AALBORG UNIVERSITY & UNIVERSITY OF TWENTE

Knowledge transfer towards SMEs in China

Master Thesis

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Section 1: Introduction and Research Design

1.1 Introduction

With advanced economies moving from a resource-based to a knowledge-based production, an increasing number of national governments recognise 'knowledge' and 'innovation' as significant driving forces of economic growth, social development, and job creation. Knowledge has become so important that the current socio-economic system has been named the knowledge economy or knowledge-based economy. Peter Drucker introduced the term knowledge economy in his book "the Effective Executive" (Drucker, 1966). Since then, a large number of scholars, together with many government agencies, are interested in the concept of knowledge and its economic importance. The reason for this attention is simple: over 70% of workers in developed economies rely on information and knowledge to produce efficiently (UNESCO, 2005). Due to the increasing complexity of the knowledge that is needed in state-of-the-art production, companies are interested in knowledge transfer to decrease the need of developing all knowledge in-house. This is especially true for Small and Medium-sized Enterprises (SMEs), where resources are relatively scarce in comparison with larger companies. However, the interest in knowledge transfer is not confined to companies alone. The OECD has witnessed that the promotion of knowledge transfer has increasingly become a subject of public and economic policy (OECD, 1997).

Recently, the promotion of knowledge transfer became increasingly important for more countries, such as China. This country started to catch up with more developed countries in the last decades. China is currently the third largest economies in the world, after the U.S. economy and Japan[1]. China was on par with South Africa and Austria in 1962, but its total GDP has surpassed Belgium, Sweden, Switzerland and Argentina in the 1970s while catching up with Mexico and Russia in the 1980s. Exceeding Italy's GDP in the 1990s, China's GDP overtook France in 2002 and Germany in 2007, gaining the current third place on the scale of largest economies in the world. During the last 30 years, the annual growth rate was on average above 10%, tremendously outperforming most OECD countries. As the Chinese economy developed, its economy became more depending on knowledge. Therefore, knowledge transfer became more important for Chinese firms. The growth of the Chinese economy is largely a result of the

[1] Data about the state of the Chinese and other economies in this paragraph is retrieved from www.gapminder.org. The data is based on various sources, however mainly acquired from the UN Statistics division.

developing private sector, more specifically the establishment of a vast number of SMEs. While the number of firms in the private sector (including SMEs) was zero in 1980, the estimates of SMEs in China in the mid-2000's range from 3.65 million up to 39 million (Hall, 2007). The growing number of Chinese SMEs has already transformed the Chinese export, which is now dominated by SMEs, thus emphasising their importance for the Chinese economy and the world economy as a whole. The share of Chinese export goods that is created by SMEs has grown from 0% in 1980 to 62% in 2002 and even 68% in 2004 (Hall, 2007).

A significant amount of firms in China, mostly SMEs, is less focused on creating innovative products or services. Historically, technological development in China has been focused on imitation and at most only slight changes to existing products (Xie & White, 2006). This focus did not change significantly since the entry of China to the WTO in 2001. Most firms only developed their manufacturing capabilities and no major investments were made to innovative capabilities. Furthermore, the lack of experience in public-private collaborations (e.g., between firms and universities and/or other research bodies) contributes to the low degree of innovative capabilities of SMEs. In addition, Li et al. state that the existing innovation systems in China interfere with each other and thus create redundant input (Li et al., 2009). The argument of Li et al. is that the already scarce innovative capacities are partly wasted due to the interference of the existing innovation systems.

To enhance the innovation capabilities of Chinese SMEs, the Chinese premier Jiabao Wen announced in March 2008 that China would start a program to form "National Innovation Platforms" (NIPs). These NIPs are proposed to increase the knowledge transfer from public resources towards enterprises, especially SMEs. An NIP is an organisation that centralises and streamlines the various efforts in innovation systems in China. It can tentatively be described as an instrument that is developed to allocate resources, such as knowledge, facilities and skilled people, towards application-oriented innovation within a certain sector on a nationwide scale (Li et al., 2009). NIPs are an attempt to integrate the already existing programs in different regions and sectors and streamline them in nationwide platforms. Therefore, NIPs will build on innovative capabilities of already existing innovation systems.

1.2 Research Design

1.2.1 Research Questions

In this thesis, the main research question is revolving around the effects that the Chinese NIP-concept has on knowledge transfer. The situation before the introduction of the NIP-concept is needed to estimate these effects. Also, literature is needed to understand knowledge transfer and to measure the effectiveness of the current innovation systems. Combining these considerations into one question, results in the following main research question.

Is the National Innovation Platform a potentially effective instrument to enhance the knowledge transfer from current innovation systems towards small- and medium-sized enterprises in China in the light of current, relevant academic literature?

To understand the dynamics of knowledge transfer, the term knowledge and the process of knowledge transfer need to be conceptualised. Due to the development of the knowledge-based economy, research towards knowledge in the context of economic activity intensified in recent times (Roberts, 2000). This increase in research has resulted in a large number of diverse definitions of the term knowledge. Romhardt (1998) found forty dichotomies for the term knowledge. Each of these dichotomies divided the term knowledge along the dimension of (at least) one factor. The same is true for concepts closely related to knowledge, such as the transfer of knowledge. Factors that influence the transfer of knowledge are numerous as well. Due to the complex nature of knowledge and knowledge transfer, those factors can cover various areas. A number of influencing factors could very well cover areas outside the scope of this thesis. Therefore, a thorough investigation of the literature is needed before the research questions can be answered.

To assess if the NIP is a potentially effective instrument to enhance the knowledge transfer, the present situation around knowledge transfer has to be investigated. Therefore, current actors involved in knowledge transfer towards SMEs in China are analysed. Before the introduction of the NIPs, regional innovation platforms were supporting SMEs in China. These regional innovation platforms deliver knowledge and other business services to the SMEs. To assess how the introduction of NIPs will influence the transition of knowledge towards SMEs, the approach of how knowledge was transferred towards SMEs from these regional innovation platforms should be analysed first. Therefore, an investigation is needed as to how knowledge was transferred from regional innovation platforms towards SMEs in China, before the introduction of the NIPs.

To discuss analytically the influence that the introduction of NIPs has on knowledge transfer, research is needed that goes beyond the question of how knowledge is transferred from Regional Innovation Platforms (RIPs) towards SMEs in China. The characteristics identified in the literature have an influence on the knowledge transfer between SMEs and the innovation systems. By assessing how the relation between SMEs and the existing innovation systems can be described by those characteristics, a deeper understanding of the relation between these is created.

(RQ 1) Are Chinese Regional Innovation Platforms effective in transferring knowledge towards SMEs, based on the impact factors identified in the literature and based on additional empirical research?

The concept of NIPs is an attempt of the Chinese government to improve the knowledge transfer towards SMEs in China (Li et al., 2009). As of December 2009, evaluation of the NIP-concept could be traced back to only one paper. Additional information about the NIP-concept is needed to examine the transformation from RIPs to NIPs. To discuss critically the NIPs in China and its influence on knowledge transfer, the first research question is states as follows.

(RQ 1) Will the National Innovation Platform be effective in knowledge transfer, based on the impact factors identified in the literature, the experiences with RIPs, and additional research on NIPs?

The research questions stated in this part cover the main research question of this thesis totally. Thus, information that is needed to answer the main research question is given in the answers to the various research questions. Furthermore, the sum of the research questions is limited to the same broadness as the main research question. The limitations that apply to the main research question are also applying to the research questions.

1.2.2 Research Goal and Constraints of the Thesis

The situation before the introduction of the NIP-concept will be described, as well as how the NIP-concept might change the transfer of knowledge towards SMEs. This leads to the following research goal:

The purpose of this thesis is to discuss critically the concept of the Chinese National Innovation Platform and its potential effect on knowledge transfer towards SMEs in China in light of previous theory.

The thesis is limited by practical constraints concerning the data needed to achieve the research goal. The NIP-Concept has scarcely put into practise as of December 2009. Therefore, it is not feasible to

analyse the effects now of the introduction of the NIP-concept to the transfer of knowledge towards SMEs in China directly. The thesis is analysing the characteristics of knowledge transfer towards SMEs in China, ex ante the introduction of the NIP-concept. In addition, the NIP-concept and its influence on the characteristics of knowledge transfer will be discussed critically. This will result in an expectation of how the Chinese NIP-concept changes the transfer of knowledge towards SMEs rather than a direct measurement.

Section 2: Theoretical Framework

The theoretical framework covers a variety of subjects. First, the concept of knowledge will be introduced. Different opinions on knowledge have been analysed and a general concept has been formalised that is applicable for this thesis. After the definition of knowledge, knowledge transfer has been studied. The concept of knowledge transfer is broken into smaller pieces and these were analysed as well as the relations between them. Third, a variety of characteristics that influence knowledge transfer is introduced in this section. Finally, the Chinese regional innovation platform and several other innovation systems are introduced and compared.

Knowledge has a tremendous impact on the economic performance of a company. It is needed to enable the company to use economic capital, labour and/or other capitals to create products that have value for others. The knowledge enables a company to combine inputs into products that have a larger value than the sum of the inputs. The importance of knowledge increased in recent decades even more, as products become more complex (Nonaka & Takeuchi, 1995). In addition, knowledge itself is becoming a product that gains demand, as can be seen via the increase of patent sales and consultancy services (OECD, 1996).

Knowledge leads to innovations in firms. In an article by Thornhill (2006), the connection between the intensity of R&D in firms and innovations is made. It is arguable that a higher intensity of R&D is analogous to a higher level of knowledge within that same firm. Therefore, more knowledge leads to more innovations. This increase in innovations leads in turn to higher revenues which can be used to intensify the R&D again. Thus, Thornhill concludes that it is difficult to create new knowledge for a new company with limited resources.

As SMEs are limited in size, their budgets are too. This limits the intensity of R&D that SMEs can undertake. Therefore, it is extremely difficult for an SME to create new knowledge. To circumvent this dilemma, SMEs could gain knowledge from other actors, such as research institutes or other firms. Gaining knowledge from other actors is referred to as knowledge transfer. As SMEs in China have even smaller budgets, knowledge transfer is a necessity for them to gain new knowledge.

2.1 Defining Knowledge

This section starts with an exploration of knowledge from an economic perspective. When analysing knowledge from an economic perspective, a large number of diverse definitions can be found. The

definition of knowledge evolved since the 1960s within economic research until now and is expected to change in the future as well. In the past, the definition of knowledge tends to be specified to the needs of specific school of economics that uses it. To understand the concept of knowledge, a global explanation of knowledge is presented, followed by a comprehensive overview of the diverse definitions in the various schools of economics. After this overview, a definition of knowledge for the purpose of this thesis is given.

Knowledge is in economics in general perceived as either a business product, as educational and innovative intellectual products and thus can be exploited for a high value return or as a productive asset (Drucker, 1966). The importance of knowledge for economic development has been recognised by policy makers and academics several decades ago. Since then, the interest in the economic influences of knowledge and knowledge transfer has grown steadily within policy makers and academics (OECD, 1996). The first notion of the importance of knowledge for economics can be found in the micro-economic school. Soon after, the evolutionary theorists and the cognitive economists followed.

In standard micro-economic analysis, knowledge, like information, is perceived as comparable to a public good. This results from its non-excludable and non-rival nature. Furthermore, its production is characterised by high levels of indivisibility (Arrow, 1969). In this view, knowledge is transferred rather easily, although still subject to some transactional costs. This micro-economic view on knowledge has been challenged by other economic approaches.

Evolutionary theorists altered the definition of knowledge. The role of knowledge and learning is more important in their view, compared with the standard micro-economic view. Evolutionary economics see knowledge as dynamic; i.e. it changes over time and the specific changes depend on the characteristics of the particular actor that hold the knowledge at that point. This makes the knowledge highly idiosyncratic, and therefore difficult to transfer (Kogut & Zander, 1993). However, it expands the meaning of knowledge towards an important source or competitive advantage (Marcotte & Niosi, 2000).

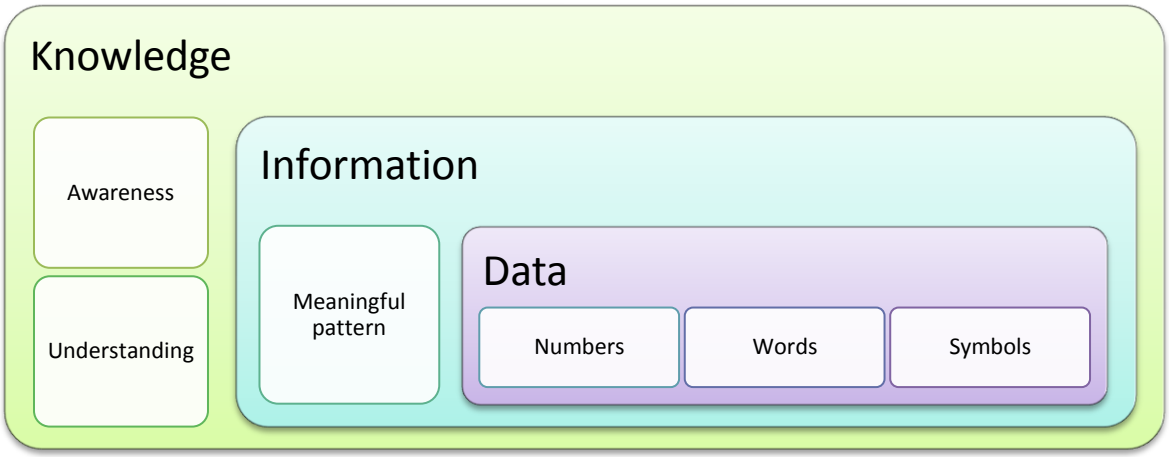
Another economic perspective that utilises the concept of knowledge is the cognitive approach to economics. The cognitive approach, based on the work of Herbert Simon and his colleagues, shares the view with the evolutionary theorists that knowledge is difficult to transform and transfer (Simon, 1974). In the cognitive approach, organisations are very similar to individuals concerning the acquisition and processing of knowledge. In the cognitive view, knowledge changes over time while an actor holds it. Both persons and organisations have the ability to hold knowledge and in both the knowledge changes

over time. The specific changes to knowledge depend on the characteristics of the actor that holds the knowledge i.e. the individual or the organisation. In this the cognitive approach to economics is comparable to the evolutionary approach. Yet, according to the cognitive approach, organisations are comparable to individuals when concerning learning: both individuals and organisations need to develop their interest and ability to understand why some approaches of doing things work, while other approaches do not work (Marcotte & Niosi, 2000). Understanding why certain approaches are effective and others are not is called “insight” by cognitive authors. This insight is comparable with mastery of an artisanship or craftsmanship. When an actor has insight of certain knowledge, the actor is able to use the knowledge intuitively to solve complicated problems that are associated with that knowledge (Boisot, 1999).

For the usage in this thesis, the definitions of knowledge and information are slightly adapted from previous definitions. Focussing on a rapidly changing environment as the Chinese economy, the constructs are based on the cognitive view. The cognitive view is best suited for environments that are changing rapidly and actors are adapting to these changes. This is due to the change that knowledge undergoes changes within an actor as the actor itself changes as well. As arrangements for knowledge transfer towards SMEs are changing rapidly in China, also partly due to the introduction of the NIPs, an approach is needed that takes the consequences of those changes into consideration.

A graphical representation of knowledge and related concepts is given below as figure 1.

Figure 1: Knowledge and related concepts



Based on and altered from Roberts (2000), Kvanvig (2003) and Ogata et al. (1996).

To understand knowledge, first the construct of information has to be clarified. Following Roberts (2000, p. 430), *Information* is defined as data that has been arranged into a meaningful pattern. Data are necessary inputs into information and knowledge, and are defined as series and observations, measurements, or facts in the forms of numbers, words and symbols. Data itself have no meaning. However, when a meaningful pattern is added, data provides the raw material from which information is produced. This meaningful pattern is represented by equations, grammar or layouts.

Understanding is developed as a person is not only memorising the knowledge at hand, but also is able to use that knowledge in relation to new problems. Knowledge is learned within a certain setting. For example, the layout of a city can be learned from a map. When newly acquired knowledge can be put into use in another setting understanding is enhanced. In this example, understanding relates to being

able to use that knowledge while navigating around in that city. Thus, understanding is the ability to see when certain knowledge is relevant (Kvanvig, 2003).

Awareness is closely related to understanding. Awareness refers to the notion that a person is conscious of the knowledge he/she possesses. A person is aware of knowledge when that person is considering applying that knowledge in a specific situation. Alternatively, a person can also be aware of a lack of knowledge, i.e. is not able to solve a problem due to lack of a vital piece of knowledge. Awareness in relation to multiple actors refers to the notion that persons are aware of each other's knowledge. In this case, awareness is a process, where different actors are recognising their own knowledge in each other (Ogata et al., 1996). This creates not only a notion of the knowledge that is similar in both actors, but also an impression of the knowledge that one actor possesses and the other does not. Thus, discrepancies between the total knowledge of one actor and another are discovered.

Concluding from the above, the following definition of knowledge was conceptualised. ***Knowledge is a set of beliefs and ideas about the causal relationships between information and involves a degree of awareness and understanding.***

2.1.1 Tacit and Explicit Knowledge

Knowledge can exist in a tacit and an explicit form. Knowledge that is put into words, like in a manual, is referred to as explicit knowledge. Explicit knowledge is codified, in formal language or mathematical expressions, specifications, etc. It is discrete or "digital". Therefore, it can easily be stored in archives such as libraries and databases and is accessible without difficulty. In the West, this kind of knowledge has been emphasized in general (Polanyi, 1966). However, not all knowledge is stored in explicit form. Additional knowledge exists within individuals or organisations. This additional knowledge is referred to as tacit knowledge by scholars (Nonaka & Takeuchi, 1995; Polanyi, 1966). Tacit knowledge comprises of knowledge that has not be codified. Examples of tacit knowledge range from complicated tasks such as how to fine-tune machines, artisanship in painting or playing an instrument, to more basic tasks such as biking or swimming.

Scholars believe that when the explicit knowledge in a manual or other any written source tends to become complicated, the language used in the manual starts to resemble a form of code. The ability to read that code is also a form of tacit knowledge (Roberts, 2000). A large number of scholars agree with the assumption here, i.e. stating that for effective knowledge transfer not only explicit knowledge but

also tacit knowledge has to be transmitted. Polanyi argued that "[…] all knowledge is *either tacit* or *rooted in tacit* knowledge. Thus, wholly explicit knowledge is unthinkable and could better be described as memorized information" (Polanyi, 1966, p. 7). More recently, Lundvall (2003) agrees that all knowledge is, as least partly, tacit. In addition, Lee et al. (2010) and Kane (2005) argue that complex knowledge needs persons in order to be transferred. Therefore, completely explicit knowledge itself is not effective for knowledge transfer.

