanisms:

- Two respondents argue that the mechanism behind this principle refers to mutual dependency. Others state that open innovation is important and that a situation in which organizations are not dependent on each other is desirable. Trust and reciprocity are crucial for innovation.
    - See also: Rob van Tulder
    - See also: research that investigates the relation between trust and the format for creating formal agreements.
    - See also: Bart Nooteboom
    - See also: Maura Soekijad
- People need a motive to collaborate.

6. Build on strengths

Comments with respect to the content:

- The relationship between two main aspects of this design principle is unclear: the reflection on achieved successes (relating to the group) and building on talents (relating to the individuals).
- Building on strengths means: connecting to previously developed knowledge and skills. Reflecting on achieved successes means: reflection on what has been done before.

Comments with respect to underlying mechanisms:

- There is a tension between using (or: falling back on) past successes and innovation. If you keep on doing what you did, it will never lead to innovation. Using past successes could lead to laziness and to repetition of what has been done before. Learning from mistakes and falsification are very important as well.
- In the phase of dispersion, this principle is very important. For the learning process the connection with what one already knows and can, is very important.

Boundaries:

- Innovation is a very insecure process. Feeling insecure might not help to build on your own strengths. How does that work?

7. Create something together

Comments with respect to content:

- There is a relationship between this principle and design principle 4 (Make unusual combinations of subject matter expertise), namely the creation of something on the boundaries of communities.
- The principle might be broader than only 'making' something. It could also refer to doing something, investigating, consulting, solving problems.
- This principle refers to the fact that one must go further than a polite conversation (see also: Scharmer, see also: Yanow).

Comments with respect to underlying mechanisms:

- Experts made the association with learning in which natural situations (e.g. refurbishing a car) are used (see also: Alex van Ernst).
- Conflicts can arise in the process of making something. Inspiration and ideas can arise from conflicts (see also: Akkerman).
- The necessity for action leads cognitive development (see also: Von Glaserfeld).

Questions:

- Why is it so important to make something *together*?

8. Entice to see new signals and to give them new meaning

Comments with respect to content:

- Comparing the content of this principle to the organizational learning cycle (see also: Nancy Dixon), the absence of some phases is striking (e.g. recognising signals, analysing them).
- The principle seems very conceptual. It explains a process theoretically, but not how it works in practice.
- The principle should also refer to the process of giving meaning to prior knowledge and interpreting signals that come from outside.

Comments with respect to underlying mechanisms:

- The process this design principle refers to, does not occur straight away. Rather, it goes together with negotiation about meaning.
- See also: Von Glaserfeld
- See also: Ralph Stacey and Hebert Mead

Boundaries:

- Often people *think* that they are open to new ideas from outside, but actually often they are not. People's openness towards new ideas might be related to:

- their personality (some people are more likely to develop something new whereas others like to further develop existing solutions)
- the phase of their life they're in (young people might be more open toward new ideas)
- time pressure (developing a new path takes some time)
- the context (when an old or experienced employee leaves, people experience room for innovation).

Questions:

- Does this principle relate to recognising signals from an undercurrent?

9. Connect the world inside the innovation practice to the world outside

Comments with respect to content:

- This principle mentions the link between the innovation practice and the 'outside' world. This means that it is not enough to develop a new solution, it also needs further development. This is confirmed by other respondents. Often, they state, in the context of innovation, people only have attention for the first phase, to developing something new.
- The 'outside' world has actually an active role. They not only 'adopt' and 'follow' or 'implement'. The word 'adoption' suggests that.
- The participants in the innovation practice must follow what happens outside and make the effort to connect to that.

Comments with respect to underlying mechanisms:

- For knowledge transfer contextualisation, decontextualisation, and recontextualisation is necessary.

Boundaries:

- The connection to the outside world should not be made too early in the process. At the beginning of the innovation process it is necessary to let go of the context. Holding on to the context could make it difficult to realise something new. The context can even hinder the process of innovation in that phase.

Tips:

- Boundary objects can help to connect to each other (see also: Carlile).
- When implementing the innovation it is necessary to connect to the competences of people within the context. It is important to define the innovation in terms of concepts instead of telling people what they should *do* differently.

10. Pay attention to the social and communicative process

Comments with respect to content:

- This principle seems to be a truism.
- This principle shows that there are two perspectives to look at innovation processes: a content perspective and a process perspective. This is important for participants in innovation practices to realise.
- The communicative skills are not isolated skills that could be learned outside the innovation practice.

Comments with respect to underlying mechanisms:

- Is it necessary to actively initiate a learning process to acquire these communicative skills? Or is it enough to be occupied with the content of the particular innovation, and will people then learn these skills spontaneously?
- The quality of the interaction is important. Reflection and generative dialogues are often lacking (see also: Van de Ven).

Boundaries:

- Is this specifically true for the context of the present research, in which aldermen and engineers must learn to collaborate?

11. Actively support the development of competences

Comments with respect to the content:

- If people organize innovation as a learning process, then the innovation process contributes to the ability to innovate.
- This is an abstract principle.
- The principle does not tell what must be done in order to realise the development of competences.

