Recognizing

How small firms recognize external knowledge

Daan van Rossum

UNIVERSITY OF TWENTE.

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MASTERTHESIS

Author	Daan van Rossum
Institute:	University of Twente
Program:	Master of Science in Business Administration
Department:	NIKOS
Track:	Service Management
Graduation committee:	Ir. S. Löwik
	Dr. ir. J. Kraaijenbrink

External committee member: Dr. J. Boshuizen

Enschede, April 2010 – Jan 2011

Preface

During my master class I was thinking what area of theory I did find the most interesting during my master courses. This resulted in a search for a master assignment that had a connection with network theory. After several talks with different teachers at the university I choose to start an assignment with Sandor Löwik, about networks and knowledge exchange.

The study started with a very wide scope, which made it very explorative in nature. To link the theory with practice, I could use the contacts of Sandor for two case studies with the companies Almi and Herikon. The interviews in these companies gave me new insights and data for the study. I would like to thank the interviewees for their time, I really enjoyed learning about the way those companies do business and especially how they search for new knowledge.

During this thesis I had good assistance of my supervisors, therefore I want to thank the members of my graduation committee for their support, effort and time. Especially Sandor, with whom I started this study and exchanged ideas about its directions many times, also the discussions about the different concepts really helped me understanding and choosing theory. Also Johannes Boshuizen (who is now external member of my committee, because he switched jobs), helped me in the first months of the study with nice discussions and arguments that I still remember e.g.: 'If that's so, why not put gravity in the model too?'. I was glad Jeroen Kraaijenbrink wanted to step in after Johannes left, his fresh look on the thesis made me make some decisions which really clarified the thesis and helped me finish it.

Finally I want to thank my girlfriend, Merel, and my family for their support and patience in the times when I was looking for new solutions and probably wasn't the most cheerful person to be with.

Summary

In the literature, the capability of finding, extracting and exploiting external knowledge is described as the absorptive capacity of a firm. Absorptive capacity is a dynamic construct which contains three sub capabilities: recognizing, acquiring/assimilating and exploitation. These capabilities are present in firms in the form of processes. Each capability has its own process and can therefore be studied separately from the other capabilities. These processes are not described in much detail in theory; this leaves a gap for new research. This study will partly fill that gap through exploring the first capability: recognizing; which serves as a building block for the rest. Furthermore, the search for new knowledge is expected to be less structured in small firms, which could increase the chances of finding new insights. This study is focused on them specifically. Together with the focus on recognizing this resulted in the goal of exploring the recognizing process in small firms. To reach this goal the study was guided by the central question: *How does the process of recognizing external knowledge for innovation work in small firms*?

In order to use the newest insights in the absorptive capacity theory the latest model, that of Todorova and Durisin (2007), was used to select the attributes that are included in the knowledge recognizing process. Elaborating on these elements in theory and differentiating for small firms resulted in some extra attributes which formed a proposed model specifically for recognizing. These attributes were: knowledge type, investments, intrusiveness, strategy and a capability developing feedback loop.

Verifying this model in practice is done by using a qualitative design: the case study approach. The small firm cases selected for this multiple case study were Herikon and Almi. Both firms are situated in Twente and operate in the manufacturing industry. To assess how these case firms recognized new external knowledge, this study used the relational approach in its interviews. This approach is used to create a retrospective overview of the most important knowledge relations of the firms in the past two years and a description of how they recognized them. Altogether the eight interviews resulted in 49 different relationship descriptions.

All elements of the proposed model, except investments, are confirmed in the interview analysis. This resulted in the inclusion of these attributes in the recognizing model. The new model is aimed to better describe recognizing in small firms. In this model recognizing in small firms is redefined, due new empirical insights, as: *A firm's capability to see new opportunities, search for new knowledge and estimate its potential value along with the choice for a partner.* Not all activities mentioned in this definition have to be exercised in every process run through.

Furthermore, the interviews revealed some additions to the relation of the attributes with recognizing. These resulted in propositions which state that:

- A problem-solving reputation has a positive effect on the amount of external stimuli, which could result in new opportunities.
- Internal and external stimuli will more often be handled as opportunities when there is a supportive culture in the firm.
- Innovative relations with much influence in the firm positively influence recognizing. This is because these firms present innovative questions which influence especially the recognizing of opportunities.
- Social integration between firms influences the search for new knowledge positively in small firms, through the search for new knowledge in existing relations.

The new model and propositions will help small firm managers in their decision making to improve recognizing. For theory, this research will help with the clarification of recognizing in small firms and illustrate the usefulness of studying the steps of absorptive capacity separately. The propositions will hopefully trigger other scholars for more specific research in the relations of the recognizing model.

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Chapter 1: Introduction

1.1 Research approach

Firms can generate their own knowledge through internal sources or look for new knowledge and ideas outside their firm. This new knowledge and ideas help a firm making innovations in order to stay in the race or even outperform their competitors. The internal sources are already available for the firm, but the external partners have to be found and their knowledge extracted. The search for this external new knowledge is a capability labeled in the absorptive capacity literature as 'recognizing' (Cohen & Levinthal, 1990; Lane, Koka, & Pathak, 2006; Todorova & Durisin, 2007; Zahra & George, 2002). So far, there has been no research which verified the existing absorptive capacity models in small firms, filling this research gap could therefore be beneficial for theory and small firms in practice. Zooming in on the beginning of the construct leads to the purpose of this research: explore the recognizing capability for small firms in order to provide the absorptive capacity literature with new propositions and small firm's managers with a basis and directions for their recognizing decisions. This way the research contributes to a connection between theory and practice of recognizing in small firms.

1.1.1 Absorptive capacity

Absorptive capacity is a widely used construct, which explains the amount of ability of a company in extracting knowledge from the external environment. This phenomenon was introduced in the literature by Cohen and Levinthal (1990) as the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends, to enhance innovation. After completing all the steps of absorptive capacity a firm's chances for innovation increase. Empirical evidence for this mediating effect of absorptive capacity between knowledge acquisition and innovative capability is provided by Liao, Wu, Hu and Tsui (2010).

As described in the definition of absorptive capacity by Cohen and Levinthal (1990) above, the process contains a number of different steps which follow each other in a sequential order. Zahra and George (2002) changed the steps from recognize, assimilate and applying to two main categories: potential and realized absorptive capacity; they subdivided these categories into acquiring and assimilating for potential absorptive capacity and in transformation and exploitation for realized absorptive capacity. Todorova and Durisin (2007) reviewed the changes to the construct and concluded Zahra and George (2002) dismissed the capability of recognizing too quick, because it is different from acquiring and necessary in the absorptive capacity and infer a reification of the construct. This happened because many scholars only cite to, for example, Cohen and Levinthal (1990) and do not make, or use, new insights in the construct. Lane et al. (2006) argue to partly solve the reification through using a new definition that couples the construct with the new insights and outcomes. This resulted in the following definition:

Absorptive capacity is a firm's ability to utilize externally held knowledge through three sequential processes: (1) recognizing and understanding potentially valuable new knowledge outside the firm through exploratory learning, (2) assimilating valuable new knowledge through transformative learning, and (3) using the assimilated knowledge to create new knowledge and commercial outputs through exploitative learning" (Lane, et al., 2006, p. 856).

1.1.2 As dynamic capability

Various scholars argue that absorptive capacity can be seen as a dynamic capability (Lane, et al., 2006; Mowery, Oxley, & Silverman, 1996; Zahra & George, 2002). This because its processes and routines of recognizing, acquiring, assimilating, transforming and exploiting of external knowledge are necessary to build other organizational capabilities such as marketing, distribution and production (Zahra & George, 2002).

The dynamic capabilities approach of a firm has its origins in the resource-based view (RBV) (Eisenhardt & Martin, 2000; Teece, Pisano, & Shuen, 1997). For firms to obtain a competitive advantage and to maintain that advantage, Eisenhardt and Martin (2000) take the RBV as a theoretical framework. With the RBV, firms can be analyzed as bundles of resources that are heterogeneously distributed and persist over time. Competitive advantages arise because of good resource configurations, but when the competitive landscape changes, some firms are still able to preserve this competitive advantage. The RBV does not give an explanation for the success in changing competitive environments. Therefore, dynamic capabilities are necessary to change the resource base of a firm from time to time.

Eisenhardt and Martin (2000) argue that dynamic capabilities are a set of specific and identifiable processes such as product development, strategic decision making and alliance formation. Their definition of dynamic capabilities that is used is similar to the definition of Teece et al. (1997), namely:

"The firm's processes that use resources - specifically the processes to integrate, reconfigure, gain and release resources - to match and even create market change. Dynamic capabilities thus are the organizational and strategic routines by which firms achieve new resource configurations as markets emerge, collide, split, evolve and die" (Eisenhardt & Martin, 2000, p. 1107).

1.1.3 Capabilities influenced by processes

In the literature summarized above, scholars explain what dynamic capabilities are. But when we try to explain how they work, a further exploration of the appliance in organizations is needed. Eisenhardt and Martin (2000) argue that these dynamic capabilities are processes and that analyzing the processes is thus the way to analyze these capabilities in organizations. Helfat et al. (2007) partly agree with this by stating that processes support the dynamic capabilities of a company and that they are part of the resource and capability base of a firm. In other words, processes influence dynamic capabilities, but are not the same thing.

A process can be defined as "an organized group of related tasks and activities that work together to transform inputs into outputs and create value" (Daft, 2006, p. 372). Because the outcome can be different in accordance to the situation this basic model is extended with the input of variables which can influence the activities performed.

According to Lane, Koka and Pathak (2006) it is necessary to separate the dimensions of absorptive capacity, because "each of these dimensions requires different processes within the organization". In this way the different natures of the processes and there interrelation will become clear.

1.1.4 Focus on recognizing

Since absorptive capacity should be viewed as a multidimensional construct, every dimension of the construct can be studied separately; therefore the processes influencing these dimensions should also be measured separately (Jansen, Van Den Bosch, & Volberda, 2005). In the review of Lane et al. (2006) the analysis indicates that almost no study used the first dimension of absorptive capacity as key building block. Furthermore Todorova and Durisin (2007, p. 777) argue that the absorption of external knowledge "depends to a great extent on the ability to value the new external knowledge". Therefore this study chooses to focus on the first dimension of the absorptive capacity construct, the building block, that of recognizing. This is the identification of external knowledge and assessment of its value, in order to assimilate and exploit it later on the process. This dimension of recognizing mostly depends on the gatekeepers in the organization and the communication with the rest of the group (Cohen & Levinthal, 1990).

As stated above the knowledge as input of the recognizing process enters the organization via external sources. This information has the important characteristic of being new to the firm and can therefore be used for innovation purposes. When the recognizing of external knowledge is

effectively followed up by the other steps in the absorptive capacity process it could lead to innovations and eventually a better firm performance, as empirically tested by Tsai (2001). The importance of this first dimension is also explained by Todorova & Durisin (2007) by stating that the recognizing of knowledge can be crucial for the survival of a firm, because it is a necessary step to begin the absorption at all. This focus in the study is accentuated in figure 1.



Figure 1: Focus area of this research, accentuated in this scheme.

1.1.5 Focus on small firms

A second specification is made for small firms. Small firms are different from large firms and therefore have other process characteristics. Firm size is defined by the headcount and the turnover in the company. According to the European Union's definition¹ a small firm has less than 50 employees and a turnover beneath the 10 million euro's.

Furthermore small firms are expected to approach the environment with less structure in their searching than bigger firms do. This makes it harder to improve recognizing for small firms, because it is not just an investment in an existing structure, like the R&D department or monthly market analysis. That's why it is more interesting to see how this 'unstructured' knowledge search works. Another advantage is the better chance of finding new constructs influencing recognizing, because of the broader scope of a less structured search. This could also lead to new insights for a structured search.

According to Lang, Calantone and Gudmundson (1997), small firms differ from large firms in their information seeking practices on 1) the sophistication of their Management Information Systems, 2) the concentration of the information gathering on just a few individuals, 3) the lower amount of resources available for information gathering and 4) the quantity and quality of available environmental information. Through these differences one would also expect difference in the recognizing process.