2.1.2 Knowledge, Know-How and Skills

The concept of knowledge characterised here is comparable with the concept of know-how coined by other scholars. Lundvall and Johnson (1994) proposed four different kinds of knowledge, one of these being know-how. Know-how as defined by them, refers to skills, i.e. to capabilities to do something. Examples of know-how used by Lundvall and Johnson are a businessperson judging market-perspectives for a new product, a manager selecting and hiring staff and a skilled worker operating a machine. All these people require skills, and these skills represent know-how, a form of knowledge. Lundvall et al. refer here to Polanyi (1958) who explains how skills are also needed by scientists.

Polanyi states that skills can be communicated only by example, and not by precept. He states that acquiring skills, or in the terminology of Lundvall et al. gaining know-how, can only be done via a long course of experience under the supervision of a guidance or a master. Precept, or the reading of characteristics and learning these without practising and experiencing them, is useless in the eyes of Polanyi. Lundvall et al. agree as they state that know-how is typically learned in apprenticeship-relationships. They state that the learning of know-how is based on practical experience and that know-how will typically develop into a mature form only through years of experience in everyday practice. The overlap between the know-how of Lundvall and the skills of Polanyi is large, as can be deducted from the example they both use: in both sources, a connoisseur is used as example of how mastery can only be learned via experience.

A number of similarities can be found between knowledge as defined in this thesis and know-how and skills introduced here. In all cases, they are more than information, or "fact-knowledge". In the concept introduced by the author, knowledge requires understanding and awareness, whereas information requires only the ability to memorise and recite. Polanyi refers to subsidiary awareness when using skills, which is the ability to use a skill when it is needed without having to focus on the action. This instinct is the result of years of training and can be compared with the awareness mentioned earlier in this section. In addition, knowledge, know-how and skills are all rooted in a person via experience. The

experiences of a person are needed in all three concepts to let them evolve. Due to these similarities, it is tentatively arguable that the concepts are related or even analogous.

The definition of knowledge lays the foundation for the rest of the literature review. In the next part, the transfer of knowledge is analysed. Defining knowledge is needed to take this next step in the theoretical review.

2.2 Defining Transfer of Knowledge

The transfer of knowledge from one actor to another is called knowledge transfer. The actors could have various forms, such as firms, governmental agencies, individuals, groups, divisions or departments. Knowledge transfer is not restricted to a pair of matching actors, i.e. two individuals or two firms, but may occur between form of actor as a sender of knowledge and any form of actor as the receiver of knowledge.

To introduce knowledge transfer and other related concepts an example is presented. In this example, an SME is introducing a new machine in its production process to become more efficient. The SME is the receiver of knowledge in this example. The SME or "the receiver" purchased the machine, but was unable to integrate successfully it in the existing production process. To gather knowledge about how to integrate the machine, the SME contacts another organisation, which is referred to as "the sender". The sender is typically a research institute and has knowledge needed to integrate the new machine in the current production process. The knowledge exists within the sender due to previous experience with installing the new machine for other SMEs. In addition, connections with universities and other academic organisations are inputs for knowledge of the sender. The situation with a sender and receiver of knowledge as described above is quite common in China. Real life examples will be discussed in Section 4 of this thesis.

To investigate the theoretical background of how the knowledge is transferred between the sender and receiver of knowledge, the transfer of knowledge will be dismantled into three stages. These stages are consecutive, while the whole process of knowledge transfer is iterative. In the example used here, first the sender has to gather the relevant parts that comprise the knowledge that is desired by the receiver. Then the knowledge is transmitted from the sender to the receiver. The last stage is the interpretation of the knowledge by the receiver. After the interpretation of knowledge by the receiver, the sender will gain additional insights due to feedback by the receiver.

Transfer of knowledge is not equal to transmission of knowledge within this thesis. Transmission of knowledge refers solely to the action of sending knowledge from sender to receiver. Transfer of knowledge relates to the complete process of giving knowledge to another actor. Transfer of knowledge involves whole process of the collection, transmission and interpretation of knowledge and the iterations of this process. In other words, transmission of knowledge is only a part of transfer of knowledge.

In sum, the definition of knowledge transfer for this thesis is: ***The transfer of knowledge from one actor to another actor that consists of the phases of identification, transmission and interpretation of knowledge which are iterated until the desired knowledge is transferred.***

2.2.1 Stage 1: Identification of Knowledge

The first stage in knowledge transfer is to identify the relevant parts of knowledge that have to be transmitted. This stage is not solely relying on one actor, but depending on both the sender and its capabilities, and the receiver and his insights as well. Awareness of the receiver is needed to identify the discrepancy in knowledge. The receiver is required to explain the current situation in the work process along with the desired new situation. Awareness of the sender is needed as well. It has to be aware of the knowledge it holds. The sender can gather the parts of knowledge that are required to go from the current situation to the desired situation.

Authors disagree on the amount of effort that is needed to identify appropriate knowledge. Szulanski (2000) suggests that the costs of identifying knowledge are depending on the uncertainty if the knowledge identified to transfer is truly appropriate for solving the identified problem. The success rate of identifying the appropriate knowledge is based on the previous successes of the sender of the knowledge. Therefore, more success in identifying the appropriate knowledge in the past is lowering the costs of identifying the appropriate knowledge in future endeavours. However, Kane et al. argue that identifying knowledge is undemanding (2005, p. 56), and thus bears little or no costs. In their view, Kane et al. see identifying knowledge in organisations as similar to remembering knowledge in an individual. Others such as Lundvall (2003) and Roberts (2000) agree with Szulanski. These authors see the identification of appropriate knowledge as a complex task that demands insight and experience. Following the majority of the scholars, it is assumed that the identification of the appropriate knowledge to solve a particular problem is a difficult undertaking that requires a significant amount of resources.

In the example introduced throughout this thesis, it is recognised that the sender has to prepare explicit parts and tacit parts of knowledge. The explicit parts of knowledge could consist of a manual to operate the new machine. Tacit parts may consist of knowledge that is needed to understand that manual and with knowledge integrating new machines in production processes in general. After the identification, preparation and collection of the parts of knowledge that are needed by the receiver, transmission is the next stage in the knowledge transfer process.

2.2.2 Stage 2: Transmission of Knowledge

The transmission of explicit knowledge differs from the transmission of tacit knowledge. The transfer of explicit knowledge is done via embodiment in blueprints, patents or manuals, in machinery, as part of licensing agreements, franchise or as trade between agents. Transfer of explicit knowledge is generally arranged by appropriate contractual agreements (Roberts, 2000). In general, transfer of explicit knowledge is a simple task in the current society. As explicit knowledge is discrete or "digital" by definition, sending an e-mail is sufficient in most situations.

Transmitting tacit knowledge is a complicated task, in contrast to the ease of transmitting explicit knowledge. In general theory, it is suggested that the transmission of tacit knowledge is only possible by co-location of the sender and the receiver of the knowledge. These meetings have the form of an apprenticeship situation or of a period of "learning by doing" (Polanyi, 1958; Argote & Ingram, 2000). Argote and Ingram identified that the personal dimension is also influencing the effectiveness of knowledge transfer. They suggest that knowledge transfer within an organisation is more effective as knowledge transfer between two organisations as "people are more similar within than between organisations, and interactions involving people transfer more readily within than between firms" (2000, p. 150). Alternatively, tacit knowledge can also be transmitted by relocating employees from one firm to the other, hiring the services of consulting firms or firm agreements, such as intra-firm transfers, joint ventures and co-operative research agreements (OECD, 1996). Knowledge transfer of tacit parts is geographically restricted. As Lambooy states "most of the learning processes involved in knowledge transfer are local, because of the interpersonal characteristics" (2004, p. 652). Arora (1996) acknowledges that tacit knowledge is needed to facilitate the understanding of explicit knowledge. In his view, the transmission of codified knowledge alone may fail to facilitate the successful transmission of (complete) knowledge. Roberts states "[...] there are elements of knowledge that can only be transferred through a process of demonstration facilitated by face-to-face contact between the transmitter and the receiver" (2000, p. 191).

In our example, the transmission of the explicit parts of the knowledge is simple. Only the manual of how the new machine has to be used has to be transmitted. For the transfer of tacit knowledge, this translates to transmitting the knowledge of how to solve common problems with the new machine, how to not only read but also actually understand the manual of the machine, and how to integrate the new machine in the existing production process of the SME. Translating this to the hypothetical situation at hand, a person from the sender has to meet a person from the receiver.

2.2.3 Stage 3: Interpretation of Knowledge

It is arguable that all knowledge that is beyond a certain degree of complexity requires the interpretation of tacit elements of knowledge to be understood by the receiver of that knowledge. In addition, Dosi et al. found that once knowledge is interpreted, it could be used and re-used without it wearing out. In addition, these scholars state that persistent use of knowledge implies that knowledge is at least kept fresh within the minds of the people of the organisation. Most likely, the understanding of the knowledge might even increase as it is used more often. In this, usage of knowledge is different from usage of standard economic goods. Or, as Dosi et al. formulate, "Knowledge does not display wear and tear" (2010, p. 177). Therefore, the interpretation of knowledge by the receiver is not finished with the sender transmitting knowledge. Usage of the newly gathered knowledge increases the understanding of that knowledge and thus intensifies the interpretation of knowledge.

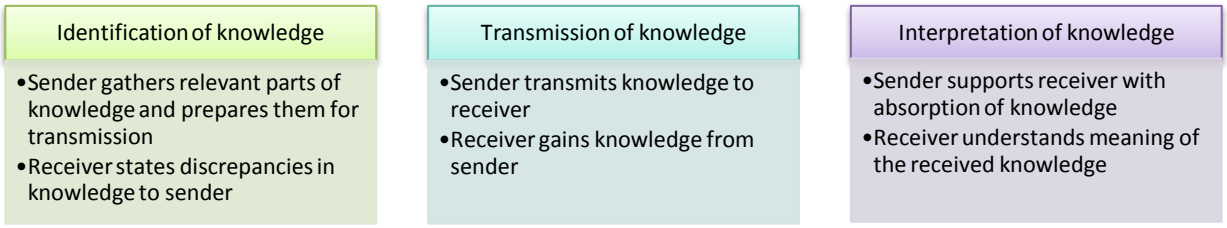
Now that the receiver in our example has received the knowledge it desires, the interpretation of the knowledge within the receiver starts. While this part seems evident and relatively unchallenging, interpretation of knowledge might be the most complicated task. The easiest part of interpretating knowledge for the receiver in the example used here, is to understand the manual of the new machine. Since the new machine is part of a production process, it is arguable that the manual for that machine is relatively complex. Thus to interpret the manual, not only the manual itself has to be understood, but also the "code" in which the manual is written. Therefore, not only the explicit knowledge within the manual itself requires interpretation, additional tacit knowledge needs to be interpreted by the receiver. Additionally, during the usage of the new machine, the receiver will understand the received knowledge more and thus interpretation of knowledge will endure.

2.2.4 Iteration

It is highly unlikely that the knowledge transfer is complete and satisfactory after one run through these stages. It is expected that the transferred knowledge is not sufficient after a single iteration (Szulanski et al., 2004). During the interpretation stage, the receiver might become aware of a new

discrepancy of knowledge and requests additional knowledge. This, in turn, triggers additional identification of knowledge and the process begins anew. For successful transfer of knowledge, the process shall be iterated until the desired situation at the receiver is reached.

Figure 2: Stages of Knowledge Transfer



2.2.5. Alternative Approach: Learning by Doing

Alternative to the idea of transferring knowledge from another organisation is the generation of knowledge within the own organisation. One approach to generate knowledge is the concept of Learning by Doing. Von Hippel et al. (1995) describe Learning by Doing as a form of problem solving that involves application of a possible answer in the environment in which it should be used. The problem solving is done by a method of trial and error, directed by some amount of insight as to the direction in which a solution might lie. Trial and error comprises of several steps; these are trial, failing, learning, revision and re-trial.

Von Hippel et al. argue that trial and error procedures only guarantee a solution if the problem is "well-structured", that is a process of trial and error can be *precisely specified* in order to find a desired solution within a practical amount of time. However,

> *"In general, the problems presented to the problem solvers of the world are best regarded as ill structured problems. They become well-structured problems only in the process of being prepared for the problem solvers. It is not exaggerated much to say that there are no well structured problems, only ill-structured problems that have been formalised for problem solvers [...]* (von Hippel & Tyre, 1995, p. 2).

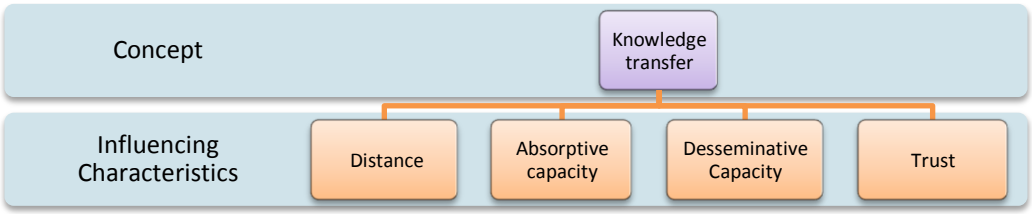
In the case of ill-structured problems, the domain in which the solution for the problem lays is not known upfront. Therefore, ill-structured problems are solved by creating one or more (typically several) alternative solutions. These may or may not be the best possible solution for the problem. Next, these solutions are tested against a set of requirements and constraints. Test outcomes are used to revise and refine the solutions under development and, generally, progress is made towards an acceptable result.

In principal, this approach could make the collaboration with a sender of knowledge obsolete. If an actor would use the process of trial and error, it could eventually generate a solution by itself and would not need support by an external party. However, an expert in the specific area could take an ill-defined problem of the actor and compare this problem with similar problems that were solved by the expert before. Even if the problem is most likely not synchronous to a previously solved other problem, it is likely that a related problem could be found. The solution of this related problem is known to the expert. This knowledge of the expert helps to transform the ill-defined problem of the actor into a more well-defined problem. For this more well-defined problem, a somewhat comparable solution is known, giving a better starting position in the process of trial and error. This might decrease the number of iterations, saving time and costs for the actor at hand. Therefore, even if the expert does not know an appropriate solution to the specific problem of the actor, the experience with previous problems should decrease the amount of resources needed to solve the problem.

2.3 Characteristics influencing Transfer of Knowledge

For the creation of usable indicators that influence knowledge transfer, characteristics have to be identified that are mutually exclusive, yet covering all relevant aspects of the transfer of knowledge. In the following, several of these characteristics are discussed separately. Each characteristic is defined first, followed by its roots in theory and then related to the example of a receiver of knowledge that wants to acquire knowledge from a sender about how to integrate a new machine in the existing production process.

Figure 3: Characteristics influencing Knowledge Transfer



2.3.1 Distance

A large body of literature claims that agents that are located near each other, can benefit from knowledge externalities (Allen, 1977; Ambos & Ambos, 2009). Knowledge externalities are positive effects for others when knowledge has been discovered by one actor, but benefits are also exploited by other actors. Examples of knowledge externalities can be found at universities and companies working together with those universities. While universities create new knowledge via research, companies connected to these universities benefit from that new knowledge. Benefits could emerge from collaboration in research programmes, or the hiring of graduates of that university. Studies suggest that knowledge externalities are geographically bounded: firms near knowledge sources tend to outperform other firms in the dimension of innovative performance (Audretsch & Feldman, 1996; Howells, 2002). When actors are located near each other together, information contacts become more likely and the transfer of tacit knowledge is facilitated. The closer two actors are located near each other, the less the distance between these two is. Thus, distance is defined as the amount of physical space between the sender of knowledge and the receiver of knowledge. The more the distance between actors increases, the less the intensity and frequency of these contacts become, thus the positive externalities decrease and therefore the more difficult it becomes to transfer knowledge.

For the transfer of knowledge between the sender and receiver in our example, distance is a relevant influencing factor. The knowledge transfer requires face-to-face contact, specifically for the transmission

of the tacit parts of knowledge. To achieve face-to-face contact, at least one representative of the sender has to meet in person with at least one representative of the receiver. For this meeting, travel is needed and the amount of travel is dependent on the distance between the sender and the receiver. If the distance increases, so does travel time. Thus, the effective time that the representatives meet relative to the total time that is needed to facilitate the meeting, decreases as the distance increases. As a result, the effectiveness of the knowledge transfer decreases as the distance between the sender and the receiver increases.

2.3.2 Absorptive Capacity

For the receiver to be able to understand and use the transmitted knowledge, absorptive capacity is needed. Absorptive capacity is defined as the limit to the rate or quantity of scientific or technological information that a firm can absorb. It relates to the knowledge that is already present in the receiver of knowledge. The more related the knowledge that is present at the receiver is to the newly received knowledge, the easier that new knowledge can be understood and used by the receiver (Cohen & Levinthal, 1989; Cohen & Levinthal, 1990).

In their research, Cohen and Levinthal (1990) claim that for each new technology, there exists a minimum level of related knowledge, below which firms are incapable of bridging their knowledge gap. For this reason, actors or require absorptive capacity firms to absorb new knowledge. In other words, the knowledge base and expertise of the receiver should not differ too much from that of the sender, since the absorptive capacity of the receiver is limited. Other scholars argue that absorptive capacity is not there or not, but rather is a variable (Boschma, 2005). Thus the larger the absorptive capacity is, the easier the receiver understands the transmitted knowledge.

For the receiver in the example, the absorptive capacity consists of knowledge about machines in the production process. The knowledge that is already present about production machines supports the understanding of the newly transmitted knowledge that is needed to operate the new machine efficiently. The absorption capacity could consist of specialised terms, i.e. a specialised language, used for the new machine, processes within the machine that are somewhat similar to the processes of an old machine or operations on the machine that represent similar equipment. The more people within the receiving actor previously have acquired knowledge that is similar to the new knowledge, the larger the

absorptive capacity for the new knowledge is, and thus the easier the receiver can understand the new knowledge.

2.3.3. Disseminative Capacity

The competence to diffuse knowledge is known as the disseminative capacity in the literature (Mu et al., 2010). Disseminative capacity is the counterpart of absorptive capacity and is a competence of the sender. It is developed when knowledge is transferred from the sender to the receiver. The development of disseminative capacity is encouraged by feedback from the receiver during the process of knowledge transfer. Some scholars state that knowledge senders have to be uniquely qualified to do the job of knowledge transfer (Minbaeva & Michailova, 2004). A comparison with teachers can be made here. In educational knowledge transfer, the success of the knowledge transfer is reflected in the grade that a student receives. It is tentatively arguable that this success is not only depending on the absorptive capacity of the student but also to some extent on the disseminative capacity of the teacher.

In the example introduced at the beginning of this section, the disseminative capacity plays a vital role for the success of the knowledge transfer. The receiver can only understand how to integrate and operate a new machine if the sender is able to explain this in a manner that is suitable for this situation. These capabilities are depending on the understanding that the sender has of the problem but also on the understanding that it has of the receiver in question. To be able to provide the receiver with a solution that is feasible, the sender has to understand what knowledge already exists within the receiver. Otherwise, the solution may too complex or too unfamiliar for the receiver to be able to put it to practise.