Comments with respect to underlying mechanisms:

- People do not develop the ability to innovate automatically. Structural reflection is necessary for that.
- Exercising something (e.g. innovating) makes you automatically smarter ('learning by doing').
- Innovation is a necessary condition to develop the competences necessary for innovation, but it is not sufficient (see also: Cohen & Levinthal).

Tips:

- Reflection can be stimulated by holding on to the lessons learned.

- Reflection helps to see patterns. Seeing patterns is necessary for breaking them through.

Appendix G – Overview of design labs and period of data gathering

Type of design lab	Participants	Period of data gathering
A	9 Dutch students in the field of HRD	May 2005
	30 international researchers in the field of KM	August 2006
B	8 Dutch facilitators of innovation practices	May 2006-January 2008
C	9 Dutch facilitators of innovation practices	January 2008
	7 Belgian practitioners in the field of HRD	April 2008
	9 Dutch practitioners in the field of HRD	April 2008
	7 Dutch participants in an innovation practice	May 2008
D	12 Dutch practitioners in the field of HRD	May 2008
	20 Belgian practitioners in the field of HRD	May 2008

Appendix H – Description of type A design labs

Type A design labs, in which participants worked with a given case, consisted of four consecutive steps. These are summarised in Table H1.

Table H1

Protocol for type A design labs

No	Activity	Instrument	Result
1	Getting to know the context of the innovation practice Five actors presented a case by reciting five monologues. The characters, portrayed in the monologues, are involved in a town planning process. They present their experiences and reflections in the innovation process. These monologues offer the participants the concrete context of an innovation practice.	Case presentation by means of five monologues.	Participants learn about the innovation practice they will be working with. The presentation in the format of enacted monologues offers a real life involvement of the case study, which enhanced the commitment to participate in the design activities that followed.
2	Analysis of the innovation practice and definition of difficult situation Using the context that is presented in the monologues, the participants analysed this case using the set of design principles. The respondents worked in groups of 3-4 people. In total, 12 circular scales were filled out. They also defined the difficult situation that they wanted to contribute to. For this purpose they were asked: imagine that you are the facilitator of this innovation team: What design question is at hand? What does this team need?	Each of the 11 design principles was placed on a card that the participants could position in circular scales.	Participants have made an analysis of the innovation practice with help of the 11 design principles. The placement of the cards on the circular scales was preceded by deliberation among the participants. They made their impressions and interpretations explicit.

Table H1 (contined)

Protocol for type A design labs

No	Activity	Instrument	Result
3	Choosing one or more design principles and designing one or more interventions The participants chose one or more design principles to work with and they were asked to design interventions that could enhance the process of knowledge productivity within the presented context.	Handout with a short overview of the design principles. Report sheets with supporting questions.	On the basis of the supporting questions the participants evaluated the design principles and deliberated on possible interventions. This led to interventions that were proposed to improve knowledge productivity in the given case study.
4	Discussion and closure The workshop was closed by discussing the interventions that the participants designed. The participants were also asked how they experienced the workshop and if they had any suggestions for improving the lab.		

Selection of participants

9 Students in the field of Human Resource Development (HRD) and 30 researchers in the field of Knowledge Management (KM) attended type A design labs. These respondents all have affinity with the subject of knowledge productivity and innovation and were eager to learn more about the design principles. Their motivation was an important reason for working with them.

Instruments

Four instruments were used:

- The monologues: The monologues describe five characters involved in an innovation practice in the context of innovative space use in a town planning process. The monologues are dramatised texts, based on the data that was collected in the reconstruction studies and parallel study. Figure H1 summarises the context of the monologues and the characters that play a part.
- Circular scales: As a data collection instrument a set of circular scales was applied. The participants were asked to place cards, with design principles as labels, in the rings according to the degree they found these active in the innovation practice: from very much attention for a principle (inner

circle) to absence of a principle (outer circle). This instrument is based on the method of 'mapping' as described by Van der Waals (2001). The rings resemble a five-point Likert scale.

- Handouts with a short overview of the design principles: Every participant got a handout that contained an overview of the design principles, each with a brief explanation of this principle. The handout was meant to get some help in interpreting the design principles.
- Report sheets: A form consisting of supporting questions guided the design process of the participants. The questions helped the participants to define the design question, choose design principles to work with, and propose interventions.

Figure H1.

Content of the monologues.

The monologues illustrate the perspectives of five stakeholders in an innovation practice. The innovation practice deals with a district of a city where the public activities are increasing. More and more companies are moving to this district, because of its nice site. This increasing activity is a threat to the characteristic part of the city that this district also contains: the companies need lots of space. Besides the physical space they need, they also attract traffic streams. In addition there is a threat to the nearby green environment. This area attracts a lot of local visitors in the daytime, especially on weekends. These people are drawn to the rhododendron -garden and the specialty shops of local entrepreneurs.