1.2 Academic research objective

In all the research that is performed in the field of absorptive capacity, there are only a few articles that do not take the definition for granted (Lane, et al., 2006), while the others only use the basic construct definition without taking into account the original considerations; this leads to a reification of the concept. In order to overcome this reification, new research has to be based on previous insights in the field of literature and an understanding of their original underlying assumptions. In that way the concept remains connected to the theoretical developments and considerations. This doesn't mean the concept can't be altered. In contrary it

¹ In Recommendation 2003/361/EC of 6 may 2003

can, or perhaps should, be revised, but this has to happen explicitly and with refutation or replenishment of the original underlying arguments.

The objective of this study is to use these developed insights of absorptive capacity and verify them with the process in small firms that is underlying the first step of absorptive capacity. This can lead to new propositions, which can be the basis for a further embedding and development of the absorptive capacity construct. This is also what Zahra and George (2002) recommend for further research: "there is a clear need to capture the individual capabilities that constitute a firm's ACAP. Our review of empirical work indicates that measures have been rudimentary and do not fully reflect the richness of the construct. Clarifying and describing each dimension allow future researchers to isolate and capture underlying dimensions. "

1.3 Managerial research objective

Looking for new knowledge is a very opaque process for managers of small firms. Due to the many possibilities to get in contact with other firms, it is hard to choose or change the strategy of looking for this new knowledge. Describing this process and determining the influence of absorptive capacity attributes, creates the possibility to give managers an overview of this process and advice them on possible changes in their recognizing strategy. In the long run, with the help of further research, a clearer process description and empirical verification of it can help managers in making a research based strategy.

1.4 Research boundaries

Absorptive capacity is build of three different processes: recognizing, acquiring/assimilating and exploitation of external knowledge. This research focuses only on the first process, that of recognizing. Through this lens of absorptive capacity, which is about external knowledge extraction, the internal knowledge for innovation is also outside the research boundaries.

Within these external sources of information that can be recognized by a firm, a differentiation can be made between two different sources of external knowledge: partner firms and public available sources such as research, magazines, the internet and books. I will focus on the external knowledge of (optional) partner firms and therefore frame the process of recognizing as a process for knowledge partner selection.

Selection of partners is in the literature also linked with trust. Organizational antecedents influence the amount of trust between partners and therefore also the chances of a successful relationship. Because the trust literature is different from the other literature streams and does not inference with all other process characteristics separately (it probably does influence the overall absorptive capacity) it will be left outside the scope of this research.

1.5 Central question

The purpose of this study is to explore how managers recognize partners for innovative knowledge in their network for small firms in Twente. In the beginning of this thesis, recognizing will be defined as: the ability to search and value new knowledge for innovations which could be absorbed by the company.

In order to assess how the process of recognizing works and if there are specific characteristics of absorptive capacity literature that are not applicable in small firms, this research will be guided through the following central question:

How does the process of recognizing external knowledge for innovation work in small firms?

1.6 Research questions

The answer for the central question will be formulated by the answer of the research questions. The first research question is about the description of the absorptive capacity attributes in current theory.

How do absorptive capacity attributes influence the recognizing process according to theory?

Answering this first question will create an image of the recognizing process according to the current theory. This image can be verified and maybe adjusted for small firms by studying the process in practice. This part of the research is guided by the following question:

How do small firms use absorptive capacity attributes, which influence recognizing, in searching and valuating new knowledge?

1.7 Methodology

The theoretical questions will be answered through a literature study. Through this literature search a first idea about the recognizing process and the factors influencing it can be created. This will form a set of constructs which can be verified and extended through an explorative research in small firms. This research can provide the answers for the practical research questions. The research design is elaborated upon in chapter three.

1.8 Outlook

Chapter two will start with a description of the literature involved and answer the first research question which will result in a conceptual model at the end of the chapter. In the third chapter the methodology used to answer the next research questions is elaborated upon. Chapter four will give the results of the field research and analyze them, which will form an answer for the second research question. In this chapter propositions for further literature are developed too. The results and analysis are discussed in chapter five after which the central question is answered, along with the implications for theory and practice. In figure 2, this outlook is coupled with the research questions, in order to give a quick overview of the thesis outlook.



Figure 2: Thesis outlook

Chapter 2: Theory

2.1 Method for literature selection

As explained in the introduction this study has the goal to explore the recognizing process, through the constructs of the absorptive capacity theory that could influence this process. In order to extract these construct from the theory, many articles in this field were reviewed. This review started with the most important and well known articles: Cohen & Levinthal (1989, 1990, 1994) and Zahra & George (2002). Furthermore the most articles are found in applying a back- and fore ward search via these articles.

To broaden the scope a little and verify if no important articles were skipped, some search terms were entered in different search engines. The terms used are: Environmental scanning, Recognizing, Absorptive capacity, Knowledge, Innovation, Networks, Social Networks, Dyads, Relationships, Dynamic capabilities, Information searching and combinations of these. The terms were entered in three different search engines in order to verify if no important articles were missing in every field. The used search engines are: Google scholar, Scopus and Science Direct. The most relevant articles were filtered from the search results based on different criteria: Newer articles are preferred above older ones (not applied if the article is cited 500+ times), the field and journal should be relevant to business administration, more citations are preferred and finally the title and abstract. If selected, the entire text determined the usability of the article.

This literature search resulted in a description and framing of absorptive capacity and especially recognizing, even as a number of attributes influencing the process.

2.2 Constructs from absorptive capacity model

Lane et al. (2006) argue a reification of the absorptive capacity construct. This reification could be overcome through integrating basic assumptions and new developments in the theory about absorptive capacity. In order to do so I use the most recent model with the newest insights, that of Todorova and Durisin (2007) as basis for the exploration (see figure 3 below) and reviewed the underlying assumptions in the work of previous authors.



Figure 3: Model of Absorptive capacity (Todorova and Durisin, 2007)

Since the focus is on recognizing, the shaded box in figure 3, all elements influencing recognizing according to this model will be discussed in this paragraph. Extracting all elements that, directly or indirectly, influence recognizing from the model of Todorova and Durisin (2007), results in a

new basic recognizing model that can form the beginning of this research; this model is depicted in figure 4 below.



Figure 4: Basic recognizing model

2.2.1 Recognizing the value

The 'what' question about recognizing is answered in the literature by naming the activities in the recognizing process (Cohen & Levinthal, 1990; Lane, et al., 2006; Todorova & Durisin, 2007). A description of such a dynamic capability can best be given by applying a strategy-as-practice approach (Jarzabkowski, Balogun, & Seidl, 2007) and thus investigating the influence of the different factors on the activities in the process. Although the model above (figure 4) only shows the label: 'recognizing the value', the process does exist of two main activities:

One of the two recognizing activities is the search for new knowledge, this is an activity performed by the managers of an organization. The activity of searching knowledge is concentrated around the interaction of the managers with external partners.

Second there is the activity of assessing knowledge value, in which managers assess if the knowledge found in the external environment will be of value for the organization. If the estimation of the value is positive the description of this knowledge and its value will enter the next process in line of absorptive capacity, that of acquiring knowledge.

2.2.2 Prior knowledge

Absorptive capacity is influenced by the company's prior knowledge (Cohen & Levinthal, 1990; Todorova & Durisin, 2007; Zahra & George, 2002). It has two components concerning the recognizing of external knowledge. First, prior knowledge can help with the search and valuation of new knowledge and second it could cause path dependence. Cohen and Levinthal explain this influence as follows: "Some portion of that prior knowledge should be very closely related to the new knowledge to facilitate assimilation, and some fraction of that knowledge must be fairly diverse, although still related, to permit effective, creative utilization of the new knowledge." (Cohen & Levinthal, 1990, p. 136).

So, the extent to which the new knowledge is complementary with the existing knowledge positively influences the valuating. This means that a more diverse knowledge base makes it easier for a firm to value new knowledge in general. For the search activity, prior knowledge is used as basis for identification of the new knowledge; without prior knowledge a firm wouldn't know where to look for. Prior knowledge is also used for the selection of the partner: if the firm's knowledge base is similar to that of the potential partner the chance for succeeding in recognizing and valuating of the knowledge improve according to the research of Lane and

Lubatkin (1998) and Dyer and Singh (1998). So, choosing a firm as partner for knowledge exchange can be positively influenced by the knowledge similarities with the potential partner. There are more similarities between partners that have a positive influence on the partner choice. Darr and Kurzberg (2000) showed with their research that firms are conscious of strategic similarities within their industry and choose their partners according these similarities. This stems from the similarity-attraction hypothesis (Byrne, 1971 in Darr and Kurzberg, 2000): "managers making the same choices will likely be inherently attracted to each other", these same choices are reflected in the business strategies of the firms.

Next to the 'need' of prior knowledge in searching and valuating new knowledge, there is also a negative influence to the process of recognizing. Companies are path dependent through the prior knowledge: firms often fail to identify valuable new knowledge, which could lead to a 'lock-out' (Cohen & Levinthal, 1990). This path- or history dependence is domain specific, because the prior knowledge from one domain will not cause path dependence in another.

Thus, prior knowledge can have a positive and negative effect on recognizing, but what about the characteristics of knowledge itself? Cohen and Levinthal (1990) state that absorptive capacity is domain specific, which means that each knowledge domain has a different process. In line with this reasoning Sammarra and Biggiero (2008) conclude in their paper that the process of exchange is knowledge type specific. They differentiate three types of knowledge: technical, market and managerial. These three knowledge types should have slightly different processes. Further they also found that in most relationships partners exchange technological knowledge at the same time with market and managerial knowledge.

2.2.3 Feedback loop

Firms use their prior knowledge as input for the recognizing process in order to know where to look for and to help understand the new knowledge. The prior knowledge base is not static in nature. This is because after an iteration of the processes, which carry out absorptive capacity, the resulting knowledge is added to the prior knowledge base. Through this feedback the prior knowledge base is updated with either knowledge that keeps the firm on the current path or that enters a new path, which both could be used during the next iteration of the absorptive capacity processes. These updates of the prior knowledge base, stress the dynamic nature of the process through positive feedback (Todorova & Durisin, 2007). This is what Ambrosini, Bowman and Collier (2009) call the renewing dynamic capabilities, because this dynamic is aimed at the renewing of the resources base.

Next to the knowledge that is the result of the process, there is also new knowledge about the process that could help improving the capability itself. This knowledge helps in developing the capability of recognizing through feedback from earlier iterations. Through these developments the process influenced by the capability can be changed. The capability developing feedback also illustrates the dynamic nature of absorptive capacity on the level that it changes the dynamic capability itself, which is what Ambrosini et al. (2009) call the regenerative dynamic capabilities. This highest level, regenerative, dynamic capabilities renew the capabilities itself; this is in coherence with the capability life cycle view of Helfat and Peteraf (2003).

2.2.4 Knowledge source

In order to recognize new knowledge from the external environment a firm's gatekeepers need to have access to, and an overview of, the sources that could provide this knowledge. A view of the knowledge sources on the current market and at current partners, which is labeled as 'knowledge source' by Cohen and Levinthal (1990) can be created through several different links with the environment. The different interaction possibilities with the external environment create together an image that contains the available knowledge for the firm. This knowledge source could be divided in A) different partner types (Cohen & Levinthal, 1990):

• University labs

- Government labs
- Materials suppliers
- Equipment suppliers
- Downstream users of the industry's products

Or as B) different sources to find a partner

- Interaction with possible knowledge sources can originate from the membership of a business association for example. Membership of such an organization can be of big influence in the shaping of the external network of a firm. As Boshuizen states about a field study among Dutch entrepreneurs: "Almost automatically, they started mentioning membership in business associations as an important means of establishing and maintaining regional network contacts and acquiring access to knowledge" (Boshuizen, 2009, p. 64). A main distinction between those associations is those that bound the firms together through geographical proximity and those that are association through the type of business.
- Another origin of interaction can be the personal contact between managers, as acknowledge by Burt (2004) and Daft and Weick (1984). This contact can stem from meeting in working or private situations. It is hard to purposefully select these personal contacts for new knowledge, because you can meet them almost everywhere.
- Other possibilities to see and find new knowledge are via the Internet, through current customers (also potential customers), seminars or business magazines. It is also possible that firms exchange knowledge with a firm with which they had another type of relations before, a supplier for example (Ahuja, 2000).
- A last example is that of trade fairs (Rosson & Seringhaus, 1995). These meetings, organized in many cities, give companies the opportunity to present themselves to potential customers, whom could be triggers for new information or bring new knowledge along. But it is of course also possible for the focal firm to visit a trade fair as potential customer in search for new information.