2.3.4. Trust

Another influencing factor for the transfer of knowledge is trust. Casson defines trust as “a warranted belief that someone else will honour obligations, not merely because of material incentives, but out of commitment too. It is assumed that such moral commitment is rational because it generates emotional rewards” (1997, p. 118). For this thesis, this definition of trust is applied. Trust, as an economic concept, influences the perception of level of risk and uncertainty arising from a transaction between organizations and/or with the market. For explicit knowledge, contracts and licences create a legal basis of the transaction. For tacit knowledge, this is not a feasible solution. It is not known upfront, what tacit knowledge is needed by the receiving party and what knowledge the sender can (and wants to) offer. A contract might be desirable here, but cannot be specified, as stipulating the tacit knowledge that will be

transferred cannot be defined in words (the tacit knowledge has to be codified, which is often not possible). Thus, trust between the sender and the receiver is a perquisite here.

In the literature, it is recognised that trust is highly important for the effective operation of the market in a knowledge-based economy, since the exchange of knowledge gives rise to a high level of risk and uncertainty. The higher the level of trust is between actors, the lower the perceived risks and uncertainties are (Roberts, 2000). Furthermore, Levin et al. (2004) reported that trust is improving the usefulness of knowledge, especially in the case of tacit knowledge. Following Levin et al., trust is recognised as a mediating characteristic for the transfer of knowledge.

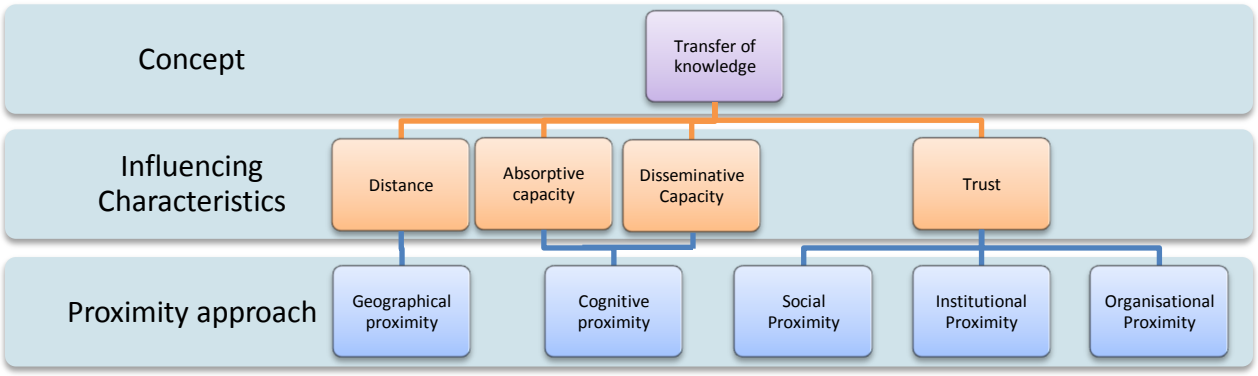
For the receiver and the transfer of knowledge towards it in our example, trust is needed when receiving knowledge from the sender. The receiver has to trust the sender that it will be provided will the tacit knowledge it needs to operate the new machine efficiently. More specifically, the representative of the receiver has to trust the representative of the sender that the sender's representative offers all the tacit knowledge he has while helping the receiver's representative to understand for example the manual of the new machine. Defining the tacit knowledge that the sender will use to facilitate the transfer of knowledge in a contract is not possible. Therefore, also in the example at hand, trust is a necessity for effective knowledge transfer.

2.3.5 Proximity Approach to Knowledge Transfer

Rather than a collection of characteristics, a complete framework that examines knowledge transfer could improve the analysis and understanding of knowledge transfer. First, redundancy of characteristics could lead to biases. If concepts of several indicators overlap, it could lead to biased results when applying those concepts. Indicators that are defined to one concept might also influence other concepts and thus biased results when gathering new data. These biases could be anticipated for, however the biases should be known upfront. As concepts are used by multiple scholars, the amount of overlaps is not clear. Therefore, a framework created by a single paper is preferred. Second, trust itself is still difficult to define as a concept. Several scholars have tried to unravel this concept of trust into more tangible dimensions (Boschma, 2005; Roberts, 2000; Ambos & Ambos, 2009; Goodall & Roberts, 2003).

A framework to characterise knowledge transfer is developed by Boschma. In this framework, five concepts called proximities are used to characterise the transfer of knowledge. Trust is untangled into three concepts: social proximity, organisational proximity and institutional proximity (see figure 5 below). The division of trust into three concepts makes it easier to operationalise trust. Geographical proximity is used as a substitute for distance. Analysing both concepts reveals that these are similar. It is tentatively assumed that Boschma introduces the term geographical proximity to harmonise the terms of the different concepts introduced in the framework. Cognitive proximity is related to absorptive and disseminative capacity. Whereas absorptive capacity and disseminative capacity are based on only the sender or receiver, cognitive proximity is based on the relationship between these two. It is assumed that the proximities within this framework are not overlapping.

Figure 4: Relation between Influencing Characteristics and the Proximities Approach



Geographical Proximity

Geographical proximity is defined as “the spatial or physical distance between economic actors both in its absolute and relative meaning” (Boschma, 2005, p. 69). Geographical proximity ranges from high, in case of cities or smaller parts of a country, via medium, when referring to nationwide areas, to low, while referring to areas that cover one or more continents.

In his article, Boschma refers to the negative effects of geographical proximity. When the geographical proximity is too high, a geographical or spatial lock-in might arise. This lock-in occurs if organisations concentrate excessively on contacts within their own region. If a large number of organisations concentrate on their own region, these regions might become inward looking and lose the ability to respond to developments from outside their own region. This could harm the innovative capabilities of that region, as it is no longer aware of developments outside of its own regions and thus cannot anticipate on these. Geographical proximity can also be too low. In this case, the costs of meetings are high, and become an obstacle for meetings. The costs are in the transportation costs such as airplane tickets and time costs such as the time to travel.

The geographical proximity of the sender and the receiver is important for knowledge transfer between them. The closer the two actors are located, the more likely it is that employees from the organisations meet each other. Travel times are decreased when sender and receiver are closely located. For knowledge transfer, meetings with face-to-face contact are preferred. When the organisations are located close to each other, the travel times for these meetings are diminished and thus, the efficiency of these meetings is increased.

Cognitive Proximity

Cognitive proximity, as defined by Boschma refers to “people sharing the same knowledge base and expertise” so that people have the ability to learn from each other. Furthermore, it influences also the speed and efficiency of knowledge transfer (2005, p. 63). Absorptive capacity is referred to the knowledge that is already present in the receiver and enables the receiver to understand the newly absorbed knowledge. Disseminative capacity is defined as the capacity of the sender to transfer knowledge. Disseminative capacity is needed to make knowledge transferable and to ensure understanding of the knowledge when it is received (Mu, Tang, & MacLachlan, 2010). When combining the concepts of disseminative and absorptive capacity, it seems that the compatibility in knowledge embedded in the sender and receiver has an influence on the effectiveness of knowledge transfer. Now the assumption is made that the more the knowledge base or two actors is similar, the more they are

compatible. Assuming the assumption is correct, it is tentatively arguable that the combination of absorptive and disseminative capacity on the one hand, and cognitive proximity on the other hand, are similar within the scope of this research.

Cognitive proximity could be negative for knowledge transfer. If the cognitive proximity is too large, it could harm knowledge transfer. First, if the cognitive proximity between the sender and receiver is too small, the knowledge base between these two differs not much. The amount of knowledge that could be transferred between these is relatively small as the difference in knowledge between these two is not large. Second, a form of cognitive lock-in could emerge when all actors have a large cognitive proximity. This lock-in is in the sense that routines within an organisation and all its contacts become similar and organisations become obscure towards technologies and new market possibilities that differ from the familiar (Boschma, 2005). Cognitive proximity could also be too low. In this case, the sender and receiver are not able to understand each other. In the worst case, the receiver is no longer able to understand the knowledge of the sender. In that case, the knowledge transfer cannot be successful.

To create a positive effect, the cognitive proximity has to be large enough for the sender to understand the different facets of the problem of integrating new knowledge. This enables the sender to create a solution that is feasible for the receiver. Larger cognitive proximity enables the sender to provide a solution that is easier to integrate at the receiver. From the side of the receiver, larger cognitive proximity makes it easier to provide the sender with a description of the problem at hand, resulting in fewer misunderstandings.

Social proximity

Social proximity relates to the socially embedded relations between agents at the micro level. These socially embedded relations involve trust based on friendship, kinship and shared experiences (Boschma, 2005). It is the first of three constructs that amounts to trust according to Boschma. Other scholars recognised the importance of social proximity for knowledge transfer as well. Scholars indicate that economic relations are to some extent embedded in a social context (Granovetter, 1985; Polanyi, 1966; Roberts, 2000). It can be tentatively stated that these scholars agree on the notion that social proximity, in relations between firms and other economic actors, encourages knowledge transfer. Social proximity encourages a social and open attitude towards communicating knowledge, rather than a pure, calculative and narrow market orientation that is based towards minimising (transaction) costs. This results from the support of friendships and kinships by the transaction of favours. These favours are more often knowledge and knowledge transfer based than money and money transfer based (Kane,

Argote, & Levive, 2005). In addition, social proximity reduces, but not eliminates, the risk of opportunistic behaviour (Boschma, 2005).

Too much social proximity may have adverse impacts on innovation and knowledge transfer. Embedded relationships, in which much loyalty is involved, may lead to an underestimation of opportunism when relations are influenced too much by friendships and kinships. According to Uzzi (1997), much social behaviour may have negative consequences in a world with calculating actors, in markets where technologies and policies continually change in conditions of uncertainty, and where opportunism is a common attitude. For example, a sender could transmit knowledge as a favour to a receiver due to a social bond, but the receiver will not return a favour in the future, as he will not gain from it directly. In addition, long-term relationships may lock actors in routines or established ways of doing things. If these routines lead to closed networks that deny entry of outsider, new ideas may be denied as well, and thus opportunities are spilled.

Social proximity creates a more secure environment where the sender and receiver of knowledge meet. It is easier to ask questions that elaborate the knowledge for the receiver, as remarks about the level of questions will be perceived as less judgemental within the context of a friendship. In addition, it is expected that the sender will attempt to transfer the required knowledge even more thoroughly. The receiver is expected to engage in a more open way of communication towards the sender. Therefore, the problems of the receiver can be transmitted more clearly to the sender and a solution that is more suitable for that problem can be found.

Institutional proximity

Institutional proximity relates to norms and values of conduct at the macro-level. This contrasts with social proximity, which relates to friendship, kinship and shared experiences, and thus only exists at the micro level. Institutions themselves are defined here as rules, laws and codes of conduct. Institutional proximity relates to the amount of overlap between the institutions of two firms or institutes that are engaged in a transaction. Larger institutional proximity eases the transfer of knowledge, since the involved parties engage in the transaction according to similar laws and rules of conduct (Boschma, 2005).

Other scholars see the significance of institutional proximity as well. Edquist and Johnson (1997, p. 46) see institutions as a sort of “glue” for collective action (such as knowledge transfer) because they reduce uncertainty and lower transaction costs. As such, they enable the mechanisms that are part of

knowledge transfer. Furthermore, Zukin and DiMaggio (1990) state that a common language, shared habits and intellectual property rights all provide a basis for economic coordination and interactive learning. Concluding, the importance of institutional proximity is founded in the academic literature, only the application of it in this framework of proximities is novel and not yet extensively discussed.

Institutional proximity might become too large if it leads to institutional inertia. When the institutions of all actors are equal, all actors become used to these institutions and adjust their routines accordingly. Boschma argues that eventually, if all actors are adjusted to these institutions, there will be no incentive to adjust the institutions in the future. This could hinder the development of innovations that require the build-up of new, or the restructuring of old, institutional structures. As a result, institutional rigidity leaves no room for improvements of institutions of innovations that are interlinked with these new institutions.

The sender and receiver in the here used example require institutional proximity for the transfer of knowledge. For example, the institution of law, more specifically contract law, is needed to ensure a smooth workflow and payment during the knowledge transfer. Similar rules of conduct can improve the effectiveness of knowledge transfer. For instance, similar expectations about the preparations for a meeting between representatives create a more effective work environment and thus more effective knowledge transfer.

Organisational proximity

Following the definition of Boschma (2005, p. 65), organisational proximity is defined here as the extent to which relations are shared in an organisational arrangement, either within or between organisations. Organisational proximity between the actors influences the transfer of knowledge via the stability of the framework for interaction and communication it provides. These relations give an indication of the autonomy of the actors and the degree of control that can be exerted via the organizational arrangement. Organizational proximity reaches from low with no ties between independent actors (e.g. free, priced-based market) via medium, with loosely coupled networks with weak ties between autonomous entities (like in the case of joint ventures or relational suppliers), to high that is embodied in strong ties (such as a hierarchically organised firm or integrated network).

The influence of organisational proximity on knowledge transfer is supported by other authors. Strong control mechanisms such as intellectual property rights (IPRs) and other contractual agreements are often needed when transferring knowledge. For example, IPRs describe a certain amount of knowledge,

giving an indication of what parts of knowledge should be transferred. In addition, IPRs can be used to authenticate the source of knowledge in situations where expertise is required. However enforcing contractual agreements via legal instances is often a rather long and costly process. Nootenboom (1999) states that organisational power relations can solve disagreements more efficient than legal instances, when these are in the sphere of knowledge transfer. Furthermore, organisational proximity facilitates thorough action when changes are needed in the process that facilitates knowledge transfer (McNaughton, 2000). In sum, organisational proximity is recognised by several authors as a facility to control uncertainty and opportunism in knowledge transfer.

Yet, too much organizational proximity might not be favourable for knowledge transfer as well. As with other proximities, organisational lock-in might occur. The lack of openness towards other, dissimilar organisations could lead to the disregard of new ideas from these organisations. Secondly, if the organisational proximity leads to a hierarchal relation, novel and groundbreaking ideas might not be rewarded anymore, as in hierarchal organisations, a lack of feedback is common. Consequently, the incentives to create new ideas diminish, and the innovative capabilities decrease.

For the sender and receiver in our example, the organisational proximity is rather small as they are not part of a common company or other organisation. Thus, in case of disagreements about or changes to the method of how the knowledge is transferred, no organisational influence can be used to solve differences. This could threaten the effectiveness of the knowledge transfer. A possible solution in this case is to compensate the lack of organisational proximity by focussing on increasing other forms of proximity. More specifically, increases in social proximity could mediate the effect of low organisational proximity.

2.4 Innovation Systems

The sender and receiver of knowledge are situated within a certain network that influences transfer of knowledge. In previous paragraphs, knowledge transfer was regarded between one single sender and one single receiver. However these actors are not situated in a vacuum as firms are usually embedded within a network. Therefore, knowledge transfer is not only concerned with the sender and receiver of knowledge, but also dependent on the network where the knowledge transfer takes place. These networks are called innovation systems.

A variety of innovation systems is analysed. The variety of innovation systems is found in various articles in the literature. To analyse these innovation systems, characteristics are needed that are comparable between the different systems. These characteristics are the proximities as defined by Boschma and introduced in the previous paragraph. Thus, in the following, the innovation systems discussed by other articles are first analysed and then compared in terms of proximities.

In the beginning of section 2.3, it was assumed that the proximities are not overlapping. Analysing the theory of Boschma this seems to be true. However, the different proximities could very well still interfere with each over. A change in one dimension of proximity could have consequences for one or more other dimensions of proximity. For example, as higher geographical proximity leads to an increase of encounters of individuals, these encounters could in turn lead to an increase friendships and kinships. This increase in friendships and kinships increases the social proximity. Understanding these interferences of proximities could be vital in a later stage of this thesis.

In section 2.4.1, the idea of innovation systems is introduced. Then several innovation systems are introduced and categorised along the five proximities. In addition, the Chinese Regional Innovation Platform (RIP) is analysed according to the five proximities. The different innovation systems will be compared along the dimensions of proximity. These innovation systems will be discussed in section 2.4.2 until section 2.4.5. Boschma is not explicitly introducing measures along the dimensions of proximities. He refers to certain examples for each dimension but does not specify a complete dimension in his framework. To be able to compare different innovation systems the researcher introduces a uniform range for all dimensions of proximity here. The least amount of proximity is labelled as “Low” and increases via “Low / Medium”, “Medium” and “Medium / High” to the other extreme “High”.

2.4.1 Definition of Innovation System

Definitions of innovation systems are numerous and several scholars have contributed a suggestion. Freeman (1988) sees an innovation system as "[...] the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies." Lundvall (1992) describes an innovation system as "[...] the elements and relationships which interact in the production, diffusion and use of new, and economically useful, knowledge". Another definition is suggested by Nelson, "a set of institutions whose interactions determine the innovative performance ... of firms" (1993). All scholars see institutions and interactions as parts of the innovation system. Within the concept of an innovation system, the flow of knowledge among people, enterprises and institutions is vital to an innovation process. Furthermore, it contains the interaction between actors that is needed to turn an idea into a process, product or services on the market.

2.4.2 Cluster

To define a cluster, a vast array of terms and designations has been used to characterize them, such as "*industrial districts*, *new industrial spaces*, *local production systems*, *local high-tech milieux*, *local and regional innovation systems*, or *learning regions"* (Asheim et al., 2006, p. 2). In this report, the definition coined by Porter has been chosen. This scholar defines clusters as: *"Geographical concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, associated institutions (for example universities, standards agencies, and trade associations) in particular fields that compete but also co-operate"* (Porter, 2008, p. 213). The definition emphasizes three characteristics, which are broadly recognized as distinctive for clusters. These are:

- Linkage between the actors within the cluster, either vertically, horizontally or both;
- [High] Geographical proximity; and
- A large variety of firms and organizations constitute the set of actors within a cluster.

An example of a well-known cluster is the filmmaking industry in Hollywood, Los Angeles. The filmmaking cluster in Hollywood is an agglomeration of companies that produces films or provides services for companies that produce films. Linkages between companies are numerate (de Propris & Hypponen, 2007). Actor schools, agencies, movie studios and other organisations create a certain variety of actors. Since all actors are located within the same city, the geographical is high.

The cognitive proximity within a cluster is average. There certainly is coherence within the knowledge base of the different firms and organisations of a cluster. This follows from the definition by Porter.

Thus, the cognitive proximity is not low. However, due the large amount of different actors, companies and organisations tend to specialise in certain niches within a cluster. Thus, the knowledge base is varying in each actor and therefore the cognitive proximity is not high.