These developments create a tension. On the one hand there is a need of space for the companies to settle and a need of increasing infrastructure for this district. On the other hand there is an urge to preserve the unique characteristics of the district and the green area. For some years, the local government has had the ambition to rearrange this city-district in order to facilitate these conflicting developments. They have been looking for cooperation with different parties. Even though there was a collective ambition regarding district renovation, no innovation process has started since then. Therefore the alderman of town planning initiated a new approach.

In the monologues, the following participants involved in this innovation process speak:

- George Brown, employee in the civil services of Green Area and Construction Control
- Willy Freeman, real estate developer at a large construction company
- Rosemary Wiggins, inhabitant of the district
- Kim Liong, owner of a typical stationery shop in the district
- Tom Banks, alderman for town planning and the initiator of this new approach

Procedure

Each of the design labs took approximately four hours and took place at two moments in time. Nine students in the field of HRD attended design labs in May 2005. From these labs it became clear that there was a need for some extra support in the phase of the design of the interventions. In the second round of design labs the report sheet was introduced to offer the participants extra guidance. The second round of design labs took place during the ISMICK conference at the University of Stellenbosch SA, in August 2006. Thirty researchers in the field of KM attended these labs. In both series of labs the respondents as a group were first asked to listen to five theatrical monologues that set the scene. While working in groups, consisting of 3-4 participants, the participants filled out the circular scales. They could make use of handouts that contained a detailed description and examples from practice for each of the design principles.

Data analysis

The circular scales were used as input for a qualitative analysis. The report sheets were analysed for an overview of the design principles that were chosen to design interventions with and the reasoning that lied behind this choice.

Appendix I – Description of type B design labs

In type B design labs the researcher worked with facilitators of innovation practices. The labs consisted of four consecutive steps. These are summarised in Table I1.

Table I1

Protocol for type B design labs

No	Activity	Instrument	Result
1	**Analysis of the innovation practice and definition of difficult situation** The innovation practice that the facilitator facilitates is analysed in order to find out what the design question at hand consists of.	A report sheet guided the steps to take.	An analysis of the innovation practice by means of the 11 design principles and a design question that relates to a relevant issue in the innovation practice.
2	**Choosing one or more design principles and designing one or more interventions** The facilitator together with the researcher selects one, two or three design principles that could create a breakthrough in the innovation practice. Furthermore they design this intervention.	A card with an overview of the 11 design principles helped the facilitator to remind the design principles. Participants in this lab were all acquainted with the design principles.	The design of an intervention that could help to create a breakthrough in the innovation practice.
3	**Implementation of the intervention in practice** The facilitator implements this intervention in the innovation practice.	The facilitator could use the report sheet as a reminder for the steps to take in practice.	An intervention that is implemented in practice.

Table I1 (continued)

Protocol for type B design labs

No	Activity	Instrument	Result
4	Evaluation In an interview via telephone, after the facilitator has implemented the intervention in the innovation practice, the researcher and the facilitator reflect upon the effects of the intervention and they identify new design questions. In some instances these questions were used in another design lab.	Interview guide.	Insight in the extent to which the intervention implemented in practice, led to the expected breakthrough.

Selection of participants

In type B design labs facilitators of real life innovation practices participated. They used the design principles for the design of interventions for their innovation practices. Previously, these facilitators participated in the parallel study that lead to the development of the set of design principles. Eight facilitators had their own innovation practice at that moment and all of them participated in one or more design labs.

Instruments

Three instruments were used:

- Report sheet: this sheet consisted of questions that guided the design labs. The questions in the report sheet are:
    - What is happening at this moment in the innovation practice?
    - What is the design question?
    - What design principles do you want to work with?
    - What intervention could you design based on this principle?
    - What do you expect to happen?
    - How did it work out in practice?
    - Did something else (unexpected) happen?
- What would be a next step?

The last three questions were not used in the design lab, but in the telephone interviews that were done after the implementation in practice.

- A card with an overview of the 11 design principles: This card served as a mnemonic aid for the participants.

- Interview guide: The last three questions of the report sheet were used as interview questions during the telephone interviews in which the researcher and the facilitator looked back upon the implementation in practice.

Procedure

Each design lab took place at two moments in time. The first moment was when the researcher and the facilitator of an innovation practice came together in order to define the problem and plan the intervention. After this meeting the participants would apply the intervention in practice. Then, there was a telephone meeting in which the intervention was evaluated. The telephone interview was the second part of the design lab.

Each design lab was attended by one of the researchers and one participant. The meeting was guided by the questions on the report sheet. The aim was to design an intervention for the innovation practice the facilitator was involved in. The interventions the facilitators developed together with the researcher, consisted of a description of what they wanted to realise, the technique or way of working to be used (e.g. '2x2-questions' (a special question technique); the use of interviews), and the structure of the meeting in which this would be done.

After the design lab the researcher filled out the report sheet and checked this with the facilitator. For the facilitator this report sheet served as a reminder for the action to be taken in practice. For the researcher this sheet was the format to report the steps in the design process and to report how the implementation of the proposed design worked out in practice. The evaluation of the results was done by means of a short telephone interview after the intervention took place.