2.2.5 Activation triggers

In order to start the process of recognizing a gate keeper may receive a trigger to start searching for new knowledge. Therefore triggers, as proposed by Zahra and George (2002), influence the relation between the knowledge sources and recognizing of external knowledge. Zahra and George (2002) differentiate between internal and external triggers. Internal triggers could stem from an internal crisis or events that shape the firm's strategy.

External triggers on the other hand stem from events that shape the future of the industry (Zahra & George, 2002). A more direct external trigger is a customer question; this could lead to the search for new knowledge with which the firm could create a solution for the problem of the customer. Another trigger for the recognizing process could be a personal contact, through whom an idea for a new product or service is created.

2.2.6 **Power relationships**

Todorova and Durisin (2007) added power relationships as contingent factor to the process description of absorptive capacity in order to explain why only some of the available knowledge is used by firms and why some firms are better in the exploitation of it. Power relationships have been defined as those relationships that involve the use of power and other resources by an actor to obtain his or her preferred outcomes (Pfeffer, 1981 in Todorova & Durisin, 2007). Focusing on the influence of recognizing, the actors with a power relation are those who can influence the outcome through power are especially a firm's customers. Christison and Bower (1996) found that firms have problems with properly assessing the value of new knowledge when it is not relevant for the current customers, which decreases the chance of absorption of that knowledge. This could lead to a focus of a firm's resources on knowledge that's directly

applicable to the current customers base which can result in a failure of applying new technologies or finding new customers segments.

Furthermore Todorova and Durisin (2007) argue that commitment to other actors, such as suppliers, could also hinder the correct valuating of new knowledge. This could for example be the case if a firm has made long term deals for the delivery of a specified resource, through which it is not worthwhile for the firm to try another material or develop a new product.

2.2.7 Social integration mechanism

Organizational processes consist of social interactions, which are influenced by integration mechanism. While Zahra and George (2002) argue that social integration mechanism only influence assimilation and transformation of external knowledge, Todorova and Durisin (2007) propose an influence on the other capabilities too. Integration mechanisms build connectedness and shared meanings between social entities, like managers.

A further description of this connectedness can be given through the strength of the ties with partners. Description of this strength started with Granovetter's (1973) differentiation between strong and weak ties. Strong ties are the close relationships an individual has, through which a lot of information is exchanged; weak ties are connections with less closer 'friends', so a lot less information is exchanged. The strength of weak ties is a theory of Granovetter's (1973) which assign much power to weak ties, because they posses knowledge that is not familiar with close, strong relations and therefore new for the firm.

The social integration between partner firms, or connectedness, is proposed to be a negative moderator between search process of absorptive capacity and innovation (Todorova & Durisin, 2007); this is because strong ties can block the absorption of new knowledge. Jansen et al. (2006) also expected a negative influence of connectedness on potential absorptive capacity. Their analysis on the other hand showed a positive influence on assimilation and no proof of a negative influence on acquisition.

Polonsky et al. (2010) designed a model that described the dynamics of relations in which a tie can go through different phases. This means that a weak tie can become strong and vice versa, which influences the proposed relation of Todorova and Durisin (2007), because strong ties can become weak again.

2.2.8 Regimes of appropriability

Appropriability regimes moderate the relationship between absorptive capacity and the outcome of competitive advantage (Zahra & George, 2002) and between knowledge sources and absorptive capacity (Todorova & Durisin, 2007). Markets with strong regimes, characterized by many intellectual property rights and a difficult replication will have a bigger chance of appropriating their innovation investments. While on the other hand weak regimes create knowledge spillovers, which according to Cohen and Levinthal (1990) stimulate absorptive capacity, because in order to use this spillovers a firm has to invest in its own R&D too.

2.3 Small firms and the environment

Small firms are different from large firms in their knowledge seeking practices (Lang, 1997). Combined with the notion that Todorova and Durisin (2007) didn't design their model specifically for small firms, there could be elements that should be discussed or added to the model. Lang et al. (1997) mention a difference in the sophistication of their Management Information Systems and the quantity and quality of available environmental information.

These differences make the environment less analyzable for small firms. This environment analyzability is one of the two dimensions in the environment interpretation model of Daft and Weick (1984). According to Daft and Weick (1984), the strategy of a firm is related to the way a firm interprets the environment. Therefore the Daft and Weick (1984) used the strategy

classifications of Miles and Snow (1978) and coupled them with an organizational interpretation mode, which implies their influence on the way an organization searches the environment. The four different strategies and their characteristics are:

- Reactor: move with the environment, personal contacts and see what is coming.
- Prospector: lots of initiative towards the environment, change and new possibilities.
- Defender: analyze the environment and protect the knowledge the firm has.
- Analyzer: Stable activities and innovations if the environment allows it.

Since small firms have fewer resources to analyze the market their strategy is coupled with an unanalyzable market view. According to the classification of Daft and Weick (1984) this dimension's strategies are the reactor and prospector strategy.

The second dimension Daft and Weick (1984) distinguish is the difference in the way that organizations can intrude the environment. Managers can look active or passive for new information in the environment. In which active looking companies allocate resources to their search activities and passive organizations accept whatever information the environment provides them with. This is also recognized by the environmental scanning literature as is described in the review of Morrison (1992). Therefore a firm's intrusiveness in searching knowledge could be an element in the recognizing model.

Furthermore Lang et al (1997) differentiated small firms on the concentration of the information gathering on just a few individuals and the lower amount of resources available for information gathering. Fewer individuals for information gathering will not change the recognizing process, but investment limitations can. Cohen and Levinthal (1989) argue that investments in R&D, stimulate the process of exploitation in absorptive capacity. A few years later in their article 'Fortune favors the prepared firm' (1994) they provide mathematical prove for the fact that these investments can provide an advantage on competitors, because of the faster recognizing of this new knowledge.

2.4 Conclusion

Based on the literature overview in the previous paragraphs, the elements in the figure below represent the constructs which will be verified for the small firm recognizing process in practice. The shaded boxes are those attributes which are added to these of Todorova and Durisin (2007), based on the theoretical elaboration above. The design of this verification process is elaborated upon in the next chapter.



Figure 5: Summarized recognizing model from theoretical insights

Chapter 3: Methodology

3.1 Research design

In coherence with the research question, the goal of this study is to explore the recognizing process for small firms. Due to this explorative objective the best suited research type is a qualitative design (Creswell, 2009). Within this research type there are different strategies of inquiry; the one that best fits this research is a case-study design. This design can be defined as: "an empirical inquiry that investigates a contemporary phenomenon within its real-life context when the boundaries between phenomenon and context are not clearly evident and in which multiple sources of evidence are used" (Yin, 1989, p. 23). I made this choice, because an explorative form of study was needed that could describe the absorption of knowledge within a company. Due to the interaction with different partners from time to time this is a changing phenomenon. Furthermore it is essential for the goal of this study to explore the dynamics in a case, because these could lead to new insight about recognizing in Small firms. This is in coherence with the case study purpose description of Eisenhardt (1989): "The case study is a research strategy which focuses on understanding the dynamics present within single settings" (Eisenhardt, 1989, p. 543).

3.1.1 Relational approach

In order to verify the attributes from figure five through a case study, one can ask actors about examples connected to the attributes in a regular interview. But in order to explore the capability of recognizing and increase the chance of finding a reliable description of all elements, I used a specific approach: the relational approach. This approach is relevant to absorptive capacity, because new knowledge for innovation enters the organization through links with the external environment. Exploring absorptive capacity means examining communication structures between 'the organization and its environment' as well as between subunits and the distribution of expertise within the organization (Cohen and Levinthal, 1990: 132). These communication structures are present in the network surrounding the company. Thus studying "the embeddedness of the firm in a network of inter-organizational relationships sheds additional light on how and why firms act and perform the way they do" (Zaheer, Gözübüyük, & Milanov, 2010). This is another reason to study the process from a network perspective. The network perspective can be used in different ways, like Zaheer et al. (2010) describe the approach that a network analysis is not a theoretical lens on itself, but more of a methodology. This means that the researcher gives meaning and interpretation to the network study results through the addition or combination with other theoretical perspectives.

In its most general definition a network describes "the interaction of any individual unit within the larger field of activity to which the unit belongs" (Kilduff & Tsai, 2003, p. 14). A network of a company (as unit) can be described in different levels, which are in general the dyad level, the focal firm level and the network level. Dyer and Singh (1998) conclude in their article that a pair, or network, of firms can develop relationships which in their turn can result in competitive advantage. One of the ways to reach this competitive advantage through such a relationship is that of knowledge sharing. Their theory suggests that a firm's ability to identify, assimilate, and apply another firm's knowledge is based on the "sociological interactions" and collaborative process that the partners develop, as well as the relationships between the members of those firms i.e. the relational view. From this perspective choices made in network partners are important, because social structure, especially in the form of social networks, affects economic outcomes, since networks affect the flow and quality of information (M. Granovetter, 2005).

In order to explore the process of recognizing I will search for the most important knowledge exchange dyads in the focal network of each case firm. Combining this relational view with knowledge resource perspective can be reached through asking how the focal firm found its most important knowledge extracting relationships (from time 0 to 1 in figure 6) and how these relations work. The latter question will be assessed through analyzing what information travels

through the pipeline of the relationships (after time 1 in figure 6). That's how the absorptive capacity constructs are explored using a relational approach in this research.



Figure 6: Emerging relationships between firms

3.2 Case selection

For the research design I used a case-study checklist designed by Eisenhardt (1989), which specifies some important points for the research design. An important point is the theoretical sampling of the population; this is because the goal is not to generalize to a bigger group, in which case random sampling would be preferred, but the goal is to explore a phenomenon in a well specified population. In her description of the case study methodology, Eisenhardt (1989) also distinguishes between single- and multiple- case study design, in which the latter explores more cases. The big advantage of a multiple-case study design is that the researcher can make a cross case comparison and can develop a theory that has a higher likelihood of being accurate and reliable compared with a single-case study. Therefore I used two case companies instead of one.

The different cases selected operate in the manufacturing-industry in Twente. The choice is made for the manufacturing-industry, because the firms in this industry have the most diverse set of actors and knowledge types. Through this diversity the chance is bigger that all different elements are represented in the final process model. Furthermore innovations with the three knowledge types are clearly identifiable, because in the manufacturing industry technology innovations are visible in the product characteristics, managerial innovations are visible because of the workforce employed even as possible differentiation in strategy and finally the market innovations are visible through the big amount of actors surrounding the company. The case companies build different kinds of machinery or products and are selected based on the similarities of size, type and location, which makes it possible to determine the differences in the processes of recognizing to other factors. The two case companies are:

- Almi: produces block cutter and pipe grinders, but also designs and fabricates metal products for all sorts of customers.
- Herikon: fabricates and designs different types of plastic products, which experience lots of friction or other extreme conditions during operations. All products are produced with the polyurethane and silicones.

These companies do have a knowledge exchange relation with each other. This relation emerged from a customer-supplier relationship. The change in the relation stems from personal contacts which emerged in a business club². The relation between these two cases is an advantage for this study, because in this way it is possible to check the consistency of the information that managers of the focal firm give about the relations. Furthermore these two views on the emerging of one relationship increase the amount of certainty that all construct, that could influence the recognizing process, are represented in the process model.

² The business club is called VMO, which is an association of manufacturing firms in the eastern part of Holland.

3.3 Data collection

The difficulty of knowledge distribution within the organization depends on the equivalence between the expertise of the individuals in the organization and the external actors. If this expertise differs a lot there is a need for "gate keeping" or "boundary-spanning" roles (Allen, 1977; Tushman, 1977 in Cohen and Levinthal, 1990). Since this research is focused on small firms, which work with a little number of engineering- and management staff, all of them will have an expertise that matches the external actors of which they need knowledge i.e. their boundary spanning and operational roles are not separated. Still a gatekeeper might be needed in order to relieve others from having to constantly monitor the environment, but because of the expertise equivalence the internal communication structures won't be as challenging as in bigger organizations.