Within a cluster, the social proximity is medium to high. Ter Wal (2009) is arguing that a lack of social proximity might prevent the emergence of networks of local collective learning in clusters, despite the geographical proximity. Thus, social proximity is needed for cluster to be successful, as collective learning is needed to update continuously the innovative capabilities of the cluster as a whole. In addition, the geographical proximity and linkage between actors results in numerous encounters between individuals within this cluster. Over the course of these meetings, friendships or kinships could arise, which increase the social proximity.

Institutional proximity within a cluster is categorised as medium. Due to the interconnection between firms, it is likely that habits and rules of thumb are becoming similar to the different actors of the cluster over time. Frequent collaboration between the actors of a cluster supports this development towards increased institutional proximity. Formal institutions are likely to be similar as well. Laws and regulations extend to the complete geographical area of a cluster, and beyond. Even special regulations, for example tax deductions for special economic zones, are not likely to cover an area that is smaller than the geographical space covered by the cluster. However, the institutional proximity will not be high, as actors are not obligated to corporate the same informal institutions in their organisations. In addition, the nature of the different actors within a cluster (i.e. research institutes, firms, governmental bodies) will have consequences for the behaviour within these organisations. Thus some differences in rules of thumb or other informal rules and regulations will last.

Organisational proximity is medium. The firms within a cluster are separate entities and the existence of other actors such as governmental bodies or research institutions within a cluster create a great variety. It is recognised that the firms and institutions within a cluster are fated to work together due to their co-location and number of intra-firm linkages. However, these power relations are less strict as in a corporate venture, for example. At most, the relations within a cluster can be seen as connected as the tie between a firm and its relational supplier.

2.4.3 Triple Helix System

The triple helix system is an innovation system that is known in a number of different varieties. It can be tentatively argued that the most common version of the triple helix model is based on institutional

spheres (Leydesdorff & Etzkowitz, 1998). These spheres stand for the academia, the government and the industry. Educational institutions of higher learning (i.e. colleges and universities) primarily represent academia in this paradigm; however, educational institutions of other levels are not excluded from contributing to, and participating in, triple helix innovation processes. Government may be represented by any of the three levels of government and their respective branches: Federal (national), state (provincial), and local (municipal). There are no restrictions on the types of industry (firms) involvement in triple helix innovation processes: i.e., industry may be represented by private corporations, partnerships, or sole proprietorships.

An example of a triple helix system is found in Catalonia, Spain. The major part of this innovation system can be found at the Barcelona Science Park near the University district of Barcelona, while other parts of this triple helix system are based in different parts of Catalonia. This Science Park seems to take into account the need for universities to be well connected with the economic and social world as their main target. The location of the Science Park in the Pedralbes Area responds to the existing availability of research potential in that area which is where the University of Barcelona locates its most active research personnel and most important research infrastructures and services (Viale & Chiglione, 1998). The same can be observed in the Catalonia Polytechnic University and in the CSIC Institutes in Barcelona. The collaboration between universities and companies is initiated, overseen and sponsored by governmental institutions, the third sphere in the Triple Helix system.

In terms of proximities, the proximities within the triple helix system are rather low. The geographical proximity can be categorised as low to medium, since the different systems might be spread nation-wide. The cognitive proximity is categorised as medium. The different actors are not related very closely via either joint production processes or development of products. However, the joint goal of a triple helix system requires the different institutions to have certain amount of common understanding and thus a knowledge base that at least slightly overlaps. Social proximity between the three spheres can tentatively be described as low, as the socially embedded relations between individuals of different spheres are often loose or might even not exist at all.

The institutional proximity within a triple helix system consists o two parts. The formal institutions such as laws and regulations are ideally synchronised and common, since these are created by the government, one of the spheres. This is contrasted by the differences in informal institutions such as rules of conduct or habits. It is arguable that the habits within firms are differing from the habits within

universities or government agencies. Due to the contrast between formal and informal institutions, the complete institutional proximity is categorised as medium.

The organisational proximity of a triple helix system is labelled as medium. The different actors within a triple helix system are not part of the same organisation; neither is the cooperation linked via a market-like system. The cooperation between the different agencies, universities and firms is most comparable with a loosely coupled network with weak ties between autonomous entities. This sort of network identified with a medium organisational proximity.

2.4.4 Sectoral System of Innovation

A sectoral system of innovation (SSI) is evolving around a set of new and established products and comprised of the agents carrying out market and non-market interactions for the creation, production and sale of those products. The set of agents within an SSI composes of individuals and organisations. The individuals are the consumers of these products and individuals working within the sector that is related to these products. The organisations are firms, universities financial institutions, government agencies, trade unions etc that are all related to the group of related products. The interactions are processes of communication, exchange, co-operation, competition and command, and their interactions are shaped by institutions (Malerba, 2002).

Klincewicz and Miyazaki (2006) describe the sectoral system of innovation in software in Japan. While working together with other nations in more basic parts of software, especially gaming software is developed in Japan. Additionally, Japan localises software for its own market. This localisation is seen in translations, or adaptations to other keyboard-layouts. This innovation system in Japan is consisting of a number of universities collaborating with large national and multi-national firms. Knowledge is traded locally between actors of the innovation system. International collaboration is limited, and most of that collaboration is via created via trans-national parts of larger Japanese firms.

In general, the geographical proximity of a sectoral system of innovation can range from low to medium-high. The sectoral system of innovation is not bound to a geographical area. Thus, an SSI could cover a large area; even exceed the geographical boundaries of a country or continent. The microchip industry is a SSI with a low geographical proximity. However, some sectoral systems of innovation are limited to only a smaller part of a country. The shoe-making industry in Marche, Italy is an example of a localised SSI (Malerba, 2002).

Within a sectoral system of innovation, the cognitive proximity can be categorised as medium. The actors involved in an SSI are connected by the same product group, thus share knowledge about the same or related subjects. However, the actors have different roles when dealing within the same sector. Therefore their view on those related products could be different and thus their knowledge base. Combining these notions, the cognitive proximity categorised as medium.

The social proximity within a sectoral system of innovation is medium to low. A sectoral system of innovation spans the whole sector. It is arguable that not all actors have direct ties with all other actors within the SSI. Actors within the SSI could only be connected as far as third, fourth or fifth indirect ties. Via these indirect ties, friendships and kinships are not able to develop, thus social proximity is not apparent. However, direct ties do exist within the SSI too. Thus, social proximity could exist between individual actors. Therefore, the social proximity within the complete sectoral system of innovation is not categorised as low, but as low to medium.

Institutional proximity of an SSI is depending on the geographical size of the specific innovation network. If the network spans a vast geographic area covering multiple countries, the laws and regulations could differ in each country, consequently lowering the institutional proximity. However, if the complete SSI is situated within a smaller region the formal institutions regarding this network might be consistent, i.e. increasing the institutional proximity. In addition, the actors within a sectoral system of innovation range from governmental agencies to research institutions and therefore are quite diverse. The codes of conduct between these actors are likely to differ, thus lowering the organisational proximity. In conclusion, the institutional proximity is tentatively categorised as low to medium.

The organisational proximity of an SSI is characterised as low to medium. The cooperation within a sectoral system of innovation is best described as a free market, with some traits of a loosely coupled network. Firms within the network are not bound to a particular supplier, a mechanism that represents the dynamics of a free market. Nevertheless, loosely coupled networks of government agencies, universities and representatives of firms are common within an SSI (Malerba, 2002). Depending on the extent of these networks, the organisational proximity within a sectoral system of innovation is either low or medium.

2.4.5 Chinese Regional Innovation Platform[2]

Recently, the development of regional innovation platforms has started in China. The open door reforms of 1978 started the development of privately owned businesses. In addition, market forces were introduced in the Chinese economy, which justified long-term investment in production facilities. With the rapid appearance of investments in production facilities, a great demand for knowledge regarding the specifics of these investments appeared. The demand was identified by government officials and craftsmen alike, which together started the founding of "crafting schools". Some of these developed rapidly and transformed into research institutes with a focus on a particular sector. The collaboration between private firms and these institutes, together with (partial) sponsoring of governmental agencies for research projects, was formalised into the current Regional Innovation platforms. The geographical scale of these regional innovation platforms is provinces, as provinces in China are administratively and economically independent geographical regions. Since the open-door reform, provincial governments have gained autonomy for formulating economic and social development policies. Although all are subject to the same legal and political institutions that are under the control of the central government of China, each region has its own governmental rules. Technology policy and innovation plans for example have strong regional features (Li X. , 2009).

The geographical proximity of an RIP is categorised as medium to high. The geographical area of an RIP is limited to one province and thus proximity could be categorised as high. However, the typical geographical area of a province in China is several times larger than the area of for example Denmark or the Netherlands. Therefore, the geographical proximity is categorised as medium to high, and not as high.

The cognitive proximity within a regional innovation platform is medium to high. In the case of an RIP, the firms and research institutes are focussed on the same sector, thus the knowledge bases of these actors have numerous similarities. Firms have gained knowledge from the research institutes and thus similar knowledge is available in both groups of actors. However, the point-of-view of the various

[2] Here, only an overview of the academic literature regarding the Chinese RIPs is given. Conclusions about the proximities within the Chinese RIP are based on this literature alone. The results of the data collection in China by the researcher are given in Section 4.

organisations is different and thus their understanding of the similar product may vary. Since knowledge base is not completely overlapping, the cognitive proximity is categorised as medium to high.

Social proximity within a regional innovation platform is difficult to categorise. Boschma uses friendships, kinships and shared experiences as indicators for social proximity. Friendships and kinships may have a different value in China, as their perception is depending on the culture of the country. Shared experiences do exist between partners in the Chinese RIPs. Firms and the research institute developed together from being basic entities in the 1980's towards the more modern organisations they now resemble. In addition, it is likely that prolonged cooperation between actors within the innovation platform sparked various friendships and kinships. Therefore, the social proximity of an RIP is cautiously categorised as medium.

The institutional proximity within a regional innovation platform in China is medium to high. Since the actors within the RIP developed together, it could be assumed that codes of conduct were established that were reasonable for all organisations. In addition, laws and regulations are equal to all entities within the RIP, as these are all located within the same province. Furthermore, dialects divided along the borders of provinces, thus people within one province speak the same dialect, and the culture is coherent within one province (Li X. , 2009). Adding these features up, the institutional proximity is labelled rather high.

Within a Chinese regional innovation platform, the organizational proximity can be described as medium. The actors within a platform are representing a loosely coupled network. It is assumed that the firms are autonomous as is the research institute. The institute can be described as the relational supplier regarding knowledge for the firms.

2.5 Comparison of Innovation Systems

In the previous, three types of innovation systems were introduced, along with the Chinese regional innovation platform. These were categorized along five proximities that influence knowledge transfer.

Figure 5: Comparison of Innovation Systems along Proximity Dimensions

Type of Proximity	Cluster	Triple Helix System	Sectoral system of innovation	Chinese RIP
Geographical	High	Low / Medium	Range from Low to Medium / High	Medium / High
Cognitive	Medium	Medium	Medium	Medium / High
Social	Medium / High	Low	Low / Medium	(Medium)
Institutional	Medium	Medium	Range from Low to Medium	Medium / High
Organisational	Medium	Medium	Low / Medium	Medium

The categorisation of innovation systems as seen in figure 5 is based on the analysis in the previous paragraphs. Academic sources were found for each innovation system and analysed in the light of the five proximities as introduced by Boschma. Based on the categorisation of innovation systems, several general conclusions can be drawn about each type of innovation system and its support to knowledge transfer.

Overall, a cluster is an effective innovation system to support the transfer of knowledge. Most proximities are categorised as medium. This supports the transfer of knowledge sufficiently to be effective, but the proximity is not too large to create unwanted side-effects. However, this is not true for geographical proximity. In the case of a cluster, the geographical proximity is categorised as high. This could result in a spatial lock-in, where actors are concentrating excessively on relations within their own region. Knowledge from other regions could be perceived as invasive or unfamiliar, which harms the transfer of knowledge from other regions. Therefore, clusters are an effective innovation system for local knowledge transfer, but sole dependency on a cluster could restrict the transfer of knowledge from other, non-local sources.

A triple helix system is, in most cases, able to support knowledge transfer in an effective manner. Most proximities are categorised as medium. However, where a cluster had too much proximity which could hinder knowledge transfer, a triple helix system could suffer from too little proximity. The social

proximity of a triple helix system is categorised as low. Socially embedded relationships between different spheres of the triple helix system, i.e. government, education and firms, are often loose or might not exist at all. Therefore, the environment in which sender and receiver meet might not be perceived as secure. When the environment is not perceived as secure, knowledge transfer might not occur. The thread of opportunism or opportunism itself could become consequences as there is no strong social bond between the receiver and sender of knowledge. This is due to the fact that the receiver of knowledge does not perceive a moral obligation to return a favour in the future. This could hinder the transfer of knowledge as the sender will hesitate to transfer knowledge in the first place. Control mechanisms which are not based on social relations are needed within a triple helix system to ensure knowledge transfer. These could consist of covenants signed by all participating actors or a central organ where opportunistic behaviour could be reported. If these control mechanisms are in place, the triple helix system could be an effective instrument to support knowledge transfer.

A sectoral system of innovation is lesser equipped to facilitate effective knowledge transfer. In general, the proximities within a sectoral system of innovation are too low for supporting transfer of knowledge. Relations between actors are loose and the transfer of knowledge is not supported by a system that discourages opportunism. This hinders knowledge transfer as the fear for opportunism by potential partners could dispirit the will to transfer knowledge. In this case, additional supports for knowledge transfer are needed, such as contractual agreements or social embedded relations. Therefore, the sectoral system of innovation might encourage finding potential partners for knowledge transfer, but for effective knowledge transfer, it requires support by additional supporting systems.

The Chinese RIPs show most similarities with clusters. The organisational proximity of a cluster and a Chinese RIP is categorised as similar. The cognitive and institutional proximity differ only by a single step on the scale of these dimensions as these are higher in a Chinese RIP than in a cluster. The geographical proximity of a cluster is higher than the geographical proximity of an RIP, yet the difference is also only a single step on the scale of that dimension. The social proximity too is not different a large amount, assuming that the statement of a medium social proximity is correct. As with a cluster, the Chinese RIP is an effective instrument for knowledge transfer between its members. Nevertheless, the high proximities between members of a Chinese RIP could lead to exclusion of knowledge from outside a Chinese RIP. In the case of a cluster, external knowledge might be rejected based on its geographical origin. In the case of a Chinese RIP, knowledge might be rejected based on geographical origin, cognitive distance or institutional distance.

Section 3: Methods

3.1 Research Strategy

In this part, the research strategy for the thesis is explained. The research strategy is an argued method to answer the research questions and the main research question (Visscher, 2009). The research strategy of this thesis is give per research question. This division is chosen to devise a research strategy per question in a manner that is appropriate to that particular research question.

3.1.2 Research Strategy forRQ1

The research strategy to answer research question one is field based. Investigating thoroughly how knowledge was transferred from innovation systems towards SMEs in China before the introduction of NIPs calls for insight in the personal experiences of the members of the involved actors. To collect these personal experiences, interviews with representatives of innovation systems as well as SMEs are conducted. The interviews can provide a deeper understanding of the mechanisms and arrangements between innovation systems and SME in China. In addition, research question one requires a research strategy that covers the multiple characteristics of the relation between the SMEs and innovation systems. Each characteristic represents a degree of freedom for the relation between SMEs and the systems of innovation. A limited number of case studies could lead to biased results due to lack of variation. Lack of variation occurs if the number of cases is not sufficiently larger than the number of degrees of freedom. Since the number of innovation systems is limited, the research focuses on the SMEs. To investigate a large number of characteristics between those SMEs and an innovation system, a questionnaire is chosen to gather data. The answers given in the questionnaire are translated to indicators among the various degrees of freedom for the relation between SMEs and the innovation system.

3.1.3 Research Strategy for RQ 2

The research strategy to gather information about the NIP-concept consists of two parts. First, written information about the NIP-concept is collected. As a starting point, the article of Li, Deng & Sorensen is used. Further written information is enquired from Prof. Li Jizhen, an assistant professor at the Tsinghua University, Beijing, China. Prof. Li, together with other scholars at Tsinghua University, investigates the formation of the National Innovation Platforms in China. Second, interviews with Li Jizhen and other academics can reveal additional information about the NIP-concept that is not yet published. Since the

NIP-concept is still in a planning phase and thus changes over time, these interviews were held at different occasions between August and December of 2009.

3.2 Gathering Information from Respondents

To answer the main research question, insight is needed as to how knowledge is transferred in the direction of small- and medium-sized enterprises in China specifically. Field data is collected to reveal these insights. However, analysing all Chinese SMEs and all institutes that provide knowledge is not feasible. Therefore, only one sector of all Chinese industries was investigated, the textile sector.

The textile sector was chosen since it is the first sector where the Chinese NIP-concept is introduced. China has the largest textile industry in the world and the textile industry is highly important to the Chinese economy. In 2007, the value created within the textile industry reached € 307 billion, accounting for 12.5% of China's GDP. The Chinese textile sector is mainly based in the Yangtze River Delta, which comprises of the Shanghai, Nanjing and Hangzhou cities and the Zhejiang and Jiangsu province. It is estimated that about 20 million employees are employed by the textile industry in China (Li et al., 2009).

The field data collected in this research consists of three parts. First, a questionnaire under SMEs was conducted to gather information about relevant characteristics regarding knowledge transfer. Second, interviews were conducted to gain insight in the mechanisms involving the knowledge transfer from regional innovation platforms towards SMEs. Third, written materials were obtained and interviews were conducted to gain insight in the Chinese NIP-concept.

3.3 Questionnaire among SMEs

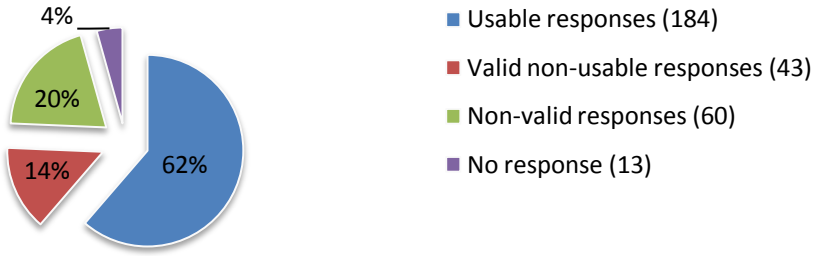
A questionnaire was filled out by SMEs that operate in the Zhejiang province. The questionnaire targeted the Zhejiang province specifically, due to the large concentration of textile industry in that province. Of all companies engaged in the textile sector, 85% are situated in the Zhejiang province. The questionnaire was held to determine how the relations between an SME and the ZIT score on the characteristics that influence knowledge transfer. The characteristics that are used in this sample are the proximities that were identified in Section two of this thesis.