Data analysis

The report sheets were used in the phase of data analysis. The sheets were used to find out what design principles were used in the design process, what kind of interventions the participants designed, and the effect of these interventions in practice.

Appendix J – Description of type C design labs

Type C design labs consist of six consecutive steps. These are summarised in Table J1.

Table J1

Protocol for type C design labs

No	Activity	Instrument	Result
1	Getting to know the design principles Before participants attended the design lab, they were asked to fill out a self-reflection test. The results were discussed.	A self-reflection test that contained three pairs of statements for each of the principles.	By filling out the self-reflection test and by sharing the results, participants got acquainted with the design principles.
2	Defining a difficult situation The participants, in two groups chose one of the problematic situations that were provided in the form of ‘moulds’. They used this ‘mould’ to define a case.	Cards with problematic situations that served as ‘moulds’.	By working with the ‘moulds’, the participants could describe a case that was relevant to all members of the group. They defined cases for which they were eager to find a new perspective.
3	Choosing one or more design principles and designing one or more interventions Each group used a scenario sheet to write a scenario based on their case. They chose one or more design principles they expected to cause a breakthrough, and used that in their scenario. They also defined the roles the other group must play in the scenario.	One scenario sheet, various sheets for the role description, and for every participant a card with an overview of the 11 design principles.	The other group knows what the case of the other group consists of, and they have directions on how to play the scene.

Table J1 (continued)

Protocol for type C design labs

No	Activity	Instrument	Result
4	Implementing the intervention and evaluating it One group gave directions to the other group that played their scenario and they aimed to reach a breakthrough. Both the 'actors', the 'directors' and the facilitator could stop the play by saying 'cut'. One scene is played three to four times. After each scene the facilitator guided the conversation in which participants reflected upon the results.	-	The participants who worked as 'directors' and learned to experiment with various design principles. They also learned to define directions that help to bring a design principle in practice. The participants who worked as 'players' learned to apply interventions that relate to the design principles in practice.
5	Switching roles The 'directors' and 'players' switched roles. The group that has just directed the other group, now plays their scenario.	-	
6	Interview to reflect upon the learning experience After the role playing game the researcher did telephone interviews with participants of the game .	For the interview an interview guide was used.	A reflection upon the experience of the participants and an indication of the learning gains.

Selection of participants

The group of participants consisted of practitioners in the field of HRD, participants of innovation practices and facilitators of innovation practices. The participants were all selected on the basis of their willingness to participate. A requirement was that respondents, in their workplace, participated in an innovation practice or could think of examples of situations for which more of the same wouldn't work anymore.

For the interviews that were held the participants were contacted by telephone. For 22 of the participants this succeeded within one month after their participation in the lab. 1 respondent was interviewed after two and a half month.

Instruments

A self-reflection test consisting of three pairs of statements for each of the principles: The self-reflection test was meant for participants to get an impression of the design principles. The test contained three pairs of statements per principle. The statement on the left side is in line with the particular design principle, the statement on the right describes behaviour that is not in line with this design principle. Respondents were asked to fill out the test by thinking of an innovation practice they participate in. The more they score a statement on the left side, the more they work with this design principle. Participants counted their own scores. To them it was completely transparent which choice would lead to which score. The test was not meant as a measurement but as a means to get to know the principles and to relate them to one's own practice. Figure J1 offers examples of three pairs of statements.

Cards with problematic situations that served as 'moulds': Fourteen problematic situations that typically occur in innovation practices were formulated in a general way. For instance: *"Nothing happens. People are having meetings and keep on talking, but nothing really happens. Everybody thinks that it is very important, but nobody takes action. We talk a lot but we see no results".* The cards had mainly two functions:

- They helped the participants to think of examples of situations they encountered themselves.
- Although every participant thought of his own problematic situation based on the card, in the end only one situation was chosen to write a scenario for. Because the situations related to these 'moulds', for the other participants in the group the situation was still recognisable and useful although it was no their own situation.

One scenario sheet, and various sheets for role descriptions: The scenario sheet contained five questions that help to define the scenario (1. What is happening? 2. Who has a role in this situation? 3. How does their role look like? 4. What is your ambition with this situation? 5. What design principle could help to create this breakthrough? 6. In what way?). The role description sheets were blank. They offered room to give directions to the actors that would play a particular role.

A card with an overview of the 11 design principles: This card served as a mnemonic aid for the participants.

Interview guide: The interview guide contained questions that referred to the four levels of evaluation as developed by Kirkpatrick (1994). The first group of questions referred to the reaction of the participants to the design lab. The second group of questions referred to their learning gains, the third group of questions aimed to learn more about the extent to which these learnings influenced their behaviour in practice, and to what extent this led to results in practice.

The questions were as follows:
Questions that refer to the learning experience:

- Have you learned something new?
- What in the game enabled you to learn that?
- What in the game hindered this?

Questions that refer to the learning gains:

- What lessons did you take out?
- Which of these lessons is relevant to you in your work practice?