Data collection for the case-study will take place in the form of qualitative interviews with members of the engineering and management staff. Because the focus is on absorptive capacity, with the goal of innovation, the employees who will be interviewed should have connections with partners and exchange knowledge for innovations with them. This could be market, managerial or technical knowledge (Sammarra & Biggiero, 2008). Thus the employees from each company should span these areas. In the case companies I interviewed the relevant engineers and managers who were available for an interview. This resulted in 7 interviews, as depicted in table 1 below.

To get a sense of the topic and see if any important aspects were missing in the interview scheme I started with a pilot interview after which some variables of the research were adjusted and the second phase of interviews could be started. One of the most interesting changes was the scanning of the technological environment. The managers of Almi often visit congresses and trade fairs to get a sense of the newest technologies and ideas for new innovation through combining the ideas of others. Therefore trade fairs were added to the knowledge sources. This change in design is allowed in case studies: according to Eisenhardt (1989), a case study is an emerging design and therefore could be adapted after new insights.

Company	Name	Data type	Date	Duration/#		
Almi	Managing director	Pilot interview	31-05-2010	80 min		
Herikon	Managing director	Interview	23-06-2010	70 min		
Herikon	Sales engineer	Interview	28-06-2010	80 min		
Herikon	Production manager	Interview	28-06-2010	60 min		
Herikon	Sales engineer	Interview	28-06-2010	60 min		
Herikon	-	Type out sales		2 pg		
		meeting				
Herikon	-	Folders with	28-06-2010	+/- 500 per		
		business cards		trade fair		
Almi	Managing director	Follow up	06-07-2010	30 min		
		interview				
Almi	Engineer	Interview	06-07-2010	45 min		
Almi	Engineer	Interview	06-07-2010	50 min		
Total		8 Interviews		7.75 H		

Table 1: Data collection in case companies

3.4 Operationalization

In this section I will describe how the different process characteristics, described in chapter two will be measured in the case companies. There will be a separation between firm related questions about the company and relationship specific characteristics. The interviews in the case companies are split up according this same characteristic. The other factors will be assessed as characteristics of the relationships in the second subparagraph.

3.4.1 Firm related questions

The first interview questions are about some general company-, market- and job characteristics to be able to correct for this background characteristics e.g. business structure, job description, competitive advantage and product or service information. Furthermore, the following firm related attributes from figure five are assessed:

Concept	Definition	Question / Operationalisation
Regimes of	Knowledge protection and	Number of patent applications in the
appropriability	spill overs.	database of the Dutch minsitery of
		Economic affairs.
Table 2: Operational	ization firm related concepts Todorov	a and Durisin (2007)
Concept	Definition	Question / Operationalisation
Strategy	In accordance with Daft and Weick (1984), firms can interpret the environment in different ways.	Through verifying the resemblance with the process characteristics described by Miles and Snow (1978) are investigated: Are opportunities found through internal environment analysis or external contacts? Does the firm move with or approach the environment?
Investment	Spending money on the firm's recognizing activities.	Did the company invest in knowledge search if necessary and if they invested in searching for knowledge at some specific points in time to stimulate new innovations?

 Table 3: Operationalization firm related concepts other sources

Finally, the last general question is about the output of the recognizing process: do all companies with potentially new knowledge become partners? If not, what happens to the rest? To verify this question I will ask what they do with the business cards of partners they do not use.

3.4.2 Relationship characteristics

As explained in 3.1.1. network ties can be used to describe different characteristics about the emerging of the relation and information that is exchanged over the tie. In the interviews I asked about the ten most important knowledge for innovation relations in the last two years; spanning the areas of the three knowledge types. Per relations I will ask questions about the following attributes from figure five:

Concept	Attribute	Definition	Question / Operationalisation
Prior knowledge	Knowledge similarity	"Basic knowledge refers to a general understanding of the traditions and techniques upon which a discipline is based" (Lane & Lubatkin, 1998, p. 464)	Based on the general description of the knowledge exchange relation with the partner firm. Firms with the same specific knowledge are marked as firms with similar knowledge.
	Path dependence	Failure to identify new knowledge through being locked to the current way of thinking.	Will be assessed through asking how the company's employees can get out-of-the- box ideas and information that differs from the current knowledge path?

Feedback loop	Capability development	The progression of recognizing through feedback of earlier iterations of the process steps.	Did this relation change the way of looking for new knowledge?
Knowledge source	Knowledge search source	The different interaction possibilities with the external environment from/ through which external knowledge can be extracted.	How did you find the partner?
Activation triggers	Internal versus external trigger	An event that starts the recognizing process.	Based on the general description of the relation with the partner firm. If the reason for starting with the relation emerged through a process, product or marketing optimalisation inside the firm the trigger is internal and from an environmental actor, external.
Power relationships	Type of relation	Partner types (Cohen & Levinthal, 1990)	Based on the general description of the relation with the partner firm, these firms are marked as one of the partner types (see 2.2.4)
Social integration mechanism	Connectedness	The importance of existing ties in the firm's network.	How long did this relationship exist before the last knowledge exchange?

Table 4: Operationalization relational concepts Todorova and Durisin (2007)

Concept	Attribute	Definition	Question / Operationalisation
Intrusiveness	Active search and passive search	The difference in the way that organizations can intrude the environment, looking for new knowledge (active or passive).	Were you looking active or passive for this knowledge?
Knowledge type		The type of knowledge exchanged in the relation: technological, managerial or market knowledge or a combination of these knowledge types	Which type(s) of knowledge is (are) exchanged in this relation?
Strategy	Strategic similarities	A related way of the manager's choices in doing business.	Does the partner firm has the same way of doing business (approaching the environment, openness in information sharing)

Table 5: Operationalization relational concepts other sources

3.5 Data analysis

In chapter four, the results of the case studies are presented for every attribute from the theory in chapter two (as summarized in figure five). The results of the case studies are used to verify the attributes that influence recognizing in theory and set new propositions for the findings that diverge from the current theory. After which, this case study does result in a new summarizing model that describes the recognizing process of small firms. The relationship questions are used to present some percentages, which can give an indication of the relationship between certain concepts which influence the recognizing process. Furthermore the relationship descriptions are also used to present examples which support the propositions that are being formulated through the case analysis.

Chapter 4: Results

4.1 Case descriptions

4.1.1 Almi

Almi is a company that manufactures pipe grinders and stone cutters and sells these to their dealers worldwide. Furthermore they develop and build metal parts for their clients. In this supply part they specialized themselves through the development of a welding robot and a handling robot, through which they have low change-over time and a 24/7 production. Almi has a very open culture; they are actively sharing their knowledge about their way of working and products with other companies in order to increase the amount of knowledge sharing and innovations:



"We are very open towards potential customers, we want to Figure 7: Logo Almi

help them and share our knowledge, instead of protecting it. This open approach does sometimes lead to very surprised reactions, which are difficult to manage." (Engineer)

Looking for new knowledge is something managers of Almi mostly do at trade fairs in Europe (TIV Hardenberg, TechniShow Utrecht, Robotics trade fair Munich, and Hannover Messe). At these trade fairs they meet potential customers, suppliers and competitors from which they can learn about new knowledge and maybe even transfer this knowledge afterwards. Another reason to visit these trade fairs is to see the status of the technology in the market and find new ideas and opportunities to work on.

Almi's competitive advantage in the area of managerial knowledge is remarkable. This is because they are working with skill certificates for their employees; they even won a national price for this in 2009. In the area of market knowledge they fall a little bit behind on competitors and in technology they master their competitors in certain areas. The competitive advantage on technology doesn't span that many areas, because this advantage is often quickly lost due to the copying of ideas. Almi tries to protect this advantage with their good name, reputation and patents. Or as argued by an engineer at Almi:

"They copy our products, so in these area's we lead the way. In technological knowledge we also prevail, because the products they copy, they copy wrong." (Engineer)

4.1.2 Herikon

Herikon is a medium sized company, which designs and manufactures all types of products using Polyurethane. Especially products that encounter a lot of friction or other extreme conditions fall into the product scope of Herikon. The company has 32 employees of which 8 work in the office and the rest in factory. New and out-of-the-box ideas are stimulated within the company; also the flat organization structure stimulates the emerging of new ideas, which are brought into the company through lots of external



Figure 8: Logo Herikon

contacts. A lot of new relations emerge on the trade fairs Herikon visits, especially the Hannover Messe. Furthermore personal contacts are a very important source of new ideas and knowledge. That this personal approach can also result in innovations is proven by Herikon many times, an example quoted from an interview with the managing director:

"Once we were standing around a table after a trade fair and designed a new product on the backside of a coaster".

Another important characteristic of Herikon is their culture in which the common sense and down to earth approach prevail (in Dutch: Gezond Boeren Verstand).

The competitive advantage of Herikon in the technological area is based on their good relationships with suppliers and prevailing technological knowledge in many niche markets. Described by Herikon's sales engineer:

"This advantage is mostly based on the constant communication with our suppliers. Our technical advantage is grounded on our materials and the specialties we search in this. [....] We are one of the few companies that really challenge our suppliers on technological knowledge. [....]Furthermore our flexibility feeds this advantage." (Sales engineer)

In the area of market knowledge they excel through some strategic alliances and do not meet competitors, this is because of many niche markets in which no competitors operate. On managerial knowledge Herikon has no special knowledge, but because of their formal and flat organization they can move quickly. This can be seen as a managerial competitive advantage, because the most, more bureaucratic, competitors lack behind although they may have more managerial knowledge.

4.2 Recognizing factors in small firms

The relations of the different interviews within a case even as these of both cases are taken together. This resulted in 49 different relationships with their characteristics³. Before these relations were taken together I compared the relationships mentioned by the different managers with each other. As expected the employees have a different perception of the ten most important knowledge relationships for the company in the past two years. This depends on their function, but also on the relationships that pop up in their minds during the interviews.

To control for the consistency with which employees describe the relationships, the relation between both case firms could be used for verification. The answer of Almi about the relationship with Herikon (mentioned by two employees) and vice versa (also mentioned twice) were almost identical; only the value of the knowledge for both companies differs, but that does not alter the consistency of the relation descriptions. This cross-case comparison will also be used for the description of the recognizing attributes below, this replication strengthens the findings.

The relational analysis will help us find out: How do small firms use recognizing in searching and valuating new knowledge? Therefore all elements from theory, as depicted in the basic model in figure 5, are verified for their practical application in the recognizing process of small firms.

4.2.1 Prior knowledge

It is obvious that the case companies do have prior knowledge. This is because they need technological, market and managerial knowledge in order to translate resources in a product and sell it. The companies use this knowledge in their recognizing process for the valuation and searching of knowledge even as the selection of partners.

Prior knowledge for searching is especially used for the extraction of technological knowledge. In line with the theory, the basic knowledge is used for the recognition of almost all technological knowledge, while the specialized or specific knowledge is different from that of the partner in most cases. An example of prior knowledge for searching and valuating in one of the cases is:

³ A short description and summary of the relational data can be found in appendix B

When Almi was looking for improvements in their chains for stonecutters, they already had some knowledge about the requirements for their chains. This knowledge was used to find a partner whom could help them through providing that specific knowledge and materials. Already before the search they could assess what the value of that new knowledge would be for them, because they knew the importance of that information for their stonecutters.

Firms looking for new knowledge are depended on the path they are currently on. This path dependence could lead to a 'lock-out' from the competing field (Cohen & Levinthal, 1990). From this point of view one can argue that this concept influences the search activity of recognizing i.e. through path dependence firms will mostly search for knowledge that complements their current knowledge.

Just like any other company, due its prior knowledge, also Almi is path dependent. But because they realize this, they generated some solutions for this problem: their R&D employee works at a desk in an engineering firm. This makes it possible for the R&D employee to look outside the scope of the company and come with new ideas. Furthermore they provide other employees with the opportunities to look at other companies to see how they do it and even lease their employees to other companies. An engineer at Almi described this as follows:

"We always say that you should not watch our own machine park, we watch in the width of the horizon and visit other companies to see if they have better solutions or machines that solve the problem." (Engineer)

Also Herikon knows the importance of looking outside-the-box in order to break from the current path. In practice they do this through interacting with many external contacts. These contacts can be within the same field, on trade fairs, business magazines and existing customers, but also from other field and other type of contacts. At Herikon these other contacts are especially personal contacts.