Of all SMEs based in the Zhejiang province and active in the textile sector, 300 were selected as the initial targeting sample. The total number of SME's active in the textile sector in

Zhejiang is 18.000 (Zhejiang Institute of Technology, 2008). The sample population of 300 SMEs was selected randomly by the Bureau of Science and Technology of the Zhejiang Province (BSZ). It can tentatively be stated that the BSZ has used a form of simple random sampling. This method is a type of probability sampling in which the units composing a population are assigned numbers. A set of random numbers is then generated, and the units having those numbers are included in the sample. The questionnaire was held in October 2009.

Three-hundred questionnaires were sent out and their responses were collected by the BSZ. The researchers of the Tsinghua University have received 287 responses from BSZ. Of these, a number were not usable, due to insufficient responses to the questionnaire or lack of readability. In addition, a few responses were clearly answered by the same person, those were identified by identical handwriting or the usage of identical names, places etc. In total 60 questionnaires were discarded, leaving 227 valid responses. Of those valid responses, 43 SMEs indicated to that they have not collaborated with the ZIT, leaving 184 SMEs that responded validly and have collaborated with the ZIT. These 184 responds are usable for this thesis.

Figure 6: Distribution of validity of responses



The 184 usable responses have been compared with the 227 valid responses to analyse the group of respondents that gave valid responses. Comparing these two groups on a number of other dimensions reveals slight differences that are statistically valid. The usable respondents tend to represent slightly smaller SMEs than the complete group of valid responses. In addition, the group of usable responses also generated less sales income over 2008. However, these differences are modest enough to state that the group with usable responses is representative for the whole population of valid responses.

Operationalisation for Questionnaire

In total, the questionnaire consisted of 81 questions. The largest portion of questions is 5-point Likert scale, six questions allowed multiple answers, three questions concerned a number or date and one

question was open. A small number of the valid responses have some minor irregularities. Despite the best efforts, these responses occasionally lack single answers.

By defining indicators, the answers of the questionnaire are related to the proximities as found in the literature. The operationalisation of the proximities towards the indicators used in this questionnaire was developed by the author himself. From the theory, five dimensions of proximity have been identified. The range for any of these proximity starts from 1 for “high proximity” to 5 for “low proximity”. Intermediate values can be 2 for “medium/high proximity”, 3 for “medium proximity” and 4 for “low/medium proximity”.

Geographical proximity is not addressed directly in the questionnaire, but perceived as medium/high in the case of regional innovation platforms and low/medium in the case of National Innovation Platforms. Since social, cognitive, institutional and organisational proximity cannot be measured directly, conceptualisation of these constructs was necessary.

To measure Cognitive proximity, the indicators “The ZIT understands the needs of the company” and “The solution offered by the ZIT fits the needs of the company very well” are used. The first indicator relates to the amount of understanding that the ZIT has of the knowledge base of the SME. The more the ZIT understands the knowledge of the SME, the closer the knowledge bases are related and thus the larger the cognitive proximity. The second indicator relates to the fitting of the provided solution of the ZIT. It is assumed that the better the solution of the ZIT is, the more it understood the problem at hand, and thus understood the deficit in the knowledge base of the SME. The more the ZIT understands the knowledge base of the SME, the larger the cognitive proximity. Both indicators are positively related to the cognitive proximity. The proximity is measured as the average value of these two indicators.

To measure Social proximity, the indicator “the company has close contact with the ZIT” will be used. It is assumed that the closer the contact between an SME and the ZIT is, the more social artefacts such as friendships and kinships can be found. The social proximity is measured directly from this single indicator, as the indicator is positively related to the social proximity. In addition, the indicator “Year of first contact with the ZIT” is introduced. This second indicator is used to investigate if the first indicator, and thus social proximity, increases as the relations with the ZIT mature.

To measure Institutional proximity, the indicator "Technological secrets have not been revealed by the ZIT" is used. The Institutional proximity is measured directly from this indicator, as the indicator is positively related to the institutional proximity.

To measure Organisational proximity, the indicators "The Company has also contacts with other innovation platforms from outside the province" and "Innovation also exists within the company without cooperation with the ZIT" are used. A higher score on the first indicator would assume that the SME is less depending on the ZIT to innovate as it also ahs contacts with other innovation platforms. A higher score on the second indicator would indicate that the SME is able to innovate on its own, without the help of the ZIT. This in turn means that the SME is less depending of the ZIT, or that the the organisational proximity is lower. Thus, the indicators are both negatively related with the Institutional proximity. To compute the Organisational proximity, first the average of the two indicators is taken. Then the negative relation is compensated by computing [6 – (average of two indicators)] as the organisational proximity.

Furthermore, one additional construct has been conceptualised. This other construct is not used for the measurement of the proximities, but will be used in the conclusion and discussion part of this thesis. This concept is "trust". For the concept of trust the indicator, "The Company trusts the ZIT" is used.

Most indicators were measured with a 5-point Likert scale. This scale ranged from one to five. One represents "strongly agree", two represents "agree", three stands for "neutral", four represents "disagree" and five represents "strongly disagree". Only the indicator, "Year of first contact with the ZIT", was not measured via a Likert scale, but was gained with and interval measurement. The interval of this measurement was one year.

3.4 Interviews at SMEs and RIPs

For this thesis, interviews were held with representatives of two different regional innovation platforms and representatives of SMEs. These regional innovation platforms are based in the Zhejiang province and in Shanghai (which also has a province status). Representatives of SMEs were interviewed in the Zhejiang province. This was done to include not only the transmitting end of the knowledge transfer, but also the receiving end. Together, these interviews give an insight to the way knowledge is transferred from regional innovation platforms towards SMEs in China before the introduction of NIPs. The interviews were held in August and September of 2009.

The Zhejiang Institute of modern Textile industry (ZIT) and the Shanghai Textile Science & Technology Center (STC) were selected as sample of the about 20 regional innovation platforms (RIPs) in the textile industry. Both platforms currently hold the status of regional innovation platform for their own province respectively. The ZIT and STC were selected as sample due to their nomination as exemplars for other innovation platforms by the Chinese government. Therefore, it is likely that other regional innovation platforms will be stimulated by the central government of China to change their work processes to resemble more the work processes of these platforms. In addition, when new RIPs will be founded, the practices of the ZIT and the STC will be used as an exemplar for these new platforms. Therefore, the sample of these two RIPs can be used as an example for other regional innovation platforms.

The interviewed SMEs are all situated in the Zhejiang province. Due to time and budget constraints, only SMEs in this one province have been interviewed. The interviewed SMEs are Yinqiao Textile Co. Ltd., Ancient Xian Road Textile Co. Ltd., New Transit and Vietnam CTI Co. Ltd. These companies were suggested by the ZIT.

Since the interviewed SMEs are all suggested by the ZIT, it is likely that these examples only represent best practices. Other partners of the ZIT with whom the collaboration was less fruitful may not have been suggested by the ZIT. Therefore, the collaboration between these SMEs and the ZIT should only be seen as a best practise-scenario and not as a representation of the common collaboration between any SME and the ZIT.

The setting of the interviews was similar in all cases, both at the RIPs and the SMEs. Each organisation was interviewed separately. The team of interviewers and representatives of the organisation at hand meet at the location of the organisation that was analysed. Each session lasted about 4 hours, either in the morning or in afternoon. In some cases, a single interview lasted 2 sessions, thus included a lunch that was enjoyed jointly. The team of interviewers consisted of three professors of the Tsinghua University, School of Economy and Management (Prof. Li, Prof Gao and Prof. Xang), one Chinese PhD-student (Li Guiqin), one Chinese Master-student (Deng Quwen) and the writer of this thesis. At the RIPs, the interviews were mostly held with several experts simultaneously, where the interviews at the SMEs were mostly with only one representative of the enterprise. A typical setting of a session can be seen on the pictures below; these were taken at the STC.

Figure 2: Pictures taken during the interview at the STC.

Left: representatives of the STC; Right: Team of interviewers

The interviews were held in Chinese and were semi-structured. The list of topics for the interview was compiled before the interviews and was open to amendments by all participants. Due to the language barrier, it was not possible for the researcher to participate directly in the interviews. However, at the end of each interview the team of interviewers revised the obtained answers. These sessions were very informative and gave a good insight in both the answers of the interviewed persons, as well as to the line of thought by the other members of the team of interviewers. Furthermore, a digital version of the complete transcript of all interviews has been handed out to the writer of this thesis.

The data obtained from the interviews is evaluated via cross-case analysis. This method uses multiple cases and compares the data of the separate cases to see commonalities and differences. In this case, the data from the interviews at the two regional innovation platforms is compared with each other. This gains insight as to how knowledge is prepared and transmitted towards SME. A similar approach is chosen for the data from the SMEs, i.e. cross-case analysis. The data from the interviews at the different SMEs is compared to find patterns in the receiving and understanding transferred knowledge.

3.2.3 Collecting Information about the NIP-concept

Gathering information about the Chinese NIP-concept is rather complicated. First, the concept is not settled as of January 2010. Amendments, restructures and rephrases are still made to the NIP-concept. Therefore, no detailed overview of the NIP-concept could be found. Second, the language barrier is frustrating the collection of data for non-Mandarin speakers. The Chinese NIP-concept is foremost relevant for internal Chinese affairs and thus the primary language concerning discussion and proposals about the NIP-concept is Mandarin. Discussing the concept with non-English speaking representatives is therefore a time-consuming and complex issue.

The article of Li et al. (2009) is used as a starting point for the collection of data about the NIP-concept. Second, a number of interviews were held with members of the department of Innovation and Entrepreneurship of the School of Economics and Management of the Tsinghua University. These included interviews with Prof. Li Jizhen and Deng Quwen, two of the authors of the article that was used as a starting point. Furthermore, Prof. Gao and Prof. Gu, both members of the same department, were interviewed. The interviewees are conducting research concerning the foundation of the Chinese NIP-projects and publish advice to the relevant Chinese governmental institutions. These interviews were held in September and October of 2009. In addition, two concluding interviews were held with Deng Quwen and Prof. Li Jizhen in December 2009 to gather updates about any changes or amendments to the NIP-concept.

The interviews regarding the NIP-concept were held in various settings in Beijing. Interviews with Prof. Gu and Prof. Gao were held in their offices, while interviews with Deng Quwen and Prof. Li Jizhen were held at their offices, various restaurants during lunch or meeting rooms at Tsinghua University. All interviews were non-structured and face-to-face, providing maximal flexibility to cover various topics in relation to the NIP-concept. Data acquired from the interviews is analysed only qualitatively.

3.5 General Validity Concerns

Reflection of the methods used to obtain the data is needed to ensure the validity of the data. This ensures that conclusions drawn from the collected data are valid. Here the validity of the data is analysed.

3.5.1 Personal Interviews with Representatives of SMEs and RIPs

Concerning the personal interviews at regional innovation platforms and SMEs, validity is threatened by a number of causes. The construct validity might be endangered by the language barrier. All questions have to be translated from English into Mandarin and all responses have to be translated from Mandarin to English. Several constructs, such as trust or social proximity, are rooted deeply in the personal culture of the respondent. These constructs might be perceived differently in the Chinese culture then in the Western culture and thus the validity of the answers is threatened. To minimise this threat, the researcher spent several months in China to experience and anticipate these cultural differences.

A greater threat to the validity of the personal interviews in Zhejiang province is the bias towards positive answers of the respondents. This is especially the case for interviews with representatives of regional innovation platforms. The creation of national platforms is still ongoing and the financial

budgets of the participating regional innovation platforms are not yet determined. Therefore, it is plausible that representatives of regional innovation platforms are positively biased towards the effectiveness and efficiency of the regional innovation platforms. Representatives of SMEs too could offer biased answers due to their loyalty with individuals within the regional innovation platforms. In addition, the choice of the SMEs was made by the ZIT. Therefore, it is highly likely that the representatives of the SMEs are only presenting best practices of collaboration. To anticipate these threats, the answers of these respondents are carefully scrutinised and answers are only adopted after careful consideration.

3.5.2 Questionnaire among SMEs

In the questionnaire, the construct validity is threatened by the language barrier and cultural differences between the researcher and the respondents. Similar to the situation of the personal interviews with representatives of SMEs and innovation platforms, loyalty could bias the answers of the respondents. In addition, the Bureau of Science of Technology of the Zhejiang Province could not have distributed the questionnaires randomly. As the BSZ has an interest that the innovation platform in that province is reviewed positively, the Bureau could distribute the questionnaire with partiality to SMEs that are positive about the institute the Zhejiang province. This could endanger the external validity.

3.5.3 Interviews about the NIP

A possible thread to the validity of the interviews about the NIP is that all interviewed experts are based in Beijing. As large differences exist between provinces in China, a larger validity would be achieved when the backgrounds of the experts was diversified over several provinces. Consulting researchers from Beijing only, might have let to bias towards the regulations and codes of conduct of Beijing. However, the NIP needs to work together with institutions in the whole of China. Therefore, bias towards codes of conduct and regulations of Beijing could create wrong expectations of codes of conduct and regulations in other regions.

Section 4: Results

Section 4 is divided in three parts. The first part presents the data obtained from the interviews with regional innovation platforms and SMEs in the Zhejiang province. This will cover the experiences about how knowledge is transferred from institutes towards SMEs. The second part illustrates the results acquired from the questionnaire that was sent out to the SMEs in the Zhejiang province. This gives insight to the characteristics that influence the transfer of knowledge. The first two parts concern data that is needed to answers RQ 1. The third part states the current plans about the NIP-concept. By analysing the NIP-concept, conclusions can be drawn about the influences that the introduction of the NIP-concept will have on the transfer of knowledge towards SMEs. This data is used to answer RQ2.

4.1 Knowledge Transfer from RIPs towards SMEs in China

The mechanisms behind knowledge transfer from RIP towards SME, as discussed in the theoretical framework, can be separated in three parts: the gathering of relevant parts of knowledge at the RIP, the transmission of the knowledge from the RIP towards the SME and the interpretation of the knowledge at the SME. In the following, the results from the interviews are presented for each step separately.

4.1.1 Step 1: Identification of Knowledge

The first step in knowledge transfer was defined as the identification and collection of relevant parts of knowledge that will be transmitted. Before knowledge can be transmitted, the relevant parts of knowledge have to be accumulated and prepared for transmission. This is done within the RIP itself. Not all knowledge that is requested by the SME is readily available when a new application is made to the RIP. Nor is upfront exactly known what knowledge might be sufficient to provide a feasible solution. How knowledge is gathered at the RIP in Zhejiang (ZIT) and the RIP in Shanghai (STRI) is explained in the following.

Gathering relevant parts of knowledge at the ZIT starts with the request of an SME to solve a particular problem. In the start-up phase of the ZIT, around 1990, these requests were relatively simple. SMEs were mainly concerned with producing bulk products for the lowest possible price. To achieve this, patterns were mainly imitated from Western products to reduce the costs of having a creative business unit. As Mr. Jin, the administrative director of the ZIT, states *"Foreigners gave us a pattern, we have changed it a little bit, but this was still mostly imitation. When the School started to initiate a program for creative design, directors were reluctant to use the offered service. They started to bargain with the School about the price of designs offered but we did not bargain, finally they bought the first designs."* In

that period, gathering of the relevant parts of knowledge was relatively easy as most of the requested knowledge was already present in the Western products that were used as a “basis” to the Chinese bulk products.

The usage of patterns from the Western market was very common in the 1990s. China was not a member of the World Trade Organisation and Intellectual Property Rights were not enforced nation-wide (Feng, 2003). Although the Western patterns were not copied completely, only a slight amount of reengineering and alteration was used. China became a member of the WTO in December of 2001, and since then IP-rights are enforced more thoroughly. Therefore, the “simple” pattern alterations were no longer feasible for the ZIT.

In recent years, the requests of SMEs in connection with the ZIT became more complex. The current trend is printing patterns digitally as well as creating patterns that are inspired on Oriental culture. Since Oriental patterns cannot be imitated from Western products, new divisions, such as a pattern design division, had to be established. For the ZIT, gathering relevant parts of knowledge of knowledge became an increasingly difficult task. Not only products had to be developed, also the machines used in producing textile became more complex and the need for tacit knowledge to operate those machines increased rapidly. The current digital printing trend let to the addition of the newest division, the Digital Printing division. According to the Mr. Jin, the machinery used in this division is the most advanced digital printing equipment (as of August 2009). The machinery utilised here can no longer be exploited to its full possibilities by the ZIT only due to its complexity. Therefore, the Zhejiang University, the Donghua University and a number of other research institutes have created collaboration agreements in the last years to develop the ZIT further.

The rise of digital printing in China led to a new way of knowledge transfer at the ZIT. Earlier a pattern was designed (or reengineered) within the ZIT and then sold to the client. The digital patterns change this. The SMEs need not only the patterns for the digital printing machines to create new products, knowledge how to operate the machinery is now also demanded. Gathering knowledge about the operation of machinery is more complicated. For this, the ZIT needs to understand what knowledge is already present at the client. In addition, the situation in which the machine is placed has to be understood by the ZIT as well as the type of products that the client wants to produce. This makes the process of knowledge transfer more complicated.

The STRI in Shanghai employs a different approach to gather relevant parts of knowledge. The mindset of the STRI is that innovations are a result of advanced research. Efforts within the STRI are focussed in advancing via new textiles or production methods as well as rapid design. Clients buy information about these advances or complete designs. Alternatively, clients can rent equipment of the STRI to do research by themselves. The equipment is normally used to produce small-scale test batches. In this case, employees of the client are granted access to the machinery of the STRI that is used for small-scale production. This machinery can then be used by the client to produce prototypes. To achieve advancements in research within the STRI, the institute provides financial incentives for achievements that lead to breakthroughs. In addition, it favours younger employees for hiring since these are known to generate ideas that are more creative.

Knowledge at the STRI is centralised in 130.000 books and publications. Here the relevant parts of knowledge that are needed to fulfil a certain request of an SME are gathered. When an employee of the STRI is convinced that all relevant parts are acquired, the research is concluded and a report is prepared. In the view of the STRI, this report is seen as the complete accumulation of the relevant knowledge and as an answer to the request of the SMEs.

A written report is however not a feasible solution to transfer knowledge to a client. The STRI sees a report as a complete product. However, tacit knowledge is needed to understand the report. It is upfront not clear to the STRI if that knowledge is already present at the client. Therefore, a report could be insufficient to answer the problem of a client, or at least be an ineffective way of transporting the desired knowledge.

4.1.2 Step 2: Transmission of Knowledge

Transmission of knowledge was defined as the actual process of relocating of knowledge from the sender to the receiver. Transmission of knowledge at the ZIT is based on a personal approach. While also a report is established, personal contact between employees of the ZIT and representative of the SME is greatly encouraged. To transmit knowledge effectively, not only a representative reserves a certain timeslot for a request of an SME. To support the transmission of knowledge, the relevant machines are reserved for these sessions as well. Due to the increasing demand of requests from SMEs, certain popular machines at the ZIT are not only booked for every day within a month, on average these machines also run 10 complete nights a month. Because of this personal approach, the transmission of knowledge is mainly towards SMEs in the vicinity. Travel time is perceived as a large obstacle for representatives of the SMEs and the ZIT to transmit knowledge towards more distant SMEs.