Questions that refer to the application of the lessons at the workplace:

- Did you apply these lessons in practice?
- What did you do?
- What did that result in?
- Were there visible breakthroughs?

Figure J1.

Examples of three pairs of statements that the self-reflection test consisted of.

Design principle 1. Formulate an urgent and intriguing question				
In my team I want to find out what makes the question that we're working on interesting for each of us	☐	☐	☐	I try to come up with a proposal as good as possible, given the predefined limiting conditions
Design principle 2. Create a new approach				
I like to experiment with new ways of working	☐	☐	☐	I usually design a feasible action plan
Design principle 3. Work from individual motive				
I find it important that everybody in the team has his own contribution	☐	☐	☐	For me consensus is very important

Procedure

The groups were sent the self-test before the actual meeting. Type C design labs were facilitated by one facilitator who was acquainted with the present research. In every session a researcher attended as well to take notes, and to observe what happened. This researcher noted down:

- A description of the cases
- The design principles that were chosen
- The interventions that were proposed
- The way the group of players used these directions
- The effect

The researcher who attended the design labs also conducted telephone interviews with the participants. Every interview was summarised and was sent back to the participants in order to check.

Data analysis

The reports that were made during the labs and the interview reports were input for the data analysis. The analysis consisted of:

- An overview of the design principles that were chosen to create breakthroughs.
- The relation of these design principles with the intervention(s) that was/were proposed.
- The relation between the proposed intervention and the effect on the innovation practice in the game.
- Finally, the interview results were used to analyse how the participants implemented the lessons learned in practice.

Appendix K – Description of type D design labs

Type D design labs, in which participants worked with their own case, consisted of five consecutive steps. These are summarised in Table K1.

Table K1

Protocol for type D design labs

No	Activity	Instrument	Result
1	Getting to know the design principles All participants that attended the workshop were asked to fill out a self-reflection test. The results were discussed.	A self-reflection test that consisted of three pairs of statements for each of the principles.	By filling out the self-reflection test and by sharing the results, participants got acquainted with the design principles.
2	Choosing a difficult situation and one or more design principles The participants, in two groups chose one of the problematic situations that were provided in the form of ‘moulds’. They used this ‘mould’ to define a case. They also thought of a design principle that could help to create a breakthrough in this case.	Cards with problematic situations that served as ‘moulds’ and for every participant a card with an overview of the 11 design principles.	By working with the ‘moulds’, the participants could describe a case that was relevant to all members of the group. They defined cases for which they were eager to find a new perspective.
3	Designing interventions The first group presented their case, they share their problematic situation and the design principle from which they expect that it could cause a breakthrough in this situation. The other groups thought about possible interventions.	-	The group that presented their case got many ideas for interventions that could cause a breakthrough. The other participants practiced to design interventions based on given design principles.

Table K1 (continued)

Protocol for type D design labs

No	Activity	Instrument	Result
4	Switching roles Another group presents their case and the other groups provide them with possible interventions based on the design principles.	-	

Selection of participants

The participants consisted of 32 practitioners in the field of HRD who wanted to learn more about learning and innovation.

Instruments

The instruments that were used (the self-reflection test, the cards with problematic situations and cards with an overview of the 11 design principles) are elaborated upon in Appendix J.

Procedure

Two design labs took place at two moments in time. In both labs four groups participated. Each group had the opportunity to bring in their own case and helped to find interventions for the other three groups. One lab was facilitated by one facilitator and one researcher, and one lab was facilitated by one researcher.

Data analysis

The notes that were taken during the design labs were transformed into report sheets afterwards. These report sheets contained an overview of difficult situations, design principles that were chosen and interventions that were proposed. The analysis of the report sheets consisted of:

- An overview of the design principles that were chosen to create breakthroughs.
- The relation between these design principles and the interventions that were proposed.

Appendix L – Results of type A design labs

Which design principles do respondents choose as a starting point for the design and what interventions are designed to promote each of the design principles?

The three design principles that were chosen most often to design interventions with, are design principles 1 (Formulate an urgent and intriguing question), 9 (Connect the world inside the innovation practice to the world outside) and 11 (Actively support the development of competences):

- Design principle 1 (Formulate an urgent and intriguing question) was chosen as a principle to work with by the respondents who had placed the principle in the outer rings of the scale when they analysed the actual situation in the innovation practice. (When respondents found a principle very active in the innovation practice they placed this principle in the inner rings, and when they found a principle not very active, they placed that principle in the outer rings). Examples of the proposed interventions are drawing and comparing dreams for the future; combining the individual questions in order to define a shared question that defines the next objective.
- Design principle 9 (Connect the world inside the innovation practice to the world outside) was often chosen to work with. The respondents motivate their choice for design principle 9 by explaining their belief that the process is ready to start off with a new phase. One group formulates this as follows: "theoretically they have made decisions on their approach to the problem. However, at the moment there is lack of commitment and transparency resulting in an inability to make decisions for future development". The interventions were diverse, but they all aimed to support the transition of the innovation practice into a new phase. Some groups of respondents proposed to ask an important person to be involved in the project, or to replace people in the team. Others proposed to develop a physical model of the proposed buildings ("our idea is that a physical model would allow the recognition of pros and cons for such building and foster creative thinking for the project").
- Design principle 11 (Actively support the development of competences) is chosen quite often to work with. This might have to do with the fact that respondents placed this principle in the outer rings when analysing the innovation practice. However, the interventions that the groups designed were not always clearly linked to the design principle. E.g. one group pro-