"Especially I and the managing director bring external knowledge inside the company." (Sales engineer)

The case companies are path depended too, this is because most challenges they encounter are with current product types and their production is limited to their current machinery. But as described above, both case firms are aware of this path dependence and try to deviate from this path through interaction with external actors, visiting (or even working at) other firms.

Summarized, a firm's prior knowledge does help with the recognition of knowledge and does influence the path dependence of recognizing, but this is weakened by efforts and external contacts which will help deviating from this path.

4.2.2 Feedback loop

Since feedback loops are an important characteristic of a dynamic construct (Todorova & Durisin, 2007), they are expected to be present in the process of the dynamic capability recognizing. These feedback loops can contain information of earlier iterations of the recognizing process and also of the other absorptive capacity processes: assimilating and exploitation. The resulting knowledge becomes prior knowledge for the next process, but there is also knowledge about the process itself with which, in the next iteration, the capability itself can be developed.

The feedback loop which updates the prior knowledge base and which illustrates the renewing effect of the dynamic capability is present in the case companies. This is illustrated by the following example:

Herikon had to improve a material in order to increase a product's lifetime in severe conditions. Supplier Hexa delivered new information about possible changes to the material characteristics. In a new iteration Herikon used this new prior knowledge and looked for other knowledge which could help them further toward the solution.

Next to this renewing feedback loop, there is also the feedback which develops the capability on a regenerative way. In the cases studies this feedback loop is found as described below.

Most of the time Almi is looking for new knowledge on the way they always do. But in one relationship the capability development in the absorptive capacity process is illustrated very clearly: the engineer of Almi participated in a workshop about product development, organized by TNO. This way of finding novel knowledge was new to the company. The engineer indicated that he would probably use this way of searching new knowledge again, especially because prototyping is an expensive investment in the product development process:

"You can better follow a workshop, instead of probing for a government innovation grant. You can take the prototype home, which otherwise costs a lot of money. Also you gain new knowledge during this workshop." (Engineer)

This example illustrates that a new way of knowledge extraction can be the input for another turn of the recognizing process.

In most cases Herikon employees search for new knowledge on the ways that learnt to be effective before, like trade fairs, suppliers and interaction with customers. In the interviews they mentioned some exemplar relationships from which they learnt a new way of absorbing knowledge. One of these relations was a firm in Sweden which helped them with obtaining market knowledge over there. This firm handled their question seriously and came up with creative solutions. At Herikon they argued that this way of looking for new market knowledge proved to be very effective and probably will be used in the future again. Also in the field of technological knowledge they did find a new way to absorb knowledge. This stems from the relation with a technological consultancy firm that guided them in the process of a technological innovation. Asking for this kind advice is a form of feedback for the recognizing process, because this also proved to be an effective way of knowledge absorption for Herikon.

In both cases this feedback mostly service as a routine, because a searching method that proved its results is, most of the time, repeated when the same kind of knowledge question occurs. In these cases this is illustrated through the search for technological knowledge at their current suppliers and the visitation of trade fairs to see new opportunities. In some instances, however, the feedback alters the way of searching new knowledge in the future. This is when a newly found way of searching, for example the use of a market consultancy firm in foreign countries, is successful and will therefore be used more often. This kind of search process developing the capabilities only occurs when firms try out new things or when the environment changes. In the manufacturing industry this probably takes a little longer than average, through which these feedback loops could have been better analyzed in a longer time frame, then the past two years I asked about in the interviews.

Through this capability development, recognizing is a learning or regenerative construct. The routines and learning effect of this development are illustrated in both cases , what's not illustrated in the cases is the failure of new way of searching and the possibility of applying this new methods for different knowledge types. From the observation that this capability development is also present in small firms, this feedback loop should also be present in the recognizing model for small firms.

Although Todorova and Durisin (2001) only mention one feedback loop; I argue that there are two: one which updates the prior knowledge base, the renewing of recognizing, and one that develops the capability itself, the regeneration of recognizing.

4.2.3 Knowledge source

"Clearly, firms acquire knowledge from different sources in their environment, and the diversity of these sources significantly influences the acquisition and assimilating capabilities." (Zahra & George, 2002) This is also the case for the small case firms, who also use different knowledge sources as input for the recognizing process. These different knowledge sources are used for the extraction of new knowledge from the environment.

The knowledge about all these sources by the managers can best be illustrated by the following quote from one of the interviews:

"Our advantage is that we all come from different branches, from which we can recall different contact [..] Furthermore we are real network people, our managing director is board member at the VMO, were all other types of companies are member, so when we have a technical question we always know where to look." (Sales engineer)

Not all knowledge contacts, found through a knowledge source, results in knowledge exchange relationships, this doesn't mean the contact information is lost. When the contact with another company does not result in a relation they store the business card or leaflets of that firm/manager. This occurs often after a trade fare; than they have many business cards, but don't use these immediately. At Herikon for example, from the approximately 500 business cards received each year only ten percent is used actively. These cards are scanned in the computer for storage and are accessible for all office employees. Most information about this contact is stored in the minds of the employees who had the contact. So when an employee is looking for a company with specific knowledge they first assess their memory of contacts and look up the information in the database of business cards. When such a contact is not known by the employee they interact with other to find out if they do know such a firm, as quoted from the interview with one of the engineers:

"If you have a problem and do not know a supplier or firm with that knowledge we talk about this together, our managing director for example knows a lot of companies and visits lots of trade fairs; also our procurement person has lots of contacts for this." (Engineer)

Concluding, knowledge sources are an input for recognizing in small firms. The difference with larger firms as indicated by Lang et al. (1997) is the sophistication of the Management Information System. In this case it is about storage of contact information. In small firms these linkages are mostly in the minds of employees, while larger firms try to capture most of this knowledge in information systems.

4.2.4 Regimes of appropriability

Todorova and Durisin (2007) stress two proposed effects of appropriability regimes. First the approach of Zahra and George (2002), who argue that in low appropriability regimes the failure rate of retrieving your investment cost is high. While Cohen and Levinthal (1990) on the other hand argue that weak regimes foster competitive spillovers and therefore increase absorptive capacity. For both points of view case evidence can be provided.

An example of the profits from a weak regime is the open approach Almi uses in the exchange of information with its competitors. They invited customers over to learn them about their techniques, their management approach and operations.

This does illustrate an open approach, through which a knowledge spillovers are available for other companies. The protection approach is also used by both firms. In appendix D the patents used by the case companies are described. This does illustrate that both firms used these

protection mechanisms in order to be able to retrieve the value of their ideas, without the possibility of competitors copying these ideas.

This leaves the same conclusion as that of Todorova and Durisin (2007), both arguments can be applied for small companies and should be investigated further in order to draw meaningful conclusions of the influence on recognizing.

4.2.5 Activation triggers

Zahra and George (2002) differentiate between internal and external activation triggers of the recognizing process. Both triggers types are found in almost equal amounts in the batch of relations. Almost all external triggers are in the form of a customer question, like:

Company Foxtrot approached Almi with the question for the fabrication of a product which should meet the very precise requirements and should have a little tolerance. After this external trigger, Almi turned to one of its suppliers to find the right knowledge to help this customer.

Internal triggers could stem from the need to, or question for, a process-, product- or marketing optimization from within the company. An example of an opportunity, resulting from an internal trigger, in the cases is:

One of Herikon's employees had the idea to search for a new market and partners in Scandinavia. From this internal trigger Herikon contacted its chamber of commerce which helped them find a marketing firm in Sweden. This finally resulted in the relationship with partner which whom they now have a joint-venture.

Next to these two trigger types there is also the possibility to recognize knowledge, without a trigger. This happens in the rare cases that another company knocks on your door with new information. One of these rare cases is illustrated in the following example.

Company Hotel did experiment with plastics in its own one-man company. When he did find a new technique for this branch he was looking on the Internet for a company that could use this in its product offerings. That's how he did find Herikon and approached them for sharing this new knowledge.

It won't be advisable for a company to just wait for these activation triggers. During the interviews in the case companies I saw a trend in the emerging of these triggers. External triggers, in these cases mostly customers, approached the company by themselves as can be further illustrated by the comments of Herikon's sales engineer about the Hannover Messe (a trade fair):

"We've got a lot of people who approach us with a certain problem: 'I've got a wearing problem' or 'I've got a problem with the appliance of a material' [..] At that stage the knowledge search starts and we have to find out if we can help that customer."

Customers approach these firms based on their image and reputation, through which they say that they will try to solve the problems of their customers. Next to trade fairs and current customers there are other ways to show your company:

Almi is working on their reputation and image through apply for different awards and working on being the precursor in different managerial, market and technological fields. This leads to much attention in magazines and other 'free' publicity.

Only the existence of internal triggers is not enough. Employees should be motivated to see new opportunities for the marketing, products or improvements in the process. This motivation, and

therefore the internal triggers in their relation with the opportunity recognition are moderated by the culture in the company. One of Herikon's employees described this as follows:

When I have an idea for a product or cooperation with a partner, our director always supports the idea and is thinking with you instead of criticizing against you. This support stimulates the internal drive for new ideas.

Based on these observations and argumentation I propose:

P1: A firm's problem-solving reputation positively influences the amount of external triggers.

P2: A firm's supportive culture positively moderates the relation between activation triggers and the opportunity recognition.



Figure 9: Activation triggers

4.2.6 Power relationships

In both case companies the influence of customers on the searching activities is present. The power coming from these existing actors is in most cases in terms of monetary resources, because if the firm is able to extract the right knowledge they can develop a solution for the customer question and receive money in return. Todorova and Durisin (2007) explain these power relationships as cause for the failure of finding new technology and customer segments. The examples in the case study do presume another explanation.

Herikon for example, has a relation with customer Beta. This customer did request if one of their products could be made of polyurethane. In order to do so Herikon needed a lot of new knowledge about certain material characteristics of polyurethane and how to chance them. This knowledge was found with the help of current suppliers, research firms and testing.

Through the power of the relationship with customer Beta, Herikon did find new technology and outsmarted its competitors.

Almi had a question of a customer Charlie, who's specialized in the development of karts. Solving this question for Charlie required a lot of specific information about the techniques used for light-weight materials. This specific technological knowledge created the possibility to present solutions for a new customer segment. From these examples another relation between power relations and recognizing can be derived than the relation proposed by Todorova and Durisin (2007). In this relation the customers of a firm push it toward new technology and new customer segments instead of pulling it away. Therefore I propose the following:

P3: A firm's innovative power relationships challenge the firm with questions which positively influence the recognizing capability, especially the activity of opportunity recognition.



Figure 10: Power relations and opportunity recognition

4.2.7 Social integration mechanism

Todorova and Durisin (2007), propose a negative and positive effect of social integration mechanisms on absorptive capacity. This effect does depend on the type of knowledge and the type of knowledge processes. In search processes, strong ties are presumed to have a negative moderating effect on the relation between absorptive capacity and innovation outcomes (Todorova and Durisin, 2007). Weak ties are proposed to be more effective in searching knowledge. That connectedness of a firm in its network would negatively influence the search for innovative knowledge, is also what Jansen et al. (2006) expected in their hypothesis; but their analysis showed a positive effect on assimilating and no proof for a negative effect on acquisition. During the interviews in the small case companies this positive effect was forthcoming as well. Social integration through strong ties led to a safer and more open environment to exchange information or problems, which in both cases positively influenced the recognizing process. An information exchange example of such a strong relationship:

Almi has a long relationship with one of its many suppliers Delta, when looking for a solution for a customer problem with the hardening of steel they approached Delta. Delta couldn't present the solution immediately, but invited one of Almi's engineers over for an introduction in the technique behind the hardening through which they could figure out a solution together.

Next to a more open information exchange, there is also a more open problem exchange with socially integrated or strong ties. An example of this can be given by:

Herikon had a good relation with company Echo, so when Echo presented its problems due the economic crisis Herikon offered to help. Through this partnership a knowledge exchange occurred about some technological aspects, but especially managerial knowledge i.e. production efficiency was the area in which both partners learned from each other.