Design requests at the ZIT are no longer answered by imitating Western products and selling these imitations to SMEs. The ZIT currently employs 10 in-house designs that transmit their products explicitly to SMEs. In addition, the ZIT started to school employees of SMEs at the ZIT itself to create designs themselves. Furthermore, freelancers are trained at the ZIT itself. These freelancers are being placed for a fixed duration at an SME to fulfil its creative demands.

The transmission of knowledge becomes more integrated at the different organisations in this approach of the ZIT. Previously, it was typical that one employee of the ZIT met with one employee of an SME. In the new situation, the transmission of knowledge is no longer done via reports or sessions alone. The transmission of knowledge is now more done via the embodiment of knowledge in persons and less via reports. This is seen in the focus of training employees of SMEs within the ZIT or the placement of freelancers at SMEs. Transmitting knowledge via persons is more effective than transmission via reports and other codified mediums. Codification of tacit knowledge is not needed as a person can understand tacit knowledge and transmit it. In addition, a person is able to absorb nuances during the transmission of knowledge that might not be noted when codifying knowledge and transmitting via paper.

At the STRI, transmission of knowledge is accomplished through sending explicit knowledge. Requests of SMEs are answered in reports. Transmission of knowledge at the STRI is perceived as sending the report to the customer. In addition to knowledge transmission on demand, the STRI prints five different specialised journals. Each of these journals targets a specific part of the textile sector, for example Wool or Cotton. In addition, four websites are hosted where (potential) customers can enquire specific knowledge. The STRI is currently establishing an “office window” for companies that are interested in any of its activities. Within the STRI, it is perceived that this would simplify the communication with clients. In addition, clients could be persuaded easier to use more than one service. A glimpse towards this new approach will be the implementation of what internally has been named “TexGoogle”. By creating a single point where all the information of the institute is stored, clients can find parts that are relevant for them easily. It should contain contact details of internal experts, related services, journal articles, relevant advertisement and patents. Companies will be able to buy a spot in the database together with their relevant specialities.

Transmission of knowledge at the STRI is based on explicit knowledge. Explicit knowledge can be transmitted cost-efficient as only sending a mail or a digital version is needed. However, if the client requires additional knowledge to read the “code” in which the explicit knowledge is written, problems could arise. Transmitting this additional knowledge is not efficient via explicit embodiment, as it first has

to be coded at the STRI. This codification of knowledge is a time consuming task, if not even not feasible in some cases. It would be more efficient to transfer this additional knowledge via personal contacts. Yet, the STRI is specialised in transmitting knowledge explicitly and thus is not trained in transmitting knowledge via personal contact.

4.1.3 Step 3: Interpretation of Knowledge

Interpretation of knowledge was defined in section 2 as the effort that is needed for understanding and effectively using the transferred knowledge by the receiver. To understand the interpretation of knowledge, the data used from the interviews with SMEs in the Zhejiang province is used. In total representatives from four SMEs were interviewed. All of those were clients of the ZIT for a long time. The long relationship with the ZIT gives those SMEs the insight as to how knowledge is transferred from the ZIT to them.

These SMEs are currently beginning to realise that bulk manufacturing is reducing their profit margin. The services of the ZIT are needed to differentiate the product lines and increase the profit margin of the SMEs. The need for the knowledge from the ZIT is dawning to some representatives of the SMEs in the Zhejiang province. As Mr Shen, a representative of Xian Ancient Road Textile (XRT) explains: *"While before the conventional products were profitable, the prices of these products dropped year after year. We had to get out of this circle to ensure making a profit. [...] The amount we create is little compared to others. We have to create high-added value products to stay profitable."*

Knowledge is interpreted at the SMEs with the help of the ZIT. *"The ZIT provides us with technology and information. We explore how that new technology works together and exchange information about the findings. Due to the platform, if we encounter a problem with an experimental set-up, the problem goes to them."* The ZIT, while consulting with the SME, decides for each case individually, if one or multiple sessions are sufficient to transfer the knowledge or if an employee of the ZIT is temporarily placed in-house at the SME. These decisions are made based on experiences in the past.

Based on these interviews, it seems that employees of SMEs are able to interpret knowledge received from the ZIT in a trouble-free manner. An SME's employee can easily ask for more explanation if something is not clear, or ask for more help with an experimental set-up. This helps the SME's employee with the interpretation of the received knowledge. In cases where new problems arise during the interpretating of a new solution, new iterations of the process of knowledge transfer are started almost seamlessly. The stage of interpreting knowledge entwines with the stage of gathering knowledge at the

ZIT, because during the interpreting stage a new iteration is started. This process also allows the ZIT to gather knowledge about how the suggested solution is incorporated in an actual set-up. Furthermore, the ZIT is able to reflect on what parts of the gathered knowledge were used in the solution and, more importantly, what additional (tacit) parts were needed to make the solution work.

When analysing the process of knowledge transfer at the STRI, it seems that smaller SMEs will encounter difficulties while interpreting the received knowledge. The SME has to interpret explicit knowledge when receiving knowledge from the STRI. To do this, background knowledge, often tacit, should already be known within the SME. However, the SME cannot request this kind of knowledge from the STRI and thus has to gain it via other channels of via the learning by doing-process. This unguided learning by doing-process requires a substantial amount of time and other resources and thus creates large costs for the SME. Especially smaller SMEs who have less spare resources will encounter difficulties when these additional costs arise.

4.2 Characteristics influencing Knowledge Transfer between RIPs and SMEs

Five characteristics were identified in the literature, which influence the effectiveness of knowledge transfer. Based on the article of Boschma (2005), these characteristics are identified as geographical proximity, social proximity, cognitive proximity, institutional proximity and organisational proximity. Four of these characteristics are measured in the questionnaire. Geographical proximity is not addressed in the questionnaire.

4.2.1 Geographical Proximity

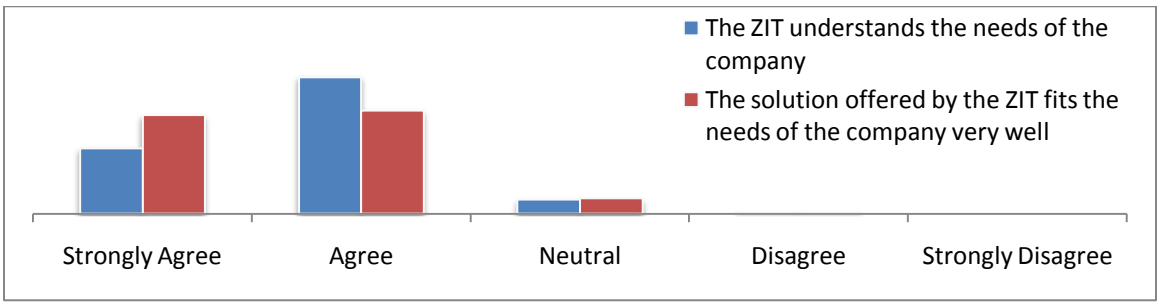
Geographical proximity is tentatively defined as medium/high if the sender of knowledge is based in the same province as the receiver. For the population of the questionnaire, this is always the case. The population is confined to SMEs in the Zhejiang province; these are the receiver of the knowledge. The sender of the knowledge is the Zhejiang Institute of modern Textile (ZIT), which is based in Zhejiang also. Therefore, geographical proximity is not investigated in the questionnaire.

4.2.2 Cognitive Proximity

Cognitive proximity was measured via two indicators. The first indicator is "The ZIT understands the needs of the company" while the second indicator is "The solution offered by the ZIT fits the needs of the company very well". The indicators are treated as equally important. In addition, both indicators are positively related to the construct of cognitive proximity. Therefore, the cognitive proximity consists of the average of these indicators.

The indicators "The ZIT understands the needs of the company" (blue) and "The solution offered by the ZIT fits the needs of the company very well" (red) have been answered by 184 respondents. The Pearson correlation between these indicators is 0.475 (positive) and is significant at the 0.01 level. The answers are distributed as follows:

Figure 8: Indicators for Cognitive Proximity

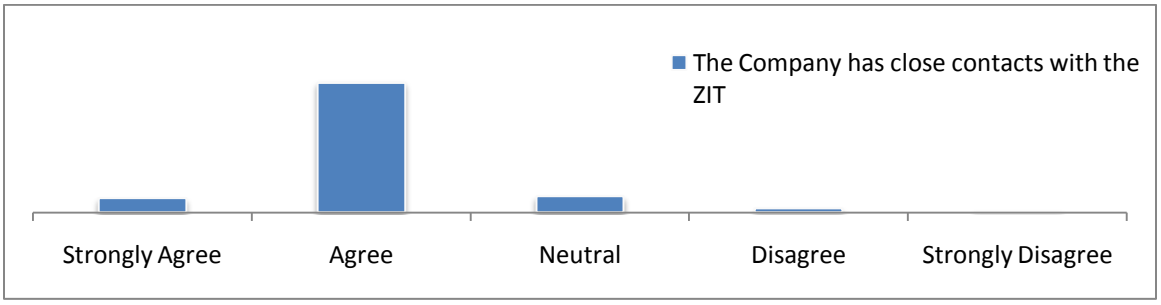


Both indicators suggest that the cognitive proximity between the ZIT and SMEs is medium/high to high. The blue indicator has an average value of 1.79, where the red indicator has an average value 1.63. The average value for both indicators is 1.71. The dimension for Cognitive proximity ranges from 1 for "high proximity" to 5 for "low proximity". The value of 1.71 along the dimension indicates medium/high to high proximity between the SMEs in our sample and the ZIT.

4.2.3 Social Proximity

Social proximity was measured via one indicator. This indicator is "the company has close contact with the ZIT". The indicator was answered by 184 respondents. The results for this indicator are as follows:

Figure 9: Indicator for Social Proximity



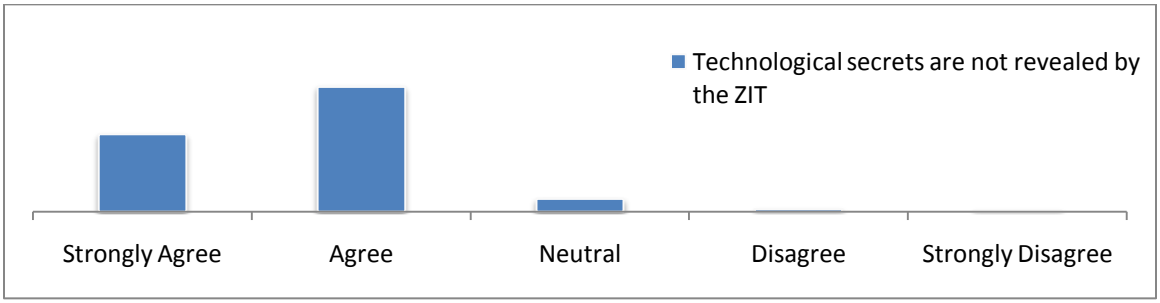
The average value of this indicator is 2.07. Since the social proximity is directly related to this indicator, the social proximity is 2.07. This indicates that the social proximity is "medium / high".

To see if the social proximity is related to the age of the relation between the ZIT and an SME we look at the indicator "Year of first contact with the ZIT". The results of the indicator "The Company has close contacts with the ZIT" were correlated with the indicator "Year of first contact with the ZIT". The Pearson correlation is 0.158 (positive) and is significant at the 0.05 level. This indicates that the social proximity is indeed increasing as the relation between the ZIT and an SME matures. The rate of which the social proximity is increasing is also given from the Pearson correlation. As the correlation is 0.158, the social proximity would increase by 0.158 each month that the SME and ZIT work together or roughly one whole step every six months. This indicates that the social proximity is not fixed and increasing rather rapidly. This could increase the effectiveness of knowledge transfer over time. On average, relations between SMEs and the ZIT are established in the first half of 2007 and thus are slightly over two and a half years old at the time of questioning.

4.2.4 Institutional Proximity

Institutional proximity was measured via the indicator "Technological secrets have not been revealed by the ZIT". The institutional proximity is related directly to the indicator. The indicator has been answered by 184 respondents. The distribution of the indicator is:

Figure 10: Indicator for Institutional Proximity



The average value of the indicator is 1.74. Translating this mean to the dimension of the Institutional Proximity, the proximity is "medium/high" with a tendency towards "high".

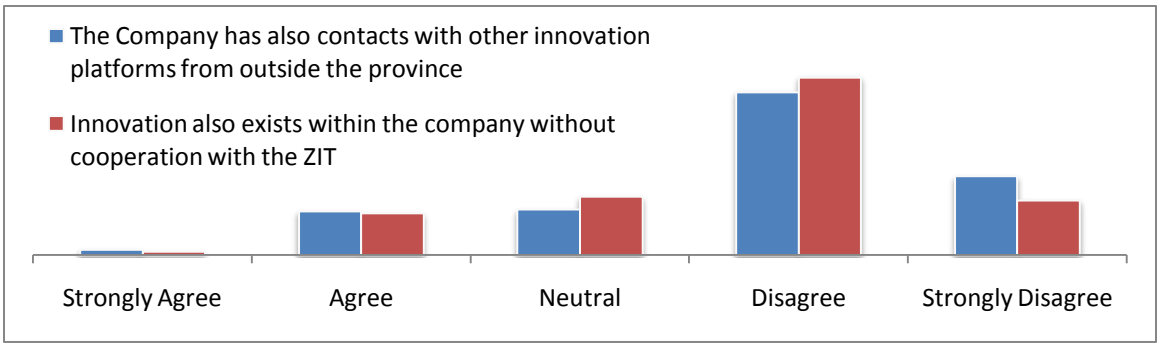
This result indicates that the ZIT shares (at least some of) the same norms with the SMEs it works with. Respecting the same institutions is beneficial for knowledge transfer as representatives work together more easily if norms are similar.

4.2.5 Organisational Proximity

The organisational proximity is measured through the indicators the indicators "The Company has also contacts with other innovation platforms from outside the province" and "Innovation also exists within the company without cooperation with the ZIT". The indicators are treated as equally important and both are negatively related to organisational proximity. To compute the Organisational proximity, first the average of the two indicators is taken. Then the negative relation is compensated by computing [6 – (average of two indicators)] as the organisational proximity.

The indicators "The Company has also contacts with other innovation platforms from outside the province (red)" and "Innovation also exists within the company without cooperation with the ZIT (blue)" have been answered by 184 respondents. The Pearson correlation between these indicators is 0.737 (positive) and is significant at the 0.01 level. The answers are distributed as follows:

Figure 11: Indicators for Organisational Proximity



Both indicators suggest that the institutional proximity between the ZIT and SMEs is medium/high. The blue indicator has an average value of 3.79, where the red indicator has an average value 3.71. The mean value of both indicators is 3.75. Computing the institutional proximity from this mean, the value for the institutional proximity is 2.25. This indicates a medium/high organisational proximity, with a tendency to medium.

4.2.6 Additional Analyses of the Quantitative Data of the Questionnaire

To investigate if the theory used by Boschma is valid, a number of indicators have been correlated. In the theory of Boschma, trust consists of social, organisational and institutional proximity. The indicator for trust is "The Company trusts the ZIT". For the proximities, the indicators remain the same as before. The Organisational proximity indicators are negatively related to the concept of institutional proximity and the concept of trust. The Social and Institutional proximity indicators are positively related to their specific concepts and thus positively related to the concept of trust. One representative of the SMEs has given no answer to this question. Therefore, only 183 correlations could be made. The complete overview of correlations is given in the figure below.

Figure 12: Correlations between Indicators of Proximities and Trust

	Trust	Social Proximity	Institutional Proximity	Organisational Proximity (1)
Trust	1			
Social Proximity	0.502**	1		
Institutional Proximity	0.347**	0.486**	1	
Organisational Proximity (1)	-0.124*	-0.129*	0.058	1
Organisational Proximity (2)	-0.190**	-0.243**	0.100	0.737**

**** Significant at 0.01 Level. * Significant at 0.05 Level**

The correlations presented here give mixed conclusions about the related Proximities theory introduced by Boschma. In his view, trust can be disentangled into Social Proximity, Institutional Proximity and Organisational Proximity. His theory suggests that indicators of all these proximities should be positively correlating with the indicators of trust. This is indeed the case for Trust and Social Proximity and Institutional Proximity, even significant at the 0.01 level. However, Organisational Proximity is not positively correlating with trust; it even is negatively correlating at the 0.05 level. Therefore, questions arise if the conceptualisation suggested by Boschma is valid.

4.3 The Chinese NIP-Concept

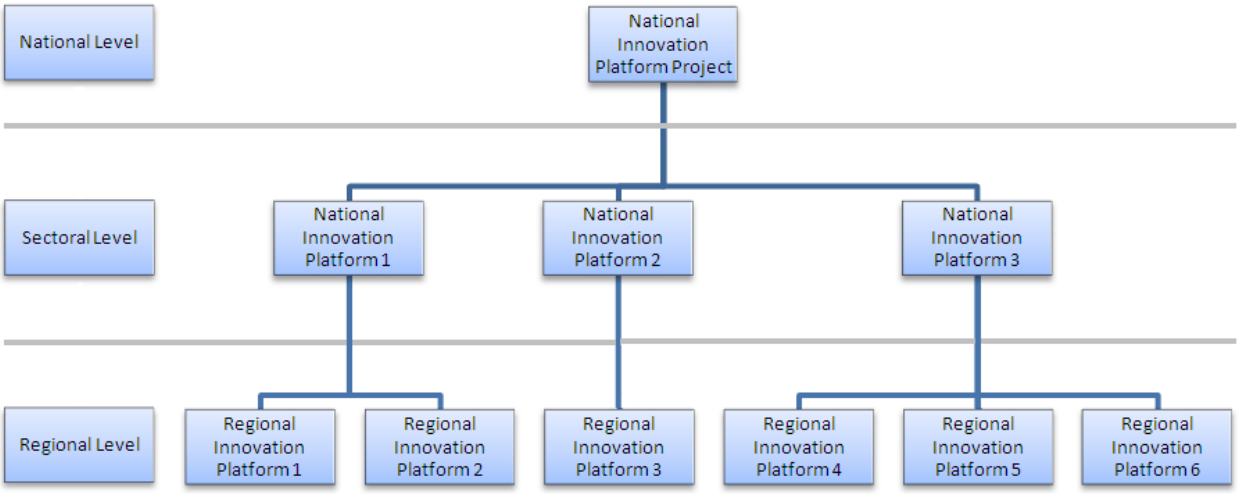
The presentation of the Chinese NIP-Concept below is the result of analysing a paper by Li, Deng & Sorensen and a number of discussions with members of the School of Economics and Management of the Tsinghua University in Beijing. These members are Prof. Li, Prof. Gao and Deng Quwen.