> posed to “bring in a project facilitator to give structure and to connect the innovation practice to the institutional”. This is an intervention that could have been linked to design principle 9 (Connect the world inside the innovation practice to the world outside) as well. One of the interventions that is clearly linked to design principle 11 comes from the group that proposes to give new responsibilities to the people in the innovation practice.

Two additional observations were made. First, there were also interventions that were developed by more than one group. An intervention that more than three groups came up with was the design of a scale model or physical design of underground offices, in order to compare various alternatives. Two groups designed this intervention in order to support design principle 9 (Connect the world inside the innovation practice to the world outside) and one group came up with this intervention in order to promote design principle 7 (Create something together).

The second observation refers to the way the respondents analysed the innovation practice. For this purpose they used the circular scales that were also used in the parallel study (see chapter 5, Section 5.2.1). The way the innovation practices were analysed has similarities with the findings in the validation study in chapter 5. Chapter 5 shows that in the validation study design principle 3 (Work from individual motivation) was best recognised by the respondents. This is similar to the findings in type A design labs. In these design labs, when analysing the innovation practice, respondents assigned principle 3 almost without exception a place in the centre (see Table L1). Design principle 11 (Actively support the development of new competences) was, almost without exception, assigned a place in the outer rings of the circular scales by respondents in the validation study (chapter 5). The respondents in type A design labs assigned this principle a place in the outer rings as well. Respondents did not recognise this principle very well (see Table L1).

Table L1

Overview of the scores on the circular scale per design principle

Design principles	M [a]	SD	N
1. Formulate an urgent and intriguing question	3,13	1,68	12
2. Create a new approach	2,71	1,30	12
3. Work from individual motivation	1,41	0,47	12
4. Make unusual combinations of subject matter expertise	3,54	1,12	12
5. Work from mutual attractiveness	2,58	0,67	12
6. Build on strengths	3,13	1,13	12
7. Create something together	2,38	1,13	12
8. Entice to see new signals and to give them new meaning	3,54	1,42	12
9. Connect the world inside the innovation practice to the world outside	3,25	1,06	12
10. Pay attention to the social and communicative process	2,33	1,35	12
11. Actively support the development of competences	4,13	0,93	12

[a] When respondents found a principle very active in the innovation practice they placed this principle in the inner rings (lower scores), and when they found a principle not very active, they placed that principle in the outer rings (higher scores).

What are the considerations of respondents when they choose one or more design principles to work with?

The dominant strategy for intervening is to choose design principles in the outer circle (considered as not yet active in the innovation practice, and therefore potentially powerful), or design principles from the inner circle, that had already proven to be successful. One group explained: "these principles are already in the centre, we expect a lot of working with them". These two strategies seemed to be based upon different hypotheses about the way the design principles work. Whereas the first group seems to believe that in an innovation practice each of the design principles should get attention, the second group proceeds from the belief that the design principles resemble capabilities of the innovation practice. They believe that the most is to be expected from the application of these capabilities participants in the innovation practice are already good at. However, the choice for the principles to work with seems not to be completely rational. Within one of the two dominant strategies, respondents still make a choice for one or more principles. Their personal affinity seems to play a role in this choice.

How do they translate these design principles into interventions?

Six of the groups focused with their interventions on the introduction of a new phase by bringing in structure and moving people in and out the innovation practice. They thought the innovation practice had an inward focus and that it was about time to make a next step in which they could be more focused on the outside world. In making this step several groups found it important that the connection with others was made (e.g. politicians and experts), two groups found it necessary to choose a facilitator for the process, and one group proposed to make a financial plan to support the next step.

Do respondents manage to implement the interventions in practice?

Implementation in practice was not an issue in design labs of this type since the respondents worked with a fictive innovation practice that was constructed especially for the design labs of type A.

Appendix M – Results of type B design labs

Which design principles do respondents choose as a starting point for the design and what interventions are designed to promote each of the design principles? Respondents chose either three, two or only one design principle as the starting point for their design. The two design principles that were chosen most often:

- Design principle 3 (Work from individual motivation) was chosen five times. Interventions developed to stimulate this principle concern discussing everybody's dreams with respect to the area that was central in the innovation practice, or asking for each other's motives by interviewing everybody individually.
- Design principle 6 (Build on strengths) was chosen three times. Some groups thought of an intervention in which the participants in the innovation practice should start their meeting with mentioning the success of the last meeting. Other groups used this principle to ways of working that allowed all the individual contributions and strengths to be used.