Based on the observation that strong, existing ties can positively influence the recognizing of new knowledge, I propose:

P4: Social integration positively influences the searching of new knowledge for small firms through existing ties.



Figure 11: social integrator mechanisms and knowledge search

Todorova and Durisin (2007), argue that the effect of social integration mechanisms is negatively moderating on the relations between recognizing and innovation. I do not want to propose a positively moderating effect, because this proposition only applies to the knowledge search activity and not to the rest of the recognizing construct.

4.2.8 Knowledge type

In this research three types of knowledge for innovations are acknowledged: Technological, Market and Managerial. These different types of knowledge can be exchanged together or alone in a relation with a knowledge partner. An analysis of these relations results in the following table:

				Meeting place partners							
			Customer	Customer Internet Network Personal Seminar Supplier Trade fa Via supp Total						Total	
Type of knowledge	MG	Count	0	1	2	2	0	0	1	0	6
transierreu		% within Type of knowledge transferred	,0%	16,7%	33,3%	33,3%	,0%	,0%	16,7%	,0%	100,0%
	MK	Count	0	0	1	1	1	0	0	0	3
		% within Type of knowledge transferred	,0%	,0%	33,3%	33,3%	33,3%	,0%	,0%	,0%	100,0%
	MK/MG	Count	0	0	0	1	0	0	0	0	1
		% within Type of knowledge transferred	,0%	,0%	,0%	100,0%	,0%	,0%	,0%	,0%	100,0%
	Т	Count	7	2	2	4	2	6	5	1	29
		% within Type of knowledge transferred	24,1%	6,9%	6,9%	13,8%	6,9%	20,7%	17,2%	3,4%	100,0%
	T/MG	Count	1	0	0	1	0	0	0	1	3
		% within Type of knowledge transferred	33,3%	,0%	,0%	33,3%	,0%	,0%	,0%	33,3%	100,0%
	T/MK	Count	2	0	1	1	0	1	0	1	6
		% within Type of knowledge transferred	33,3%	,0%	16,7%	16,7%	,0%	16,7%	,0%	16,7%	100,0%
	T/MK/MG	Count	0	0	0	0	0	0	1	0	1
		% within Type of knowledge transferred	,0%	,0%	,0%	,0%	,0%	,0%	100,0%	,0%	100,0%
	Total	Count	10	3	6	10	3	7	7	3	49
		% within Type of knowledge transferred	20,4%	6,1%	12,2%	20,4%	6,1%	14,3%	14,3%	6,1%	100,0%

Type of knowledge transferred * Meeting place partners Crosstabulation

Table 6: Knowledge source and knowledge type

Per knowledge type some knowledge sources seem to be used more often than others. This does not mean the knowledge type can't be extracted from other sources, but there is a trend for each, combination of, types. Thus the knowledge type does influence the searching activity of recognizing. This relation is made because most knowledge types are transferred separately. If firms transfer, for example, more market knowledge together with technological knowledge, these best practices will become more equal for all knowledge types.

4.2.9 Intrusiveness

Also the intrusiveness used in the search results in different knowledge sources, as depicted in the graph below:



Figure 12: Intrusiveness and Knowledge source

Just like the knowledge types, also a firm's intrusiveness influences the search activities of a firm. The trends in the figure above do illustrate this. Next to the influence of intrusiveness on the search of the knowledge source it also influences the valuation of knowledge. This is because knowledge that is searched with an active intrusiveness increases the speed and successfulness of the knowledge valuation. Therefore the intrusiveness of the firm in the process iteration is added to the recognizing model as influencing the searching and valuating activities.

4.2.10 Strategy

The strategy used by Almi best fits the prospector strategy, because they really actively approach the market. This active market approach stems from the many meetings they organize with other companies to share knowledge and exchange ideas. The strategy used by Herikon to approach the market can be described as ad hoc, active and with much initiative and will therefore also be labeled as a prospector strategy. This strategy fits the company's practice, because they start with new ideas and approach the market with them. Herikon's sales engineer describes this strategy as follows:

"The foundation for the strategy is not a written plan, but the possibility to start with all kinds of projects. There is a breeding ground for these initiatives at the managing director; therefore it is stimulated and valued to do this." (Sales engineer)

So both case companies have a strategy towards the market that could best be described as a prospector strategy (Miles, et al., 1978), this means that the firms actively approach the environment, see new opportunities and act upon them. According to Daft and Weick (1984), the strategy of a firm is related to the way a firm interprets the environment. A prospector strategy relates to an active organizational intrusiveness according to their model. However half of the knowledge relations emerged from a passive intrusiveness⁴. This means that the strategy does not influence the process directly, because the outcomes are not directly linked with the strategy.

Another way strategy could influence a firm's recognizing activities is through strategic similarities with a potential partner firm. These influence the partner choice of a firm. The reason no concrete evidence is found for this is because there are not much relations which are a results of a choice between two or more partners. But because it does occur and the managers did mention that it is easier to work with a partner who has the same way of working, a firm's strategy does probably influence the recognizing process through strategic similarities as input for the partner choice.

⁴ See appendix B

Next to the addition of strategic similarities and exclusion of strategy as attributes in the model, there is an influence of a firm's strategy on recognizing. This is because how firms recognize is a part of their strategy, which determines the approach of the firm towards the environment.

4.2.11 Investments

Cohen and Levinthal (1989) argue that investments in R&D, positively influence recognizing. The amount of investments was not investigated in this research, because the comparison of these amounts between the two cases would have no significant result. I did ask if the companies invested in recognizing in specific instances: Almi does not characterize itself by huge investments in R&D, this is a constant effort and does not fluctuate that much. Also Herikon is not characterized by quick investments in R&D; this is a constant effort sign a constant effort with some fluctuations when outside knowledge has to be hired.

Investments in the light of Cohen and Levinthal (1990) are investments in the static construct of absorptive capacity measured by R&D expenditure. Since the definition is altered to a dynamic process construct in further research, R&D expenditure is not a valid measure of absorptive capacity anymore (Lane, et al., 2006).

Investing in absorptive capacity is therefore possible, through investments in the attributes which influence the processes of absorptive capacity. Both case companies did invest in these attributes which influence the recognizing process. Investments are for example the visitation of trade fairs, visitations of other companies, patent applications, customer relations, company image and the hiring of engineering employees. Larger investments happen when an external firm is paid for its part in the recognizing process. One firm mentioned a market consultancy firm and a technological consultancy firm, which both helped recognizing external knowledge. Finding no other influences of investments in these small companies, could also stem from the differences in firm size. Small manufacturing firms, as these from the case-study, do not have the resources to do real fundamental research. One of them does have a laboratory, but uses it to perform tests with the current materials in order to solve customer problems. The different nature of the research and development in these small manufacturing companies can be a good reason for not finding an important influence of big investments.

Therefore I argue that recognizing investments in small firms is not an element in the model, but that a firm can and should invest in the process attributes in order to improve its recognizing capability.

4.3 Recognizing in small firms

4.3.1 Process activities

In the absorptive capacity literature the focus of recognizing is on the searching and valuating of new knowledge for innovations. Walking through this process I did encounter four different activities which are all influenced by at least one of the factors extracted from theory. Therefore I argue that the black box of recognizing in the process model of Todorova and Durisin (2007) should be filled with the following activities:



Figure 13: Recognizing process activities

The process activities are definite as follows:

- Opportunity recognition is the activity in which a firm's actors see new ideas for which knowledge has to be extracted from the environment.
- Knowledge search is the activity in which a firm's actors search in the external environment for new knowledge.
- Valuating knowledge is the activity in which a firm's actors assess the potential worth of the knowledge for the firm through discussing the benefits together and decide if it's worth investing in.
- Partner choice is the activity in which a firm's actors decide to choose for one partner instead of the other when there are more possibilities.

Based on these new activities I propose a redefinition for recognizing in small firms:

A firm's capability to see new opportunities, search for new knowledge and estimate its potential value along with the choice for a partner.

The activities of recognizing don't take place in every process iteration, depending on the context some activities are skipped. This is illustrated in the model through adding [0, 1] after each activity. Zero means the process is excluded in the iteration and one that it's included. In the table below some of the possible activity formations are illustrated with examples.

Example	Opportunity recognition	Knowledge search	Valuating knowledge	Partner choice
A customer approaches the firm with a question for special product requirements. The firms see this as an opportunity and starts looking for the knowledge, once found at a firm's supplier they assessed the knowledge value and stopped looking any further.	1	1	1	0
The firm decides to visit a trade fair, but no knowledge for extraction is flagged. It could be that contacts and information about technology development are stored in prior knowledge for the next iteration.	0	1	0	0
One of the firm's employees has the idea for the automation of some part of the process. The opportunity is used and new knowledge for this automation is found which is positively valuated. During the search more potential partners, who can provide this knowledge, are found. Based on the firm's similar approach in doing business a partner choice is made.	1	1	1	1
A firm presents itself and its knowledge to the focal firm. Once the firm recognizes an opportunity for using this knowledge and valuate it positively it can enter the next process.	1	0	1	0

 Table 7: Recognizing activity formation

The table above gives four examples out of the 16 activity combinations. In practice not all 16 combinations are possible, this is because opportunity recognition and/or knowledge search has to be used in the process, otherwise it is not part of the recognizing capability. Because the activity combinations are very context depend, it will not improve the understanding of the concept and conclusions or advice about, if extensive examples are given.

4.3.2 Recognizing process model

Integrating the activities, confirmed recognizing attributes and propositions results in the following model:



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Figure 14: Model of recognizing in small firms
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This model represents the recognizing process of small firms, with the additions and propositions proposed in this chapter. The tables below summarizes the conclusions for every attribute and their influence on theory and practice; separated in a table for confirmed attributes (the first in table 8) and attributes that are updated or changed since the proposed model in figure five (second in table 9).

Attribute	Conclusion			
Regimes of	They are used in small firms too, but there is no specific relation proposed			
appropriability	from this research.			
Prior	Prior knowledge is needed for the searching and valuation of knowledge,			
knowledge	but is also the cause for path dependence.			
Knowledge	Different knowledge sources form an input for the recognizing activities. Of			
source	new potential knowledge sources the business cards are stored.			
Intrusiveness	Intrusiveness does influence the knowledge search activity and the valuation of knowledge.			
Knowledge type	Knowledge types are typically found at certain types of knowledge sources.			
Strategic	Similarity in a firm's strategy increases the chance of cooperation with that			
similarities	partner.			
Feedback loop	Addition of capability development loop.			

Table 8: Confirmed use of attribute in recognizing process

Attribute	Conclusion	Proposition
Activation triggers	Importance of reputation and culture for recognizing.	P1: A firm's problem-solving reputation positively influences the amount of external triggers.P2: A firm's supportive culture positively moderates the relation between activation triggers and the opportunity recognition.

Power relationships	Rationale for investing in innovative customers.	P3: A firm's innovative power relationships challenge the firm with questions which positively influence the recognizing capability, especially the activity of opportunity recognition.
Social integration mechanisms	Advantage of strong relations with partners.	P4: Social integration positively influences the searching of new knowledge for small firms through existing ties.

 Table 9: Addition to attribute in recognizing process

It is possible for small firms to invest in the recognizing process. Screening all attributes and activities for investment opportunities, the following table:

Attribute or activity	Investment/ change possibility		
Reputation	Invest in company image and problem-solving reputation.		
Culture	Stimulate your employees for good ideas and support them.		
Power Relations	Assign extra resources to current customers once they are innovative.		
Strong ties	Invest in strong relations in order to find more knowledge at current partners.		
Knowledge search	Send employees out to trade fairs, network clubs, seminars and other events; to increase the chances of finding new knowledge or hire a company that can help with the knowledge search.		

 Table 10: Investment opportunities

As also indicated in the recognizing model the output of the process is an input for the next process. This output contains a description of the new knowledge with a description of its value and use for the firm. Next to this information about the knowledge, this model suggests that also the partner from whom to extract the knowledge is included in the output of recognizing.