The overall Chinese National Innovation Platform (NIP) Program aims at combining the efforts and resources of enterprises, universities, research institutes and government to support innovation within certain industries (Li et al., 2009). It is specifically aimed at promoting the transfer of scientific and technological advances into practical productive applications. As of September 2009, three innovation platforms have been started up as pilot projects: one in the textile industry, a second one in the integrated circuit industry and a third one in the industry that produces traditional Tibetan pharmaceuticals. The importance that the Chinese government attaches to these NIPs can be seen in their funding. Each NIP is subsidized by the central government with about $50 million and by almost the same amount from the local governments.

4.3.1Structure of NIP

One NIP can tentatively be described as an instrument that is being developed to allocate resources, such as knowledge, facilities and skilled people, towards application-oriented innovation within a certain sector on a nationwide scale (Li et al., 2009). NIPs are an attempt to integrate the already existing programs in different regions and sectors and streamline them in the nationwide platforms. Therefore, the NIPs will build on the innovative capabilities of the already existing regional innovation platforms.

Figure13: Organisation of Innovation Platforms in China



Adopted and Altered from (Li et al., 2009)

On the national level, the NIP project is hosted by the Ministry of Science and Technology (MOST). The main task of the Ministry is the division of funds between the different NIPs. According to the research team at Tsinghua University, as of December 2009, a consensus has been reached about how the National Innovation Platform for the textile industry should be shape. As the platform for the textile industry is used as a pilot project, it is likely that NIPs for other sectors will be shaped similar. The consensus is that an NIP should consist of two parts. The first part would consist of the current regional innovation platforms. The second part consists of a new NIP centre that will govern the group of RIPs and conduct research that is relevant for the whole sector.

The Chinese academics suggest that the first part, the group of existing RIPs, should focus more on direct support towards SMEs. This direct support could consist of teaching employees at the SMEs, to enhance their skills in operating machines, optimising workflow and managing the SME. Furthermore, existing regional platforms should focus on offering services that relate to the complete development process of a product: from design until the production of test series.

Focussing on services that directly enhance the innovation capabilities of SMEs will beneficial for the SMEs. Furthermore, the direct approach suggested here is likely to improve the effectiveness transfer of knowledge towards SMEs. Teaching employees new skills, such as operating machines or management skills, will improve the innovative capabilities of each employer and thus the whole SME. Furthermore, teaching the employees directly within their own company eases the implementation of the gathered

knowledge of the employee, since the employee learns the new skill within the same environment as were the employee has to use it. In addition, by offering a complete set of skills for the whole development process of new products, the SMEs can ask a regional platform for any problem they encounter in this development process.

Prof. Li, Prof. Gao and their collegues suggest that the new NIP centre should consist of a single entity. They suggest that two tasks should form the focus area of the centre: governing the group of RIPs and conducting research that is relevant for the whole sector. Governing the group of RIPs would include the division of funds and tracking existing projects within the RIPs and interfere when redundancy is detected. Research at the NIP centre should lead to increasing the development of knowledge that is industry specific. Examples of this research could include development of new machinery, development of new fabrics, tracking of existing and potential markets and scrutinising relevant international developments. The knowledge created at this NIP centre will be transferred to the group of RIPs. Here this new knowledge is translated into applicable knowledge that can be transferred towards SMEs.

Creating a centre that governs the group of regional innovation platforms will have consequences that have various impacts. The first that is mentioned by the Chinese researchers is the division of funds. By centralising this, it could create less administrative loads for each individual regional innovation platform. However, the division of funds may become a complicated task, as a system has to be evolved that divides these funds. In addition, it could lead to lobbying from the individual regional platforms to gain more funds from this central point. As the regional innovation platforms are not desired to use their resources for lobbying, this could eventually harm the amount of resources that can be used for knowledge transfer.

Looking at the tracking of existing projects by a central NIP centre, it could create a database for problems and solutions for the whole sector. This database would prove helpful for solving similar problems, or for becoming inspired by the combination of two existing solutions. However, such a database could only work if the different regional innovation platforms are willing to maintain openness about their solutions.

Possible redundancy between different innovation platforms is perceived as a threat by Chinese policy makers. Redundancy is here seen as a negative concept, but redundancy also has positive consequences. It encourages the different regional platforms to deliver better services as competition arises from this redundancy. In addition, redundancy gives the regional innovation platforms the

opportunity to start on trial-and-error runs with new solutions without endangering the amount of resources that are needed to facilitate knowledge transfer towards SMEs.

Dividing the National Innovation Platform into two parts, results in an additional step of knowledge transfer. Knowledge that is created in the NIP centre will be transferred to a regional innovation platform and from there towards SME. It is assumed by the Chinese research team that the regional innovation platforms are able to facilitate this additional step and more important are not reluctant to learn from the NIP centre. Facilitating the additional step in knowledge transfer is mainly concerned with translating the research done by the NIP centre into usable knowledge for the SME. For this step, it is very important to find a mode of collaboration between the NIP centre and RIPs that is both constructive and efficient. More difficult is the challenge to convince the RIPs to be open to learn new knowledge from the NIP centre. Suggestions to reduce the hesitation of RIPs are to create social relations and a number of personal meetings in the early stages of setting up the National Innovation Platform.

4.3.2 Responsibilities of NIPs

The MOST has issued a list of rather general guidelines that the NIPs should follow (Li et al, 2009). This list was issued in the beginning of 2009. NIPs are encouraged to (1) improve the innovative capabilities of its specific sector, while being guided by the demand of enterprises; (2) integrate the existing innovation resources e.g. the regional innovation platforms; (3) formulate and work out appropriate institutional measures and mechanisms; (4) give the government a guiding role and attract additional actors and (5) determine the rights and responsibilities of each actor clearly and encourage them to engage actively in innovation.

Improving Innovative Capabilities

The first responsibility of the NIP is the improvement of innovative capabilities. The improvement of innovative capabilities, while being guided by the demand of enterprises, is crucial for the development of innovations by SMEs in China. Improving innovative capabilities increases the capabilities that are available for SMEs. This should in turn increase the innovations made by SMEs. “That the development of the innovative capabilities is guided by the demand of enterprises could improve the benefit for each SME even more.” Professor Li, from Tsinghua University and researcher on the NIP-project, argues. He continues: “However, the aspirations of an SME are based on its own situation and can be harmful for other actors in the economy. Even when all individual demands will be heard, balanced and implemented in future improvement of innovative capabilities, these demands can be harmful to all

SMEs as a whole." This effect is also known as the tragedy of the commons. "To avoid this effect, NIPs should not be guided blindly by the demand of enterprises when increasing certain innovative capabilities, but also take into accounts the effects these new capabilities have on the general population of SMEs". The reasoning here is that an individual SME is only concerned with its own benefits and that those benefits can be harmful to other SMEs. This reasoning is analogous with the original presentation of the tragedy of commons by Hardin (1968). The article describes a situation in which multiple individuals, acting independently, solely and rationally consulting their own self-interest, will ultimately deplete a shared limited resource even when it is clear that it is not in anyone's long-term interest for this to happen. To avoid this problem, the Chinese researchers propose that the innovation platform should not only be guided by the SMEs, but also should gain insight from another source, i.e. a centralised organisation that oversees the innovation resources.

However, there are some threats to establishing a centralised organisation that oversees and divides resources for innovation. First, to start and sustain innovative processes creativity is needed. By centralising the division of resources, creativity is counteracted since a certain amount of trial and error is needed to test and verify new and innovative solutions. This trial and error is the result of "wasting" resources in trials that were fruitless. Second, it is highly doubtful that a centralised authority has a complete overview of what the needs of all SMEs are. The amount of data and insight that is needed for such an overview is enormous. Gathering the essential data would be a great task and cost a vast amount of resources. In addition, it is discussable that an SME knows upfront what resources are for its current innovation process, and even less for its future innovation processes. Therefore, the data that is needed for the insight of this central authority might not be available at all.

Integrating existing innovation resources

The second function of an NIP is integrating existing innovation resources. Chinese researchers and officials argue that the integration of existing innovation resources is encouraged to decrease redundancy of resources in these regional innovation platforms. In an interview with Prof. Li and Prof. Gao is stated that "the quantity of innovation resources is limited; therefore decreasing the redundancy can help the individual regional innovation platforms to work more efficiently." Within the group the complete group of researchers at Tsinghua University, the consensus exists that: "By decreasing redundancy, SMEs benefit from a more efficient exploitation of innovation resources i.e. more problems and obstacles can be tackled with the same amount of innovation resources."

Decreasing the redundancy of innovative resources could create two problems. First, when resources are redundant, SMEs can choose their supplier of these resources. Innovation centres have to work efficiently and competitively in order to sustain and create collaborations with SMEs. This increases the quality of the services of the innovation centres as otherwise SMEs will choose other providers of resources. Second, redundant resources are needed to hold trial-and-error runs without endangering the supply of resources towards SMEs. Trial-and-error runs are used in learning-by-doing and are helping innovation centres to gain new solutions and for tackling common problems. Without redundant resources, the innovation centres themselves are less able to investigate new methods and solutions to tackle problems of SMEs.

Formulation and application of institutional measures and mechanisms

The third function of the NIP is the formulation and application of institutional measures and mechanisms. Chinese policy makers expect that these create an environment in which tasks and regulations are clear to the involved actors. Professor Gao agrees, “This is important in the development of new innovation platforms and optimisation of existing platforms.” His reasoning is that during a process of innovation firms face a greater degree of uncertainty and instability. Institutional measures and mechanisms can provide function as beacons and help steer towards successfully creating and implicating, thus says Prof. Gao.

The creation of clear laws and regulations allow an SME to engage with new challenges in a manner that is rightful and legal. Lack of clear regulations creates greater uncertainty for SMEs. For example, a new work process or new materials could be specified as dangerous and not applicable to the market. If the SME knows upfront what kind of materials and work processes that are legal to use, spilled investments could be avoided. However, an abundance of rules and regulations could hinder the creation of innovative products if these regulations are too strict. In addition, the rules themselves could become inert. This could lead to an environment that is less able to react to new developments. Adjustment of rules is necessary to cope with new developments in technology, society or other fields.

Guiding role for Government

According to MOST, the NIP should create power relations to ensure the central government has a guiding role in innovation research. In addition, these power relations should be used for attracting additional actors. Additional actors can increase the amount of innovation resources and thus make more resources available to the SMEs. “Putting the government into a guiding role can counter-act fragmentation and segmentation of different innovation policies, again streamlining the existing

policies." as Deng Quwen states. However, "putting policy makers in charge of deciding the line of research that should be carried out, could lead to non-optimal decisions in focussing resources, as these are policy makers by nature and less skilled in the actual research that has to be carried out", Deng Quwen argues.

Creating a guiding role for the government in leading the innovation platforms is having a number of consequences. First, the idea of guiding innovation into a certain direction is doubtful. Innovations and research require creativity. As Amabile (1996) states, "We define innovation as the successful implementation of creative ideas within an organization. In this view, creativity by individuals and teams is a starting point for innovation; the first is necessary but not sufficient condition for the second". Giving the government a guiding role where the innovation should lead to is compromising the creativity and thus the effective output of innovation. Second, government officials are likely not trained within the field of innovation, change and knowledge transfer. Therefore, it is highly doubtful that government officials are able to make comprehensive decisions to allocate innovation resources correctly.

Determining rights and responsibilities of actors

Determining rights and responsibilities is the last function that Chinese policy makers account to the NIP. To determine the rights and responsibilities of each actor is important to professionalise further the organisation of the innovation platform. The Chinese line of thought is that when actors are certain of their place in the organisation of the platform, redundancy can be reduced. However, additional bureaucracy could also be introduced by the administrator whom is dividing the tasks. "Bureaucracy is already hampering the current innovation platforms." Professor Gao argues.

To determine the rights and responsibilities of all actors involved in the innovation platform might result in unwanted consequences. Creating a general code of conduct for all involved actors might introduce a stable environment for innovation. However, determining the rights and responsibilities of all actors individually could hinder these actors in finding creative solutions. Furthermore, it would restrict competition for customers of the resources of a actor. In addition, it will require a large amount of resources to establish all rights and responsibilities of the different actors. These resources could be used directly to stimulate new projects.

4.3.3The Chinese National Innovation Platform analysed via Proximities

The establishment of the National Innovation Platform is expected to influence the dimensions of proximities between an SME and the NIP. In the following, consequences for each of the proximities are discussed if the proposals of the Chinese researchers are approved and implemented. For the investigation here, the whole NIP is seen as a single actor.

The geographical proximity is likely to decrease. The distance between a regional division of the NIP and an SME will not increase as they are both still located within the same province, but most of the knowledge will no longer be created at the regional division but at the NIP centre. Therefore, the knowledge transfer is going from that National centre towards the SME, which are not likely located in the same province. In addition, China has a large geographical area and distances are larger than within most other countries. Thus, the geographical proximity will go from medium/high to low/medium.

The cognitive proximity with the SMEs will change with the introduction of the NIP. The regional centres of the NIP (the "former" RIPs) are encouraged to teach employees directly within their own SME. Representatives of the NIP will engage more directly with the challenges at hand at the SMEs. During these sessions, not only is knowledge transferred towards the employees of the SME to solve engage in those challenges, the representatives of the NIP will also learn from the situation at the SME. Problems could be better understood by these representatives and workflows within the SME are perceived more directly. This gives the representatives of the SME a deeper understanding of the situation in which their solutions will be put into practise. The cognitive proximity between (representatives of) the NIP and (employees of) the SMEs will decrease as bi-directional knowledge transfer will create a greater overlap between the knowledge bases of both actors. The cognitive proximity will increase from medium/high to high.

Social proximity is changing for some parts of the NIP. The amount of contact is changing for regional representations of the NIP in cases where knowledge transfer was primarily based on explicit mediums. In these cases, reports, charts and other written materials will be exchanged for face-to-face meetings. Increasing the amount of meetings results in an increase of human interaction where friendships and kinships could start. This results in a higher social proximity. For the regional representations that used personal meetings as a means to transmit knowledge, the amount of social interaction is not changing. Only the place is changing from meetings within the regional office to the SMEs establishment. Thus, the amount of social interaction is stable and the social proximity is not influenced by the new approach for these relations. Overall, the tendency of the social proximity will increase. As the social proximity could

not be established precisely in the case of an RIP, it is also difficult for this new situation. Tentatively argued, the situation could change from (medium) to (medium/high).

The institutional proximity is decreasing from medium/high to medium. The underlying laws and regulations remain applicable to both the regional representation and the SME as both are still situated in the same province. If the regulations change within a province, it changes both for the regional representation of the NIP and for the SMEs situated in that province. However, the codes of conduct within a regional representation of the NIP are likely to change if these become part of a larger organisation. These will resemble less the codes of conduct of an SME. Therefore, the institutional proximity is decreasing from medium/high to medium.

The organisational proximity is likely to decrease slightly. The nature of regional innovation platforms will change if these are governed by a central authority. They become part of a larger institution. While these were not connected, a regional innovation platform could be seen as an independent organisation. The size of a single RIP is comparable with that of a Chinese SME, whereas the interconnected NIP is a significantly larger organisation. This influences the mentality and workflows within the knowledge provider. The organisation becomes larger and less comparable with an SME. This is likely to happen to the institutional facilities within that organisation as well. The slight change in organisational proximity will reflect in the classification of the NIP as it shifts from medium to low/medium.

Figure 14: Comparison of the NIP with other Innovation Systems

Proximity	Cluster	Triple Helix System	Sectoral system of innovation	Chinese RIP	Chinese NIP
Geographical	High	Low / Medium	Range from Low to Medium / High	Medium / High	Low / Medium
Cognitive	Medium	Medium	Medium	Medium / High	High
Social	Medium / High	Low	Low / Medium	(Medium)	(Medium/High)
Institutional	Medium	Medium	Range from Low to Medium	Medium / High	Medium
Organisational	Medium	Medium	Low / Medium	Medium	Low/Medium

The concept of a Chinese National Innovation Platform is now categorised according to the dimensions of proximities of Boschma. According to this categorisation, the Chinese NIP is still comparable with a cluster, just as the regional innovation platforms were. However, similarities are now also present with a sectoral system of innovation. These similarities are greater than the similarities between the NIP and a cluster. Therefore, the Chinese NIP is now better sketched as a form of sectoral system of innovation.

4.3.4 Consequences for Knowledge Transfer by introducing the NIP

The National Innovation Platform (NIP) is designed by Chinese policy makers to integrate the resources of the existing regional innovation platforms. According to plans in the end of 2009, the NIP will consist of two parts, the group of RIPs that will engage with the SMEs directly and an NIP centre that will govern the group of RIPs. When transiting from RIPs to an NIP, changes in the arrangement of knowledge providers will have several consequences for the effectiveness of knowledge transfer from a knowledge provider towards SMEs.

First, the origin of the knowledge provided for an SME will change with the introduction of the NIP. The NIP centre will conduct a large portion of the scientific research, whereas earlier this was a task of the individual regional centres. This results in a change in the geographical proximity. The geographical proximity is increasing as the distance is no longer between an SME and the regional innovation centre, but between the SME and the NIP centre. Knowledge transfer will become more difficult, as larger geographical distances tend to increase the costs of knowledge transfer and decrease the effectiveness of knowledge transfer.

Second, the cognitive proximity with the SMEs will change with the introduction of the NIP. The regional centres of the NIP (the “former” RIPs) are encouraged to teach employees directly within their own SME. Representatives of the NIP will engage more directly with the challenges at hand at the SMEs. During these sessions, not only is knowledge transferred towards the employees of the SME to solve engage in those challenges, the representatives of the NIP will also learn from the situation at the SME. Problems could be better understood by these representatives and workflows within the SME are perceived more directly. This gives the representatives of the SME a deeper understanding of the situation in which their solutions will be put into practise. The cognitive proximity between (representatives of) the NIP and (employees of) the SMEs will decrease as bi-directional knowledge transfer will create a greater overlap between the knowledge bases of both actors.

A third transition is in the social proximity. The amount of contact is changing for regional representations of the NIP in cases where knowledge transfer was primarily based on explicit mediums. In these cases, reports, charts and other written materials will be exchanged for face-to-face meetings. Increasing the amount of meetings results in an increase of human interaction where friendships and kinships could start. This results in a higher social proximity. For the regional representations that used personal meetings as a means to transmit knowledge, the amount of social interaction is not changing. Only the place is changing from meetings within the regional office to the SMEs establishment. Thus, the amount of social interaction is stable and the social proximity is not influenced by the new approach for these relations. Overall, the tendency of the social proximity will increase. As the social proximity could not be established precisely in the case of an RIP, it is also difficult for this new situation. However, it can be tentatively argued, that the social proximity should increase from the establishment of the NIP.