Design principle 11 (Actively support the development of competences), 9 (Connect the world inside the innovation practice to the world outside) and 2 (Create a new approach) were never chosen as design principles to work with.

What are the considerations of respondents when they choose one or more design principles to work with?

After the analysis of the innovation practice with help of the design principles the respondents chose without doubt one, two or three principles to work with. The considerations that seemed to play a role in their choice were related to their analysis with respect to content: often they chose one design principle that illustrated the problem, and one, two or three design principles as a lever to create a breakthrough. In the various design labs the design principles that functioned as a lever were different every time. The rational analysis seemed to play a role mainly in the analysis of the question at hand, and in the choice for the design principle that could illustrate that question. The personal preferences of the participants seemed to prevail when choosing one or more design principles that they wanted to use as a lever.

How do they translate these design principles into interventions?

There were two different ways in which the respondents translated the design principles into concrete interventions. One group of respondents chose interventions they were familiar with and that they dared to implement the next meeting of their innovation practice. Another group of respondents tended to choose interventions that were new for them and that were not very easy to put into practice in the next meeting of their innovation practice. The first group of respondents was enthusiastic about the design lab and was willing to participate in another design lab, whereas the second group was not very enthusiastic. For the first group the design lab seemed to have the function of focussing on what they wanted to achieve in the innovation practice. They used the design lab to prepare themselves for the next meeting in the innovation practice. The exact design seemed to be less important than the act of engaging in the design lab. Together with the researcher they used the available time to analyse their innovation practice, to articulate their ambitions and to design concrete ways of realising this.

Do respondents manage to implement the interventions in practice?

The group of respondents that chose interventions they were familiar with, implemented the interventions in practice. However, none of them implemented the intervention exactly the way they designed it. In practice they were often confronted with a slightly different situation for which they wanted to adapt their design. However, they used elements of the original design in almost all cases.

The group of respondents that designed interventions that did not easily connect to the next meeting they had, had difficulties in implementing their interventions. Their designs often required a complete different setting.

The respondents who did use elements of their design, but who did not exactly implemented their initial plan, were not bothered by that. They did not consider the time that they took for the design workshop as a waste. It could very well be that the design that they made fulfilled the function of a compass. It helped them to give meaning to the events that happened in the innovation practice and it helped them to decide how to deal with these events.

Apparently, the design itself is not equivalent to the skilful and successful implementation of the related interventions. The competences of the respondents and their ambition with the innovation practice, seem to play an important role in the implementation as well.

To what extent do the interventions result in breakthroughs?

The respondents who succeeded in implementing (an adapted version) of their intervention in practice, used the evaluative interviews to explain elaborately how they experienced the next step in their innovation practice and to what breakthroughs they thought it had led. So the respondents did report breakthroughs in their innovation practice. It was hard, however, to trace back the breakthroughs that the respondents reported to the specific design principles they deployed. The design principles in this case served as descriptive principles that helped the respondents to reflect upon their experiences.

Appendix N – Results of type C design labs

Which design principles do respondents choose as a starting point for the design and what interventions are designed to promote each of the design principles?

Every design lab offered the opportunity to experiment with the design principles in various rounds. Reflecting on all the design labs, it becomes clear that all design principles, except for one, have been used to experiment with. Design principle 4 (Make unusual combinations of subject matter expertise) was not used at all. This might have something to do with the nature of the type C design labs. In a role-playing game people play the role that is assigned to them without having the actual subject matter expertise of the people they play. Principle 4 concerns the introduction of subject matter expertise and that is something that cannot be simulated.

The three design principles that respondents chose most often as principles to work with, are: design principle 3 (Work from individual motivation), design principle 5 (Work from mutual attractiveness), and design principle 8 (Entice to see new signals and to give them new meaning).

The description of the design principles themselves easily led to the instruction that the directors gave to group of players. So, for design principle 3 that meant that interventions consisted of instructions such as "You have to work with their personal motives, you should ask them questions", "What is his motivation to participate? You have to find that out, ask him what he likes best". Instructions related to principle 5 sounded like "You have to convince them that a central approach will give the best results" or "Can you find a new way of working that is attractive for both parties?". And instructions meant to develop design principle 8 sounded like: "Try and look at the situation in a different way", and "The process facilitator needs to ask questions in order for new meanings to come up".

What are the considerations of respondents when they choose one or more design principles to work with?

In some instances the facilitator promoted the choice of other principles than the ones that were directly chosen by the participants by inviting the participants to explicitly think of what principle they wanted to use next. This evoked them to analyse the situation more careful and to consider working with principles that would otherwise stay unused.

A strategy that was once used to stimulate experimentation was assigning principles to each of the participants who were not involved in playing and ask them to observe whether this principle is applied and what other opportunities they see for applying the particular principles. This helped the participants to stretch their creativity and to think of new interventions related to that principle.

How do they translate these design principles into interventions?

The respondents translated the design principles into interventions by using concepts of the design principle in an instructional format ("You should…" or "Ask him to…").

Do respondents manage to implement the interventions in practice?