In this model the attributes influence recognizing activities. The propositions about these attributes do not mean that the attributes do not influence activities of the assimilation and exploitation process. Therefore it is prudent to remember that the different absorptive capacity processes and its attributes are interrelated and that this model is a representation of only one part of absorptive capacity.

Chapter 5: Conclusion and Discussion

5.1 Conclusions

In the beginning of this research the absorptive capacity model of Todorova and Durisin (2007) was used for the exploration of the recognizing capability. Research in theory resulted in some extra attributes for the proposed model: knowledge type, investments, intrusiveness, strategy and a capability developing feedback loop. The case study confirms the use of all elements, except investments, in the recognizing process of small firms. Next to this confirmation the case study research did result in refined relations of the attributes and the activities even as the addition of some other activities. This led to a redefinition of the recognizing concept for small firms, an adjusted model and four propositions about relations in the model. Together these elements answer the central question:

How does the process of recognizing external knowledge for innovation work in small firms?

In small firms, recognizing is redefined in this thesis as: A firm's capability to see new opportunities, search for new knowledge and estimate its potential value along with the choice for a partner.

Attributes added to the model since the basic model of Todorova and Durisin (2007) are:

- A second feedback loop, which describes the capability development of the dynamic recognizing process. The first feedback loop that is already present in the model of Todorova and Durisin (2007) describes the ability of earlier iterations to change the prior knowledge and experiences for new process iterations.
- Strategy, in the form of strategic similarities between the focal and partner firm. These similarities influence the partner choice in the case the focal firm has more potential partners from which it can extract that knowledge.
- Intrusiveness and knowledge type of the process iteration, influencing the search and valuation activities in the recognizing process. For the search activity, the intrusiveness and knowledge type determine the preferred knowledge source and for the valuation activity an active intrusiveness increases the speed and successfulness of the valuation.
- The culture and reputation of a firm influence the activation triggers, which should result in opportunity recognition, according to proposition one and two below.

And finally the proposed relations between attributes and the process activities:

- 1. A firm's problem-solving reputation positively influences the amount of external triggers.
- 2. A firm's supportive culture positively moderates the relation between activation triggers and the opportunity recognition.
- 3. A firm's innovative power relationships challenge the firm with questions which positively influence the recognizing capability, especially the activity of opportunity recognition.
- 4. Social integration positively influences the searching of new knowledge for small firms through existing ties.

These changes result in a refined model which describes the recognizing process in small firms as depicted in figure 14 (on page 30).

5.2 Implications

5.2.1 Theory

Todorova and Durisin (2007) concluded in their article that there is no further need for a capturing of the individual capabilities, because their clarification of the components already

enhances the operationalization of absorptive capacity. This research showed that they included the most important attributes, but in the case of small firms, used some wrong explanations for the relations with the process activities. These new explanation are presented in the form of propositions, which explain certain relations in the refined recognizing process model. Next to the process model, this research contributed to absorptive capacity literature through the creation of a better definition for recognizing. The thorough empirical investigation of the process resulted in the inclusion of two other activities: opportunity recognition and partner choice. The new definition clarifies the recognizing capability and is therefore important in the process towards a unified definition of absorptive capacity.

In this study, the focus is on small firms and since the research showed that the process is different from larger firms, the importance of studying the absorptive capacity of these firms separately comes to light; this is important for future researchers on this area to keep in mind. Through explaining the difference for small firms, this research increased the usability of the construct in small firm research.

Most important for the theoretical contribution are the alternative relation descriptions in the model. Proposition three and four give other explanations to relations in the model, these explanations diverge from the current theory of absorptive capacity: Social integrator mechanisms have a positive influence on recognizing through existing ties and innovative power relations do positively influence recognizing. These propositions will result in very different research based strategies in firms, compared to the current theory, and are therefore very important insights which have to be investigated further.

Finally, this research showed that a clarification of the individual capabilities can improve the insights in absorptive capacity and should therefore also be done for the other processes.

5.2.2 Practice

Since recognizing is a very complicated process, the overview model with its attributes can help managers in decision making. This is because the overview shows the topics of which decisions do influence recognizing in order to improve their competitive advantage.

Maybe the most important implication for practice is the shift in research-based strategy this study proposes for small firms. Many articles state that in order to increase the competitive advantage, a firm has to use many weak ties that operate in different circles; through which new ideas and knowledge can be found. This study proposes to invest in the relationship with innovate power relations and socially integrated strong ties. At these partnerships new opportunities can be found too. The search for weak ties in other circles should not be cancelled, but the emphasis could be more on strong innovative relations.

Next to this shift there is also the way of investing in the recognizing process. As explained in the investment paragraph, it's not just investing in a thing, but in a process and its attributes. This study proposes, in order to improve the recognizing capability, to invest in:

- **Innovative partners to increase new opportunity recognition.** Assigning many resources to current partners is no problem when these partners are innovative, because then they will challenge the firm with innovative questions. These new opportunities are not only of value for the power relationship's alter, but also for innovations of the focal firm.
- **Reputation and culture to trigger the search for new opportunities and knowledge.** Through improving the problem-solving reputation and supportive culture of the firm, new ideas will keep coming to the firm and more often result in new opportunities. These opportunities can results in the extraction of new knowledge from the environment and ultimately lead to innovation.

- Developing of recognizing, through sharing potential knowledge relations and new best practices with colleagues. Since the capability of recognizing is always in development, potential knowledge relations and new ideas about finding knowledge should be shared between colleagues. A firm can invest in this, through storing ideas, knowledge and relations in a database or wiki and encouraging or supporting employees in sharing this information.
- **Interaction with strong relations for the increase of knowledge exchange.** Strong relations improve finding knowledge; this is because these relations have more knowledge than the focal firm is familiar with. Working together and challenging each other increases the chances of finding new knowledge at these existing relations.
- **Searching for knowledge.** Firms can invest in the search activity of new knowledge, through visiting trade fairs, let engineers visit other factories or hire a specialized firm to assist with the knowledge search.

5.3 Limitations

5.3.1 Model limitations

At the end of this research a changed model of the recognizing process is presented. The model is limited for two reasons: First, it is not representing all elements that are involved in the process and therefore can never fully describe reality. But this is something no model can: "Any model is itself a somewhat arbitrary interpretation imposed on organized activity. Any model involves trade –offs and unavoidable weaknesses" (Daft & Weick, 1984). "A theory of social behavior cannot be simultaneously general, accurate and simple." (Thorngate 1976 in Daft and Weick, 1984). This model is aimed to be a general and simple model. This means that most of the limitations are in the area of being accurate. Every relation of a firm has a different context in which it is recognized and therefore includes lots of smaller influences which are not incorporated in the model. A more accurate description would also obstruct external validity, because capabilities are unique for every firm.

Second, the model is limited to small firms. This limitation starts with the selection of, small firm specific, factors from theory e.g. the choice for a non-analyzable environment. If the model was not limited to small firms it would have been extended with indicators for an analyzable environment. Daft and Weick (1984) see indicators for this analyzable market view as: rules and cycles. Small companies do not have that much rules and cycles, because the number of managers and management layers is much less. Next to the selection of 'small firm attributes' the limitation to small firms stems from the fact that interviews, from which also new ideas could be added to the model, are only administered in small firms for verification.

5.3.2 Researcher bias

Because I was present at the interviews myself there is the risk of influencing the results, called researchers bias. This could happen through putting forward the ideas from theory in the interviews. This risk is reduced through the network study in which I directly asked for current relations and a description of these. Other, more general, questions are asked very open and only used if the answer occurred in more than one interview.

5.3.3 External validity

The limits of a qualitative research with a small number of cases are obvious: it is not clear if the results could be generalized to a larger and more diverse population. Since this is a case study this analogy of generalization is incorrect (Yin, 2003). This generalization was not the goal of the study, but the analytical replication was. Therefore it's also not a problem that the propositions extracted from the relational analysis stem from data that does not result in statistical valid relationships. This research can give no guarantee on the outcome of these propositions, but proposes theoretical explanations about certain relations.

Recognizing is a part of absorptive capacity which does describe the ability of a company to recognize, assimilate and exploit external held knowledge. This ability can vary for every company, one is better in it than the other. If the propositions are the result of two case companies who have developed this ability very bad, the propositions will be of no value. In the results of Sandor Löwik's research, in these same case companies, it becomes clear that both companies have developed their recognizing capability quite well⁵. Therefore the propositions about the process descriptions have more reason to describe a good recognizing capability.

5.3.4 Partner relations

In the relational approach used in this research, the previous recognizing of current relations is assessed. This leaves out the recognition of external knowledge and partners that did not result in a knowledge transfer. Through this 'positive bias' the valuation and search attributes that do not result in further relationship development could be missed in the research.

5.4 Further research

The propositions, which are the result of this research, are meant to be a basis for further research. Testing these propositions in wider population will strengthen the model and its external validity, which could lead to the possibility for managers to build on the model with a research based strategy for recognizing. Testing the propositions for small and large firms will also show if the proposed relation should be added to the basic model of absorptive capacity or only to the model that is specified for small firms.

Since this research is solely focused on recognizing, a replication of this research and its empirical verification for the other capabilities of absorptive capacity would help in creating an overview of all the absorptive capacity processes. With this total picture the most important attributes can be identified and empirically verified, which will result in a stronger concept description.

More of a practical tip for researchers who are aiming to empirically prove recognizing hypotheses: the use of business cards for studying absorptive capacity in a network perspective. Todorova and Durisin (2007) stress the importance of a longitudinal study in order to capture the dynamics of the absorptive capacity construct. Nowadays firms store almost all their business cards in a digital archive. Cross checking this archive with the financial administration can give a reliable overview of all the initial contacts compared with the final partnering relationships. Insights in this data can function as a longitudinal study, because these cards are added to the database throughout the years. This will result in much more reliable data for a dynamic construct. Still, the knowledge information has to be extracted from another source.

⁵ See appendix C for the results

Chapter 6: References

- Ahuja, G. (2000). Collaboration Networks, Structural Holes, and Innovation: A Longitudinal Study. *Administrative Science Quarterly*, 45(3), 425-455.
- Ambrosini, V., Bowman, C., & Collier, N. (2009). What are dynamic capabilities and are they a useful construct in strategic management? *International Journal of Management Reviews*, 11(1), 29-49.
- Boshuizen, J. (2009). Join the club! Knowledge spillovers and the influence of social networks on firm *performance*. Dissertation, University of Twente, Enschede.
- Burt, R. S. (2004). Structural holes and good ideas. American Journal of Sociology, 110(2), 349-399.
- Christensen, C., M., & Bower, J. L. (1996). Customer Power, Strategic Investment, and the Failure of Leading Firms. *Strategic Management Journal*, *17*(3), 197-218.
- Cohen, W. M., & Levinthal, D. A. (1989). Innovation and Learning: The Two Faces of R & D. *The Economic Journal*, 99(397), 569-596.
- Cohen, W. M., & Levinthal, D. A. (1990). Absorptive Capacity: A New Perspective on Learning and Innovation. *Administrative Science Quarterly*, *35*(1), 128-152.
- Cohen, W. M., & Levinthal, D. A. (1994). Fortune Favors the Prepared Firm. *Management Science*, 40(2), 227-251.
- Creswell, J. W. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches*. Thousand Oaks: SAGE Publications.
- Daft, R. L. (2006). The new era of management. Mason: South-Western.
- Daft, R. L., & Weick, K. E. (1984). Toward a Model of Organizations as Interpretation Systems. *The Academy of Management Review*, *9*(2), 284-295.
- Darr, E. D., & Kurtzberg, T. R. (2000). An Investigation of Partner Similarity Dimensions on Knowledge Transfer. *Organizational Behavior and Human Decision Processes*, *82*(1), 28-44.
- Dyer, J. H., & Singh, H. (1998). The Relational View: Cooperative Strategy and Sources of Interorganizational Competitive Advantage. *The Academy of Management Review, 23*(4), 660-679.
- Eisenhardt, K. M. (1989). Building Theories from Case Study Research. *The Academy of Management Review*, 14(4), 532-550.
- Eisenhardt, K. M., & Martin, J. A. (2000). Dynamic Capabilities: What Are They? *Strategic Management Journal*, 21(10/11), 1105-1121.
- Granovetter, M. (2005). The Impact of Social Structure on Economic Outcomes. *The Journal of Economic Perspectives*, 19(1), 33-50.
- Granovetter, M. S. (1973). The Strength of Weak Ties. American Journal of Sociology, 78(6), 1360.
- Helfat, C., Finkelstein, S., Mitchell, W., Peteraf, M. A., Singh, H., Teece, D. J., et al. (2007). *Dynamic Capabilities: Understanding strategic change in organizations*. Malden: MA: Blackwell.
- Helfat, C. E., & Peteraf, M. A. (2003). The dynamic resource-based view: capability lifecycles. *Strategic Management Journal, 24*(10), 997-1010.
- Jansen, J. J. P., Van Den Bosch, F. A. J., & Volberda, H. W. (2005). Managing potential and realized absorptive capacity: How do organizational antecedents matter? *Academy of Management Journal*, 48(6), 999-1015.