Fourth, the institutions that govern the knowledge transfer will be altered by the introduction of the NIP. The underlying laws and regulations remain applicable to both the regional representation and the SME as both are still situated in the same province. If the regulations change within a province, it changes both for the regional representation of the NIP and for the SMEs situated in that province. However, the codes of conduct within a regional representation of the NIP are likely to change if these become part of a larger organisation. These will resemble less the codes of conduct of an SME. Therefore, the institutional proximity is decreasing.

Last, the organisational proximity is likely to decrease slightly. The nature of regional innovation platforms will change if these are governed by a central authority. They become part of a larger institution. While these were not connected, a regional innovation platform could be seen as an independent organisation. The size of a single RIP is comparable with that of a Chinese SME, whereas the interconnected NIP is a significantly larger organisation. This influences the mentality and workflows within the knowledge provider. The organisation becomes larger and less comparable with an SME. This change is likely to result in changes to the organisational facilities within that organisation as well. The organisational arrangements within the former RIPs will resemble that of a larger organisation with the introduction of the NIP. Thus, the organisational proximity between former RIPs and SMEs will decrease.

Due to the changes in proximities, the knowledge transfer in the complete NIP does no longer resemble the knowledge transfer within a single cluster. Overall, the proximities within a complete NIP are most similar to the proximities within a sectoral system of innovation. The origin of large parts of knowledge is shifting from the regional innovation platforms to the NIP centre. Therefore, the geographical

proximity for these parts is decreasing significantly, and the knowledge transfer within an NIP more resembles the knowledge transfer of a sectoral system of innovation.

On a local scale, the direct knowledge transfer between a regional centre of innovation and an SME still most resembles the knowledge transfer within a cluster. Due to the interconnection between the regional departments of the NIP, these have the chance to learn from best practices in other regional departments. However, the influence of the NIP centre and the influence of the ministry of science and technology on the NIP centre could endanger the close contacts between SMEs and regional department of the NIP.

In conclusion, the introduction of a National Innovation Platform has the potential to enhance the knowledge transfer towards SMEs in comparison with the current situation of regional innovation platforms. The existing regional innovation platforms could focus more on the direct contacts with SMEs. Employees of these RIPs can more insight in the workflows and processes within SMEs when the contacts with SMEs are intensified. RIPs would start to specialise in practical knowledge, or know-how. This would enhance the effectiveness of knowledge transfer between SMEs and the RIPs, as intensified contact could lead to a more common knowledge base, an increase in social artefacts and more aligned work methods. In terms of proximities, cognitive, social and institutional proximities could increase and thus ensure effective knowledge transfer.

The geographical proximity is likely to decrease. Knowledge that is new and significant for the whole sector is created at the NIP centre. This centre is not located within the same province as most SMEs. Furthermore, the NIP centre has less connection with SMEs. Regional representations of the NIP, the former regional innovation platforms, are required to interpret new knowledge from the NIP centre into more practical and applicable knowledge and know-how to enhance its relevance for SMEs. In addition, the former RIPs are required to relay new and common problems within SMEs to the NIP centre to give direction to the research conduct at the centre.

The changes in proximities could lead to a less successful introduction of the NIP-concept. The regional representations of the NIP have to be sensitive to new knowledge that is offered from the NIP centre. Yet, the regional representations are not used to absorb knowledge from a higher organisation, or from

an organisation which is situated outside of their own province. This could inhibit a smooth transfer of knowledge between the NIP centre and the regional representation. In addition, influence from the Ministry of Science and Technology could unwillingly endanger the effectiveness of knowledge transfer. In the event that the NIP centre influences the regional representations to change their work routines, knowledge transfer from those regional representations towards SMEs could become less effective than before. The regional representations have to learn coping with two work routines, one towards the NIP centre and a different one towards SMEs.

Section 5: Analysis, Limitations and Future Research

The last Section of this thesis consists of the conclusions, the discussion and the recommendations. In the conclusions, the research questions are answered separately first. Then the main research question is answered in the conclusions. In the discussion, an evaluation is given of the implication of the research at hand, as well as the limitations of the research. The last part of this section, the recommendations, gives suggestions for further research.

5.1 Analysis of Chinese Innovation Systems

In the following, a summary is given and direct answers to the research questions are formulated. First a short recapture of the theory is given. Then, the answers for the research questions are given, followed by the answer for the main research question.

5.1.1 Knowledge, Knowledge Transfer and Factors influencing Knowledge Transfer

The review of academic literature revealed that the concept of knowledge has several distinct definitions. These definitions are moulded in different schools of economics to concepts that are appropriate for these particular schools. The definition for Knowledge created for usage in this thesis is Knowledge is a set of beliefs and ideas about the causal relationships between information and involves a degree of awareness and understanding.

Transfer of knowledge from a sender to a receiver is a process that consists of three steps. These steps are iterated via feedback until a desired situation is created. First, the relevant parts of the knowledge have to be gathered at the sender. Second, all relevant parts, including tacit and explicit parts, are transmitted from the sender to the receiver. The third step of knowledge transfer is the interpretation of knowledge by the receiver. Iteration of these steps can be used to create a satisfactory transfer of knowledge.

In the literature distance, absorptive capacity, disseminative capacity and trust are mentioned as important characteristics that influence knowledge transfer by a number of authors. However, to understand and measure the impact of trust in knowledge transfer, the framework of Boschma is used. This framework consists of five types of proximities that influence the transfer of knowledge. The five proximities suggested by Boschma are the characteristics that influence knowledge and are Geographical Proximity, Cognitive Proximity, Social Proximity, Institutional Proximity and Organisational Proximity. Geographical proximity in the model of Boschma is similar to distance used by other authors. Cognitive proximity can be traced back to the absorptive capacity and disseminative capacity identified

by other scholars. The three remaining proximities, social, institutional and organisational proximity, comprise the concept of trust. In this model, Boschma sees social proximity, which consists of friendships and kinships, as trust at a personal level. Institutional proximity relates to common laws, habits and codes of conduct, and is trust on a macro-level. Finally, organisational proximity relates to how the sender and receiver are connected via organisations and how these actors are connected via power relations and trust on an organisational level.

5.1.2 Analysis of Knowledge Transfer from RIP to SMEs

Before the introduction of NIPs, regional innovation platforms (RIPs) offered services that SMEs could obtain. These RIPs work individually and focus on their own province. The organisation of RIPS differs per province and thus the approach to knowledge transfer differs as well. Two RIPs have been studied to gain insight as to how knowledge is transferred towards SMEs before the introduction of NIPs. These are situated in Zhejiang (ZIT) and Shanghai (STRI). Their approaches of knowledge transfer have been structured into the stages of gathering relevant parts of knowledge, transmitting knowledge and interpretation of knowledge and the additional process of iteration.

Gathering the relevant parts of knowledge that will be transferred is a first step in the transfer of knowledge. At the ZIT, the relevant parts are identified by scrutinising the request of an SME. Initially, the ZIT attempts to answer the request with only the knowledge that is embedded in their internal experts. If the requested knowledge exceeds the knowledge that is readily available at the ZIT, partner institutions such as universities are invited to assist in answering the request. The STRI in Shanghai has a different approach. The majority of knowledge at the STRI is not embedded within its employees but in explicit knowledge sources such as scientific articles and books. If the knowledge that is needed to answer a request is not covered by the explicit knowledge of the STRI, research is conducted to answer the request. This research can be carried out by specialists of the STRI or the SME that sent the request can rent the equipment of the STRI.

Transmission of the knowledge is the second step in knowledge transfer. At the STRI, this process is done by transmitting explicit knowledge. At this RIP, transmitting this knowledge is done by sending a report that answers the request of the SME. At the ZIT, knowledge is mainly transmitted by face-to-face contact. While a report is drawn up as well at this RIP, support is essentially transmitted by meetings between representatives from the ZIT and an SME. These meetings can take place at the ZIT, where

relevant machinery is present to explain enhancements, or at the SME when an employee of the ZIT is temporarily placed in-house.

The third step of transfer of knowledge is the interpretation of knowledge at the receivers end. The receiver in this case is an SME. When collaborating with the STRI, the receiving SME is given no support in interpretating knowledge. The sending of a report by the STRI is perceived as the finalisation of the knowledge transfer, i.e. the interpretation of knowledge by the SME is not perceived as a part of knowledge transfer that should be supported by the STRI. At the ZIT, interpretation of knowledge at the SME is supported by the innovation platform. This support is interwoven with the transmission of knowledge. Knowledge is mainly transmitted tacit, where interpretation of knowledge is inherent to the transmission. The support is tailored to the needs of the SME and can be given at the ZIT or within the SME itself.

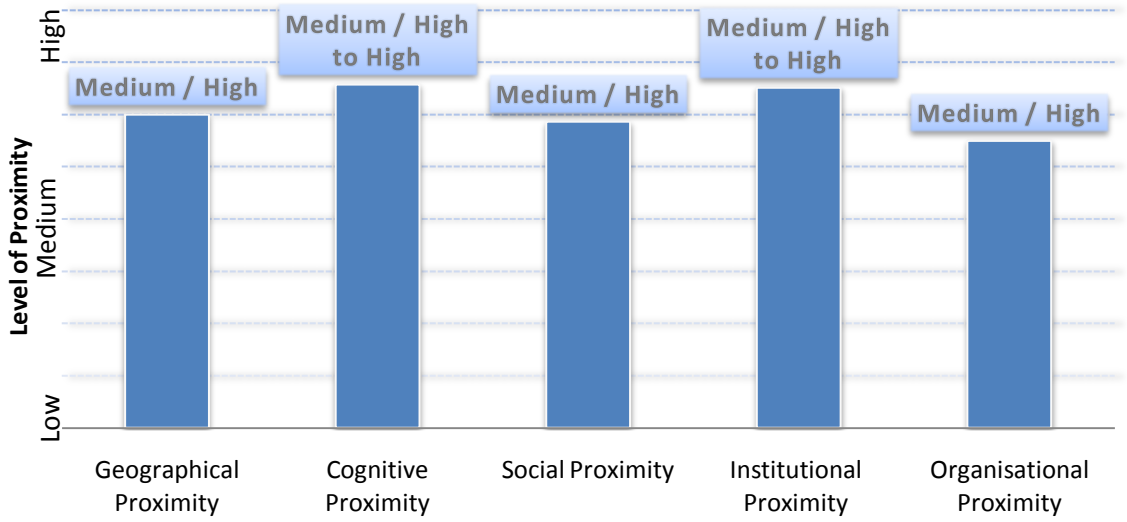
In most cases, the knowledge transfer is not finalised after the interpretation. Iteration of the three steps is needed to amend and shape the provided solution until it satisfies the need of the SME. The iteration is giving the knowledge provider insight to create a better process during the next process. The complete process is iterated until a sufficient solution is found for the SME and the desired result is implemented successfully.

The second research question investigates how transfer of knowledge can be described by characteristics found in the literature before the introduction of the NIPs. In the literature, several characteristics have been identified that influence knowledge transfer. These are Geographical proximity, Cognitive Proximity, Social Proximity, Institutional Proximity and Organisational Proximity.

Before the introduction of the NIP, the geographical proximity before the introduction of the NIP can be described as medium / high. The investigated SMEs were all established in the same province as the innovation platform that supports them. The cognitive proximity between a regional innovation platform and the supported SMEs is measured as medium / high to high. This indicates that the knowledge that is present at the RIP is significantly overlapping with the knowledge present at an SME. The social proximity between a regional innovation platform and the supported SMEs is measured as medium / high. This indicates that close contacts are often present between SMEs and the RIP. Furthermore, the social proximity is positively related with the length of the relationship between an SME and the innovation platform. Measured in October 2009, the average relation is just over two years old. The institutional proximity between an RIP and SMEs is measured as medium / high to high. This

result indicates that the ZIT shares (at least some of) the same norms with the SMEs it works with. Respecting the same institutions is beneficial for knowledge transfer as representatives work together more easily if norms are similar. The organisational proximity between an RIP and SMEs is measured as medium / high. The majority of SMEs have no contact with innovation platforms from other provinces. Furthermore, within the majority of the SMEs innovation is based on the cooperation with the regional innovation platform. This indicates that the SME is dependent on the RIP.

Figure 15: Proximities between SMEs and the ZIT



The characteristics of the different dimensions of proximity between an SME and the ZIT are most similar to the characteristics of a cluster. Therefore, it can be stated that the knowledge transfer from an RIP towards SMEs is as effective as the knowledge transfer within a cluster.

5.1.1 The concept of NIP and its influence on Knowledge Transfer towards SMEs

The NIP-Project is in the process of development as of December 2009 and is supervised by the Ministry of Science and Technology. National Innovation Platforms are sector specific. The central government and local government sponsor the establishment of each NIP with more than $50 million. NIPs are encouraged to improve the innovative capabilities of its specific sector, while being guided by the demand of enterprises and integrate the existing innovation resources e.g. the regional innovation platforms. In addition, Chinese policy makers strive that NIPs formulate and work out appropriate institutional measures and mechanisms, give the government a guiding role and attract additional actors and determine the rights and responsibilities of each actor clearly and encourage them to engage actively in innovation.

Currently the NIP-concept is tested in three sectors as pilot project. One of these is the textile industry. The NIP-concept for the textile industry is used as a basis for the general NIP-concept. The NIP for the textile industry is divided into two entities. The first entity would consist of the current regional innovation platforms and should focus more on direct contact with the SMEs. By this, the knowledge transfer between SMEs and a regional representation of the NIP can be intense. The second entity exists of a new NIP centre that will govern the group of former RIPs and conduct research that is relevant for the whole sector. Chinese policy makers and academics predict that the division of an NIP into two entities will devise the responsibilities of the different actors with more clarification. However, the division will also introduce an additional actor in the knowledge transfer. Knowledge has to be transferred from the NIP centre to the regional representation of the NIP and then onwards to the SME. The additional step in knowledge transfer could result in loss of (essential) parts of knowledge during the additional transfers.

5.1.4 Knowledge Transfer towards SMEs after the introduction of the NIP-concept

In the beginning of this thesis, the main research question was stated. The main research question for this thesis is

Is the National Innovation Platform a potentially effective instrument to enhance the knowledge transfer from current innovation systems towards small- and medium-sized enterprises in China in the light of current, relevant academic literature?

The introduction of a National Innovation Platform has the potential to enhance the knowledge transfer towards SMEs in comparison with the current situation of regional innovation platforms. The existing regional innovation platforms could focus more on the direct contacts with SMEs. Employees of these RIPs can more insight in the workflows and processes within SMEs when the contacts with SMEs are intensified. RIPs would start to specialise in practical knowledge, or know-how. This would enhance the effectiveness of knowledge transfer between SMEs and the RIPs, as intensified contact could lead to a more common knowledge base, an increase in social artefacts and more aligned work methods.

Knowledge that is new and significant for the whole sector is created at the NIP centre, which itself has less connections with SMEs. Regional representations of the NIP, the former regional innovation platforms, are required to interpret new knowledge from the NIP centre into more practical and applicable knowledge and know-how to enhance its relevance for SMEs. In addition, the former RIPs are

required to relay new and common problems within SMEs to the NIP centre to give direction to the research conduct at the centre.

However, a number of threats could lead to a less successful introduction of the NIP-concept. The regional representations of the NIP have to be sensitive to new knowledge that is offered from the NIP centre. Yet, the regional representations are not used to absorb knowledge from a higher organisation. This could inhibit a smooth transfer of knowledge between the NIP centre and the regional representation. In addition, influence from the Ministry of Science and Technology could unwillingly endanger the effectiveness of knowledge transfer. In the event that the NIP centre influences the regional representations to change their work routines, knowledge transfer from those regional representations towards SMEs could become less effective than before. The regional representations have to learn coping with two work routines, one towards the NIP centre and a different one towards SMEs.

5.2 Limitations and Future Research

Limitations

During the course of the research at hand several situations were encountered that created limitations. The validity of the gathered data is limited as several suspicions answers were discovered. While the fact that these suspicious answers were discovered provides integrity for the researchers within Tsinghua University, the data still was contaminated. Furthermore, for some interviews it became obvious that the interviewees have an interest that their organisations are pictured in a certain way. The gathering of data became entwined with the establishment of an overview of the innovation systems within the textile sector and with the division of funds related to that overview.

Cultural differences between the researcher and the majority of the theory on one hand and the data and contacts in China on the other hand could also endanger the validity of this research. Most economic and management theory is based on western economics (Tsui, 2004) while the data at hand is collected in China. This mismatch could lead to bias results. The researcher attempted to counteract this mismatch by experiencing the Chinese culture for a prolonged period to interpret the collected data correctly.

Finally, for the research at hand, data was collected about innovation systems in two provinces and within the textile sector. Extrapolation of the data to other regions and sectors is possible, however should be done with caution. The diversity between provinces is large, as is the diversity between sectors. Innovation systems could very well show different dynamics in other provinces and sectors.

The investigations conducted here gave insights that could be used by other researchers in the future. A first characterisation of the National Innovation Platform is given. Knowledge transfer was analysed thoroughly and characteristics that influence knowledge were identified. However, further investigation could lead to deeper insights and improved theories.

By conducting research via channels that are not entwined in the establishment of the NIP, the results at hand could be verified. Researchers from other universities inside as well as outside China could look at other regions or platforms, and compare their results with the results at hand. By doing so, a more complete view on the interpretation of the NIP-concept could be established.

The usage of proximities as defined by Boschma is yet not often tried in categorising innovation systems. The framework of Boschma is workable in this situation, but more case studies are needed to verify if the concept is applicable to other innovation systems. Furthermore, Boschma is using social proximity, organisational proximity and institutional proximity as concepts to replace trust. Boschma suggests this to enhance the understanding of knowledge transfer. However, in the research at hand those three proximities are strongly correlated. Therefore, it is doubtful that the introduction of three concepts is creating an enhancement in understanding the knowledge transfer in innovation systems. Further usage of the framework in other case studies could verify if the correlation is based on this case study or a characteristic within the design of the proximity framework.

The research at hand gives only a glimpse of developments in innovation systems in China. Further investigation of National Innovation Platforms is needed to understand these systems better. Current regional innovation systems have similarities with clusters. These regional systems are based within a smaller geographical area and are specific to an industry sector. The introduction of National Innovation Platforms will change the dynamics within regional innovation systems. The dynamics within the complete National Innovation P/latforms are likely to become similar to the dynamics within a sectoral system of innovation. However, if this prediction is valid has to be confirmed by additional research in the future. On a local level, the dynamics of knowledge transfer between SMEs and regional departments of the NIPs should aim to resemble the dynamics of a cluster, also after the introduction of the NIPs. Also this prediction needs verification by additional research in the future.

A great improvement is possible when this investigation is held at a number of points in time. Via this, a chronology of the development of a national system of innovation is possible. This could insight not only in the dynamics of the system at hand but also in the dynamics of establishing a national innovation system in general. Until now, research in national innovation systems is analysing the processes of these systems as if these systems are static. By investigating the processes in an emerging national innovation system, more insight could be gained concerning the dynamics of these processes. This could lead to more vision on the development of national innovation systems.

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