In some cases the implementation of the interventions went very well, and in other cases it didn't work out. In the type B design labs it became clear that a successful implementation of the interventions depended mainly on the courage or ambition the respondents had, and on their abilities. In type C design labs, these factors seem to play a role as well. The participants needed to be courageous since the interventions that they wanted to implement were often of a different nature than the interventions they would have done normally. At the same time the facilitator could help the participants to develop their ability further. The feedback the facilitator and others gave about the effect of an intervention often helped to improve it the second "take" of the scene.

Besides the courage or ambition and the ability that were called on, there seem to be two other factors that played an important role in the successful implementation of the intervention. These factors directly relate to the nature of this type of design lab.

- Being able to implement an intervention requires that you believe in the proposed intervention and expect that it will work. Because in this type of design lab the designers of the intervention and the implementers were represented by different groups, it could happen that the group who needed to implement an intervention developed by another group, did not believe in the intervention. Their thoughts or feelings in relation to the situation or the proposed intervention prevented them from implementing the intervention.
- Another factor influencing a successful implementation of the intervention in practice in this type of design labs is the extent to which respondents managed to identify themselves with the character they played. In order to implement the proposed interventions, authentic curiosity or involvement are often required. These cannot be simulated. Respondents were better able to feel this curiosity and involvement when they were familiar with the

situation they played, when they recognised the situation from their own practice, or when they empathised with the character they played.

To what extent do the interventions result in breakthroughs?

There were three groups that didn't succeed in creating breakthroughs. The other six groups succeeded in creating at least one breakthrough.

Whether a successfully implemented intervention led to a breakthrough was partly determined by the extent to which the group of players were able to empathise with the character they played. Subject matter expertise is something one cannot pretend, just as a specific motivation that is felt. Because this cannot be simulated, sometimes a potentially successful intervention did not lead to the desired effect since the other participants could not authentically bring in for instance their personal motivation.

After the design lab participants were interviewed to find out what they learned and to what extent they applied the lessons they learned in their own work environment. In the interviews respondents reported that they gained new insights through the design lab. Many of them put these insights in practice as well. The insights often concerned the importance of focusing on others. Four respondents report that after the lab, they started to actively examine the motivation of someone else; four respondents report that they have more explicitly asked others for their opinion instead of imposing their own motivation or opinion to others.

With respect to working with the set of design principles as a tool, the interviews revealed that there were some participants, although not much (4), who mentioned working with the set of design principles. Most of them (3) did, however, not actually work with the set of principles, they only had the intention of doing so. Only one respondent mentioned that he had used the set of design principles in preparing a meeting. The others intended to introduce the principles to their colleagues and one respondent intended to use the principles as criteria in assessing applications for an innovation fund in his company.

Appendix O – Results of type D design labs

Which design principles do respondents choose as a starting point for the design and what interventions are designed to promote each of the design principles?

In type D design labs, design principle 10 (Pay attention to the social and communicative process) has never been chosen as a principle to create a breakthrough. All the other design principles were chosen once or twice.

What are the considerations of respondents when they choose one or more design principles to work with?

The case owners gave the other groups the design principle from which they expected a breakthrough. Sometimes the facilitator challenged the case owners to name a principle that was unknown to them, that they were curious for, or that they wanted to challenge the other groups with. In the first round the groups who were thinking of interventions used the design principles as proposed by the case owners. The longer they were involved in designing interventions, the more often they came up with another design principle that they thought could cause a breakthrough and an intervention that related to that.

How do they translate these design principles into interventions?

Whereas the respondents in type C design labs were restricted to design interventions that could be done by people who did not actually possess the subject matter expertise and personal feelings of the people in the actual situation, in type D design labs, there was no such restriction. The interventions were more elaborate and often referred to the expertise and personal feelings of the people involved. For instance, an intervention proposed in relation with design principle 7 was: "Divide the manual in which you describe the bachelor exam to your students in pieces, and ask the teachers each to develop one piece further".

Do respondents manage to implement the interventions in practice?

The implementation in practice was not part of type D design labs.

Curriculum Vitae

Suzanne Verdonschot was born on 1 November 1980 in Ede, The Netherlands. She grew up in Wageningen where she completed her secondary schooling. She studied Educational Science and Technology at the University of Twente, graduating in 2003. Her master thesis, which was conducted at Philips Semiconductors, was on the subject of collaborative distance learning. After her graduation she began working with Kessels & Smit, *The Learning Company*. She combined her work at this consultancy firm with her PhD research. The aim of the PhD research is to better understand learning processes that lead to gradual improvements and radical innovations, and subsequently design a work environment that enables these learning processes. At Kessels & Smit, she founded the Research Practice, together with other colleagues. The Research Practice promotes research that aims not only to develop new knowledge with respect to a particular question, but also to enhance learning in practice. For this purpose Suzanne developed various unconventional research methods. Central themes in her work are knowledge productivity, knowledge workers and knowledge work. Currently, Suzanne combines her work at Kessels & Smit with thesis supervision and teaching activities on the subject of Human Resource Development at the University of Twente.

Relevant publications

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