- Jarzabkowski, P., Balogun, J., & Seidl, D. (2007). Strategizing: The challenges of a practice perspective. *Human Relations*, 60(1), 5-27.
- Kilduff, M., & Tsai, W. (2003). Social networks and organizations. London: SAGE.
- Lane, P. J., Koka, B. R., & Pathak, S. (2006). The reification of absorptive capacity: a critical review and rejuvenation of the construct. *Academy of Management Review*, *31*(4), 833-863.
- Lane, P. J., & Lubatkin, M. (1998). Relative Absorptive Capacity and Interorganizational Learning. *Strategic Management Journal, 19*(5), 461-477.
- Lang, J. R. a. C., Roger J. and Gudmondson, Donald. (1997). Small Firm Information Seeking as a Response to Environmental Threats and Opportunities. *Journal of Small Business Management*, *35*, 11 23.
- Liao, S. H., Wu, C. C., Hu, D. C., & Tsui, K. A. (2010). Relationships between knowledge acquisition, absorptive capacity and innovation capability: An empirical study on Taiwans financial and manufacturing industries. *Journal of Information Science*, *36*(1), 19-35.
- Miles, R. E., Snow, C. C., Meyer, A. D., & Coleman, H. J., Jr. (1978). Organizational Strategy, Structure, and Process. *The Academy of Management Review*, *3*(3), 546-562.
- Morrison, J. L. (1992). Environmental scanning *A primer for new institutional researchers* (pp. 86-99). Tallahassee, Florida: The Association for Institutional Research.
- Mowery, D. C., Oxley, J. E., & Silverman, B. S. (1996). Strategic alliances and interfirm knowledge transfer. *Strategic Management Journal*, *17*(SUPPL. WINTER), 77-91.
- Polonsky, M., Gupta, S., Beldona, S., & Hyman, M. R. (2010). Inactivity and the dynamics of relationship development: a proposed model. *Journal of Strategic Marketing*, 18(3), 257 273.
- Rosson, P. J., & Seringhaus, F. H. R. (1995). Visitor and exhibitor interaction at industrial trade fairs. [doi: DOI: 10.1016/0148-2963(94)00012-4]. *Journal of Business Research*, *32*(1), 81-90.
- Sammarra, A., & Biggiero, L. (2008). Heterogeneity and Specificity of Inter-Firm Knowledge Flows in Innovation Networks. *Journal of Management Studies*, *45*(4), 800-829.
- Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic Capabilities and Strategic Management. *Strategic Management Journal*, 18(7), 509-533.
- Todorova, G., & Durisin, B. (2007). Absorptive capacity: Valuing a reconceptualization. *Academy of Management Review, 32*(3), 774-786.
- Tsai, W. (2001). Knowledge Transfer in Intraorganizational Networks: Effects of Network Position and Absorptive Capacity on Business Unit Innovation and Performance. *The Academy of Management Journal, 44*(5), 996-1004.
- Yin, R. K. (1989). Case Study Research (2 ed.). Thousand Oaks: Sage.
- Yin, R. K. (2003). Case study research (3 ed. Vol. 5). Thousand Oaks: SAGE.
- Zaheer, A., Gözübüyük, R., & Milanov, H. (2010). It's the connections: the network perspective in interogranizational research. *Academy of Management Journal, February*, 62-78.
- Zahra, S. A., & George, G. (2002). Absorptive Capacity: A Review, Reconceptualization, and Extension. *The Academy of Management Review*, 27(2), 185-203.

Appendix A: Original Dutch question list

Procedure

- Voorstellen & uitleg onderzoek: hoe zit bij verschillende soorten relaties het proces van het herkennen van externe kennis in elkaar. Daarvoor eerst de relaties in kaart brengen.
- Opnemen van het gesprek in orde?
- Vertrouwelijkheid: relatie namen worden voor het eindverslag vertaald naar LeverancierX, Klant X.

Bedrijfsomschrijving

- 1. Hoe ziet de bedrijfsstructuur er ongeveer uit? (afdelingen e.d.)
- 2. Heeft bedrijfX een paar grote klanten of veel verschillende? (link met waardering)
- 3. Wat is de strategie van bedrijfX omtrent het zoeken naar innovaties (per kennis soort verschillend)?
 - Reactor: met de omgeving meebewegen, we zien wel wat er komt, persoonlijke contacten)
 - Prospector: veel initiatief naar omgeving (verandered, nieuwe mogelijkheden)
 - Defender: omgeving analyseren en beschermen van de kennis die we hebben
 - o Analyzer: stabiele activiteiten en innovaties als de omgeving het toelaat
- 4. Wat doet bedrijfX om pathdependence te voorkomen/ out of the box te kijken?
- 5. Heeft bedrijfX op bepaalde momenten extra geïnvesteerd in het zoeken naar kennis? (zo ja, had dit resultaat?)
- 6. Bezoeken jullie veel beurzen en congressen, welke, waarom?
- 7. Als het zoeken naar nieuwe informatie lastig is, is jullie oplossing dan om naar veel meer bedrijven te gaan kijken (grote scan maken) of om te proberen te leren beter om te gaan met kennis?
- 8. De output, worden alle mensen naar een gesprek uiteindelijk partner? Wat gebeurd er met de contacten die geen partner worden? (aantal visite kaartjes waar je niks mee doet)

Competitief voordeel t.o.v. concurrenten

- 9. Welke voorsprong heeft bedrijfX t.o.v. concurrenten op het gebeid van
 - o Technologie
 - Markt/ klanten (marktleider, wat zijn de voordelen/ hoe groot is de voorsprong?)
 - Bedrijfsvoering (ervaring certificaat)

Kennis relaties omschrijven

- 10. Ik vraag nu naar de <u>10 belangrijkste</u> kennis voor innovatie relaties in de <u>afgelopen twee</u> jaar (hoeven niet te zijn begonnen in de afgelopen 2 jaar). Daarvan moeten er minstens <u>2</u> <u>per kennissoort</u> zijn (managerial, technological and market) en <u>maximaal 2 per partner</u> <u>categorie</u>:
 - o Overheidsinstellingen
 - o Klanten
 - Leveranciers
 - o R&D
 - o Productie
 - Universiteiten/ scholen
 - \circ Adviesbureaus
 - Financiering
 - <u>Herikon en Alim, ook onderling!</u>
- 11. Per relatie
 - o Algemeen
 - Type kennis (technologisch/ markt/ bedrijfsvoering)
 - Hoe oud is de relatie?
 - Heeft deze partner het zoeken naar nieuwe kennis van bedrijf X veranderd? (feedback loop)
 - Heeft deze partner een zelfde strategie/ ideeën dan bedrijfX, of zijn jullie totaal verschillend?
 - In hoeverre hebben jullie dezelfde basis kennis?
 - Is er overleg geweest in het MT over het aangaan van deze relatie?
 - o Zoeken
 - Hoe hebben jullie deze partner gevonden? (bedrijfsvereniging, via andere partner, persoonlijk contact etc.)
 - Ook via andere bronnen? Internet of vakliteratuur?
 - Waren jullie actief of passief opzoek naar deze kennis?
 - Waarderen
 - Sluit de nieuwe kennis aan bij de bestaande kennis?
 - Waaraan is de waardering ontleent? (huidige klanten/ voorspellingen/ gok)
 - Was het bekend dat andere partners deze informatie niet hebben?

Sources: visite kaartjes, management team rapporten, meerder geïnterviewden

Appendix B: Description relational data

Intrusiveness Cumulative Percent Frequency Percent Valid Percent Valid active 25 51,0 51,0 51,0 passive 24 49,0 49,0 100,0 Total 100,0 100,0 49

Type of knowledge transferred

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	MG	6	12,2	12,2	12,2
	MK	3	6,1	6,1	18,4
	MK/MG	1	2,0	2,0	20,4
	Т	29	59,2	59,2	79,6
	T/MG	3	6,1	6,1	85,7
	T/MK	6	12,2	12,2	98,0
	T/MK/MG	1	2,0	2,0	100,0
	Total	49	100,0	100,0	

MG= management knowledge MK= market knowledge

T= technological knowledge



Appendix C: Results research S. Löwik



The scores above are a result of questioner about external knowledge. Divided in Technological knowledge (first blue bar), market knowledge (second red bar) and managerial knowledge (third yellow bar). The scores represent the average of multiple answers on a 7-point scale, with their standard deviation.

ALMI

	Recognizing	Acquisition	Assimilating	Exploitation
Technological knowledge avg	5,67	6	5,46	4,67
SD	0,91	0,73	1,07	1,8
Market	- 10			. – .
knowledge avg	5,43	5,05	4,94	4,74
SD	1,33	1,15	1,15	1,43
Managerial				
knowledge avg	5,2	5,15	5,1	4,93
SD	0,51	1,18	0,9	1,21

HERIKON

	Recognizing	Acquisition	Assimilating	Exploitation
Technological knowledge avg	6,11	5,61	6,03	5,93
SD	1,18	1,88	1,33	1,27
Market knowledge avg	6,16	5,39	5,75	5,44
SD	1,12	1,85	1,23	1,34
Managerial knowledge avg	4,42	3,94	4,91	5,15
SD	1,39	2,05	1,56	1,26

Appendix D: Patents⁶

Publicat ie nr.	Recht soort	Publicatie datum	Houder	Status	Titel
EP1155 797	Europee s	2-8-2006	Almi Machinefabriek B.V.	Van kracht	Hydraulische stenenknipper.
103249 8	ROW 1995	17-3- 2008	ALMI Machinefabriek B.V.	Vervallen	Inrichting voor het op producthoogte instellen van een knipmachine.
EP0623 421	Europee s	6-12- 1995	ALMI MACHINEFABRIEK VRIEZENVEEN B.V.	Van kracht	Inrichting voor het aan de einden van een uitsparing voorzien van buisvormige werkstukken met verschillende diameters.
101522 4	ROW 1995	20-11- 2001	Almi Machinefabriek B.V.	Vervallen	Hydraulische stenenknipper.
EP0443 123	Europee s	8-9-1993	Almi Machinefabriek B.V.	Vervallen	Steensplijter.
102833 5	ROW 1995	21-8- 2006	Almi Machinefabriek B.V.	Vervallen	Stenenknipper.

Table 11: Patents Almi

Publicatie nr.	Recht soort	Publicati e datum	Houder	Status	Titel
EP174963 3	Europees	12-11- 2008	Herikon B.V. Matecs B.V.	Van kracht	Werkwijze voor het vervaardigen van een flexibel slijtdeel van gelaagd polyurethaan.
1020699	ROW 1995	11-12- 2003	Herikon B.V.	Van kracht	Sparingklos met afdichtende lipconstructie.
1023230	ROW 1995	26-10- 2004	Herikon B.V.	Van kracht	Malinrichting voorzien van draadopspanmiddelen.
1029670	ROW 1995	6-2-2007	Herikon B.V. Timro Technical Components and Services B.V.	Vervallen	Werkwijze voor het vervaardigen van een flexibel slijtdeel van gelaagd polyurethaan.
2000357	ROW 1995	9-6-2008	Herikon B.V.	Van kracht	Werkwijze en inrichting voor het vervaardigen van polyurethaan producten, in het bijzonder dagmerken voor boeien.

Table 12: Patents Herikon

⁶Retrieved from: http://register.octrooicentrum.nl/register/ at 28-10-2010